

8 2 2

T H 8 5



NATIONAL ECONOMIC AND SOCIAL DEVELOPMENT BOARD
KINGDOM OF THAILAND

MASTERPLAN FOR RURAL WATER SUPPLY AND SANITATION IN THAILAND

FINAL REPORT - Executive Summary



PREPARED BY

REGIONAL RESEARCH AND DEVELOPMENT CENTER
ASIAN INSTITUTE OF TECHNOLOGY

APRIL 1985

822-TH85-6124

National Economic and Social Development Board
KINGDOM OF THAILAND

Masterplan for Rural Water Supply
and Sanitation in Thailand

FINAL REPORT

6124

ISBN 2250

322 TH85

Regional Research and Development Center
ASIAN INSTITUTE OF TECHNOLOGY
Bangkok, Thailand

April 1985

ACKNOWLEDGEMENTS

The Regional Research and Development Center (RRDC) of the Asian Institute of Technology (AIT) and other individuals who have contributed to this consultancy would like to express their sincere appreciation for the assistance given them in the course of study by various Government officials. Particular thanks should be given to the members of the Task Force Committee and the members of the Steering Committee who studied and commented on the draft Masterplan Report. The many different offices approached who provided valuable data and relevant information for the preparation of the Masterplan are likewise gratefully acknowledged.

The organizations concerned included (in alphabetical order):

ALRO	Agricultural Land Reform Office Ministry of Agriculture and Cooperatives
ARD	Office of Accelerated Rural Development Ministry of the Interior
BB	The Budget Bureau
DCD	Department of Community Development Ministry of the Interior
DMR	Department of Mineral Resources Ministry of Industry
DOH	Department of Health
DOLA	Department of Local Administration Ministry of the Interior
DPW	Department of Public Works Ministry of the Interior
EHD	Environmental Health Division Department of Health Ministry of Public Health
GWD	Groundwater Division Department of Mineral Resources Ministry of Industry
HED	Health Education Division Ministry of Public Health
HTD	Health Training Division Ministry of Public Health

ACKNOWLEDGEMENTS - Cont'd.

MU	Mahidol University
NESDB	National Economic and Social Development Board of Thailand
NRDC	National Rural Development Committee
NSC	National Security Council
PHC	Primary Health Care Office Ministry of Public Health
PWWA	Provincial Water Works Authority Ministry of the Interior
RID	Royal Irrigation Department
RHD	Rural Health Division Ministry of Public Health
RJCC	Rural Job Creation Committee
RWS/DOH	Rural Water Supply Division Department of Health Ministry of Public Health
SD/DOH	Sanitation Division Department of Health Ministry of Public Health

PROJECT PERSONNEL

Principal Investigators:

Prof. Anat Arbhabhirama
Head, RRDC
AIT

Mrs. Samorn Muttamara
Associate Professor
Environmental Engineering Division
AIT

Prof. N.C. Thanh
Professor
Environmental Engineering Division
AIT

Liaison Officer:

Dr. Krisorn Jittorntrum
AIT

Coordinator:

Dr. Eddie K.S. Hum
Research Engineer III, RRDC
AIT

Project Support Personnel:

Mr. Hilario P. Ricarte, Jr.
Senior Research Associate
AIT

Miss Wanida Srichai
Research Associate
AIT

Miss Pinthita Mungkarndee
Research Associate
AIT

Miss Sutthiya Sueppa
Research Associate
AIT

Miss Wilairat Wangcharoenwong
Research Associate
AIT

Miss Salaya Punsiri
Research Associate
AIT

PROJECT PERSONNEL - Cont'd.

Mr. Sawang Notthakun
Research Associate
AIT

Mr. Chettiyappan Visvanathan
Research Associate
AIT

Miss Amphai Pornprasertsakul
Research Associate
AIT

Mr. Siriwait Suthirawut
Research Assistant

Consultants:

Dr. Wilas Wuwongse
AIT

Dr. S. Vigneswaran
AIT

Dr. Patom Manirojana
NIDA

Dr. Wuttithep Indhapanya
NIDA

Prof. Aroon Sorathesn
Bangkok

Dr. Subarn Panvisavas
Mahidol University

Mr. Johannes Joseph Maria Mathijssen
IWACO, B.V.

Mr. Ron van Kerkvoorden
IWACO, B.V.

Mr. Ben van Bronckhorst
IWACO, B.V.

Mr. Gerard de Boer
IWACO, B.V.

Dr. Joop D. Heijnen
IWACO, B.V.

PROJECT PERSONNEL - Cont'd.

Mr. Sompong Burintratikul
LABENCO

Miss Vipa Suttipong
LABENCO

Special Advisers:

Mrs. Abha Siriwongs Na-Ayuthaya
Chulalongkorn University

Dr. Wanchai Ghooprasert
PWWA

Mr. Sittichai Pissanthaporn
PWWA

Mr. Praphorn Charujunte
Environmental Health Division
DOH

Dr. Sompool Kritalugsana
Sirilaj Hospital

ABSTRACT

The National Economic and Social Development Board (NESDB) of the Royal Thai Government (RTG) requested the Asian Institute of Technology (AIT) to prepare a Masterplan for Rural Water Supply and Sanitation in Thailand in order to cope with the demand for a safe and dependable water supply and sanitation facilities in Thai rural villages. In the Consultants' view, the improvement of public health and the quality of life of the rural population depends in part on the provision of an improved water supply and sanitation services.

The present population coverages, in terms of adequate and safe water supply for drinking and domestic purposes and satisfactory disposal facilities, are still below the desirable levels to effect health improvement.

The findings in 1983 pointed to the fact that although as much as 85% of the rural population are already served by many types of facilities, ensuring an adequate water supply the whole year round, only 15% have access to such safe sources as piped water supplies, deep wells and sanitized shallow wells. Furthermore, for that same year, it was reported by the Department of Health that there were only about 2.8 million pour-flush (PF) latrines installed throughout the country serving approximately 44% of the total number of households outside municipalities.

In the current studies, comprehensive investigations of the existing conditions of rural water supply and sanitation - with respect to the number of facilities, the population served, socio-cultural influences and other considerations - have yielded sufficient information on which to base the proposed policies, targets and plans of action and consequent estimates of implementation costs.

The present work provides a summary of the proposed Masterplan for Rural Water Supply and Sanitation. The plan is sufficiently comprehensive to achieve the target population/household coverage by 1991, and to permit attainment of the national goal for the development of rural communities in Thailand. Consequently, the Royal Thai Government will be able to fulfill its commitment to the "International Drinking Water Supply and Sanitation Decade (1981-1990)".

Thorough studies demonstrate that the provision of a water supply and sanitation in Thai villages is technically and economically justified and financially viable. This is especially true if the recommended institutional structure and investment schedule are embraced and implemented.

The net health, economic, social and environmental benefits to the rural communities, given proper execution of the support activities such as operation and maintenance (O&M) of facilities, monitoring of water quality, training of personnel, health education, and research and development (R&D), could be substantial. (Details of support activities are more fully discussed under appropriate headings.)

Other recommendations, including concepts and assumptions, are summarized in the following pages of this Masterplan report.

ABSTRACT - Cont'd.

The Masterplan, however, must be regarded as a flexible proposal in relation to institutional and financial policies. Amendments will be required as new conditions are imposed.

The total investment required for implementing the proposed Masterplan until the year 1991 is about Baht 10,382 million (not including overhead expenses), or an annual budget allocation of roughly Baht 1,500 million.

The investment cost can be summarized as follows (in million Baht):

Year	Rural Water Supply	Rural Sanitation	Total
1985	1,334.7	307.6	1,652.3
1986	1,482.2	399.9	1,822.1
1987	1,264.6	180.9	1,445.3
1988	1,309.7	202.8	1,512.5
1989	1,017.8	234.2	1,252.0
1990	1,062.8	257.0	1,319.8
1991	1,107.9	270.3	1,378.2
Grand Total	8,589.7	1,792.5	10,382.2

The total foreign exchange component is estimated to be around Baht 1,281 million, accounting for about 12% of the total outlay for the Masterplan.

TABLE OF CONTENTS

<u>Chapter</u>	<u>Title</u>	<u>Page</u>
	Acknowledgements	i
	Project Personnel	iii
	Abstract	vii
	Table of Contents	ix
	List of Tables	xiii
	List of Figures	xvii
	List of Abbreviations	xix
I	INTRODUCTION	
	1.1 PRESENT SITUATION	I-1
	1.1.1 Water-Borne and Water-Related Diseases	I-1
	1.1.2 Water Supply Coverage	I-1
	1.1.3 Distribution of Sanitation Facilities	I-5
	1.1.4 Public Investments	I-5
	1.2 RURAL WATER SUPPLY AND SANITATION PLAN UP TO THE YEAR 1991	I-7
	1.2.1 Scenarios	I-7
	A. Water Supply	I-7
	B. Sanitation	I-8
	1.2.2 Physical Targets	I-12
	A. Water Supply	I-12
	B. Sanitation	I-12
II	PLAN OF ACTION	
	2.1 RURAL WATER SUPPLY PROGRAM	II-1
	2.1.1 Rehabilitation of Existing Facilities	II-1
	2.1.2 Upgrading of Existing Facilities	II-3
	2.1.3 New Construction	II-3
	A. Rainwater Jar	II-3
	B. Other Proposed Technical Options	II-7
	2.1.4 Operation and Maintenance (O&M)	II-11
	2.1.5 Water Quality Monitoring	II-11
	2.1.6 Research and Development (R&D)	II-14

TABLE OF CONTENTS - Cont'd.

<u>Chapter</u>	<u>Title</u>	<u>Page</u>
2.2	RURAL SANITATION PROGRAM	II-19
2.2.1	Toilet Construction	II-19
2.2.2	Training	II-21
2.2.3	Health Education, Information and Communication	II-21
2.2.4	Research and Development (R&D)	II-25
2.2.5	Operation and Maintenance (O&M)	II-25
2.3	INSTITUTIONAL ASPECTS	II-27
2.3.1	Proposed Institutional Arrangement for the Rural Water Supply (RWS) Program	II-27
	A. National Level	II-27
	B. Regional Organizations	II-34
2.3.2	Transition and Phasing of the RWS Institutional Set-up	II-36
2.3.3	The Proposed Rural Water Supply (RWS) Planning and Implementation	II-37
	A. Information Collection and Processing	II-37
	B. Policy Planning	II-39
	C. Project Identification and Preparation	II-39
	D. Project Approval and Budgeting	II-40
	E. Training	II-41
	F. Local Participation and Institutionalization	II-42
	G. New Construction and Rehabilitation of Existing Facilities	II-42
	H. Upgrading of Existing Facilities	II-44
	I. Operation and Maintenance (O&M)	II-44
	J. Monitoring of Water Quality	II-44
	K. Research and Development (R&D)	II-44
	L. Monitoring and Evaluation of Decade Plan Implementation	II-45

TABLE OF CONTENTS - Cont'd.

<u>Chapter</u>	<u>Title</u>	<u>Page</u>
III	INVESTMENT REQUIREMENTS	
	3.1 RURAL WATER SUPPLY PROGRAM	III-1
	3.1.1 Rehabilitation of Existing Facilities	III-1
	3.1.2 Upgrading of Existing Facilities	III-1
	3.1.3 New Construction	III-1
	A. Rainwater Jar	III-1
	B. Other Proposed Technical Options	III-5
	3.1.4 Operation and Maintenance (O&M)	III-5
	3.1.5 Water Quality Monitoring	III-7
	3.1.6 Research and Development (R&D)	III-7
	3.2 RURAL SANITATION PROGRAM	III-13
	3.2.1 Toilet Construction	III-13
	A. Material Subsidy	III-13
	B. Revolving Fund	III-13
	3.2.2 Training	III-13
	A. VHVs and VHCs	III-13
	B. TCCs, VSCs and THWs	III-16
	C. Training Materials	III-18
	D. Workshop/Meeting/Seminar/ Orientation/Supervision	III-18
	3.2.3 Health Education, Information and Communication	III-18
	A. Incentives for VHVs/VHCs	III-18
	B. Latrines in Public Schools	III-18
	C. Posters, Leaflets, Radio Programs, etc.	III-20
	D. Mobile Units	III-20
	3.2.4 Research and Development (R&D)	III-20
	3.3 FINANCIAL ASPECTS	III-22

TABLE OF CONTENTS - Cont'd.

<u>Chapter</u>	<u>Title</u>	<u>Page</u>
IV	CONCLUSIONS AND RECOMMENDATIONS	IV-1
	APPENDICES	
A	Population Served by the Existing Adequate Facilities by the End of 1984	
B	Summary Table for the Rural Water Supply Masterplan	
C	Summary Table for the Rural Sanitation Masterplan	

LIST OF TABLES

<u>Table</u>	<u>Description</u>	<u>Page</u>
1.1	Population Coverage in Terms of Adequate and Sanitary Water Sources for Different Regions of Thailand by the End of 1983 (in percent)	I-2
1.2	Status of Existing Water Supply Facilities in the Rural Areas of Thailand in Terms of Shallow Wells, Deep Wells and Piped Water Supply Systems	I-3
1.3	The Pattern of Rural Water Supply Activities of the Current RWG Agencies	I-4
1.4	Distribution of Sanitation Facilities in Rural Areas of Thailand by the End of 1983	I-6
1.5	Estimated Number of Rural People to be Served with Adequate and Sanitary Water Sources between 1983 and 1991 to Meet Target Coverage	I-9
1.6	Estimated Number of Rural Households to be Installed with Toilet Facilities between 1983 and 1991 to Meet Target Coverage	I-11
1.7	Summary of Number of Water Supply Facilities to be Constructed/Implemented (1985-1991)	I-15
1.8	Summary of Number of Latrines to be Constructed/Implemented (1985-1991)	I-17
2.1	Estimated Number of Existing Facilities for Rehabilitation in the Different Regions of Thailand between 1985 and 1991	II-2
2.2	Estimated Number of Existing Facilities for Upgrading in the Different Regions of Thailand between 1985 and 1991	II-4
2.3	Implementatation Schedule for Rainwater Jar Construction in the Different Regions of Thailand (1985-1988)	II-5
2.4	Estimated Number of Proposed Technical Options to be Constructed Annually in the Different Regions of Thailand between 1985 and 1991	II-8
2.5	Summary of Number of Facilities by Type to be Constructed during the National Decade Plan (1985-1991)	II-9

LIST OF TABLES - Cont'd.

<u>Table</u>	<u>Description</u>	<u>Page</u>
2.6	Estimated Number of Facilities Scheduled for O&M Program in the Different Regions of Thailand between 1985 and 1991	II-12
2.7	Estimated Number of Village Operators to be Trained Annually in the Different Regions of Thailand between 1985 and 1991	II-13
2.8	Detailed Plan for the Proposed Water Quality Monitoring Program	II-16
2.9	Estimated Number of Training Courses to be Conducted for Different Categories of Personnel in Relation to the Water Quality Monitoring Program	II-17
2.10	Summary of Implementation Schedule for Various Activities of the Rural Water Supply Program (1985-1991), in number of units	II-18
2.11	Implementation Schedule for Latrine Construction in the Different Regions of Thailand between 1985 and 1991 (x 1,000)	II-20
2.12	Target Number of VHVs/VHCs, TCCs, VSCs and THWs to be Trained per Year (1985-1991)	II-22
2.13	Target Number of VHVs/VHCs to be Trained per Year by Type (1985-1991)	II-23
2.14	Estimated Number of Training Courses to be Conducted per Year in the Categories of TCCs, VSCs and THWs (1985-1991)	II-24
2.15	Summary of Implementation Schedule for Various Activities of the Sanitation Program (1985-1991), in number of units	II-26
2.16	Proposed Delineation of Responsibilities of RTG Agencies for a Particular Type of Facilities, by Region	II-33
3.1	Yearly Budget Requirement for Rehabilitation of Existing Facilities in the Different Regions of Thailand between 1985 and 1991, in million Baht	III-2

LIST OF TABLES - Cont'd.

<u>Table</u>	<u>Description</u>	<u>Page</u>
3.2	Budget Requirement for Upgrading of Existing Facilities in the Different Regions of Thailand between 1985 and 1991, in million Baht	III-3
3.3	Investment Requirement for Rainwater Jar Construction in the Different Regions of Thailand (1985-1988), in million Baht	III-4
3.4	Yearly Budget Requirement for Construction of Other Proposed Technical Options in the Different Regions of Thailand (1985-1991), in million Baht	III-6
3.5	Yearly Budget Requirement for O&M Program (1985-1991), in million Baht	III-8
3.6	Water Quality Monitoring Program Investment and Operational Cost per Year at Different Levels	III-9
3.7	Estimated Training Cost for Different Categories of Trainees (by Level) in Relation to Water Quality Monitoring Program	III-10
3.8	Yearly Budget Requirement for Water Quality Monitoring Program, in million Baht	III-11
3.9	Summary of Investment Requirements for Various Activities of the Rural Water Supply Program (1985-1991), in million Baht	III-12
3.10	Estimated Subsidy for Pour-Flush (PF) Latrine Construction in Different Regions of Thailand (1985-1991), in million Baht	III-14
3.11	Yearly Budget Allocation for Sanitation Revolving Fund in Different Regions of Thailand (1985-1991), in million Baht	III-15
3.12	Yearly Budget Requirement for Training of VHVs and VHCs (1985-1991), in million Baht	III-17
3.13	Yearly Budget Requirement for Training of TCCs, VSCs and THWs (1985-1991), in million Baht	III-19

LIST OF TABLES - Cont'd.

<u>Table</u>	<u>Description</u>	<u>Page</u>
3.14	Summary of Investment Requirements for Various Activities of the Rural Sanitation Program (1985-1991), in million Baht	III-21

LIST OF FIGURES

<u>Figure</u>	<u>Description</u>	<u>Page</u>
1.1	Accumulative Number of People Served by Sanitary Water Sources for Drinking Purposes between 1983 and 1991	I-13
1.2	Accumulative Number of People Served by Sanitary Water Sources for Domestic Consumption between 1983 and 1991	I-14
1.3	Accumulative Number of Households Installed with Toilet Facilities up to the Year 1991	I-16
2.1	Algorithm for Water Facility Selection	II-10
2.2	Structure of the Proposed Water Quality Monitoring Program	II-15
2.3	Proposed Organizational Set-up for the Rural Water Supply (RWS) Component of the Thailand Decade Plan (1985-1991)	II-28
2.4	Common Responsibilities of the CNRD and NWRB	II-30
2.5	The Rural Water Supply (RWS) Planning and Implementation Process, by Levels and Agencies	II-38

LIST OF ABBREVIATIONS

<u>Symbol</u>	<u>Meaning</u>
AIT	Asian Institute of Technology
ALRO	Agricultural Land Reform Office Ministry of Agriculture and Cooperatives
ARD	Office of Accelerated Rural Development Ministry of the Interior
BB	The Bureau of Budget
CCAWRD	Committee for Coordinating and Acceleration of Water Resources Development
CIPO	Center for Integrated Plan of Operations
CNRD	Committee for National Rural Development
CNRDC	Center for National Rural Development Coordination
CPD	Cooperatives Promotion Department Ministry of Agriculture and Cooperatives
CSC	Civil Service Commission
DCD	Department of Community Development Ministry of the Interior
DDC	District Development Committee
DMR	Department of Mineral Resources Ministry of Industry
DOF	Department of Fisheries Ministry of Agriculture and Cooperatives
DOH	Department of Health Ministry of Public Health
DOLA	Department of Local Administration Ministry of the Interior
DPW	Department of Public Works Ministry of the Interior
EHD	Environmental Health Division Department of Health Ministry of Public Health

LIST OF ABBREVIATIONS - Cont'd.

<u>Symbol</u>	<u>Meaning</u>
G-Ch-Ch	Gor-Chor-Chor information flow for planning used by the Center for National Rural Development Coordination (CNRDC)
HED	Health Education Division Ministry of Public Health
HTD	Health Training Division Ministry of Public Health
IDWWSO	International Drinking Water Supply and Sanitation Decade of the United Nations
LDD	Land Development Department Ministry of Agriculture and Cooperatives
MASU	Mobile Agricultural Service Units Ministry of Agriculture and Cooperatives
MIS	Computerized Management Information System
MOAC	Ministry of Agriculture and Cooperatives
MOPH	Ministry of Public Health
MOE	Ministry of Education
MOI	Ministry of the Interior
MOSET	Ministry of Science, Energy and Technology
MU	Mahidol University
NESDB	National Economic and Social Development Board of Thailand
NGO	non-governmental organization
NRDC	National Rural Development Committee
NSC	National Security Council
NWRB	National Water Resources Board
O&M	Operation and maintenance
PDC	Provincial Development Committee

LIST OF ABBREVIATIONS - Cont'd.

<u>Symbol</u>	<u>Meaning</u>
PF latrine	pour-flush latrine
PHC	Primary Health Care Office Ministry of Public Health
P.N.	Por-Nor information flow for planning used by the Committee for Coordinating and Acceleration of Water Resources Development (CCAWRD)
PWD	Public Welfare Department Ministry of the Interior
PWWA	Provincial Water Works Authority Ministry of the Interior
R&D	Research and Development
RID	Royal Irrigation Department Ministry of Agriculture and Cooperatives
RHD	Rural Health Division Ministry of Public Health
RJCC	Rural Job Creation Committee
RRDC	Regional Research and Development Center of the Asian Institute of Technology (AIT)
RTG	Royal Thai Government
RWS	rural water supply
RWS-DOH	Rural Water Supply Division Department of Health Ministry of Public Health
SD-DOH	Sanitation Division Department of Health Ministry of Public Health
TCC	tambon council committee
TDC	tambon development committee
THW	tambon health worker
VDC	village development committee

LIST OF ABBREVIATIONS - Cont'd.

<u>Symbol</u>	<u>Meaning</u>
VHC	village health communicator
VHV	village health volunteer
VSC	village sanitation craftsman

Chapter I INTRODUCTION

1.1 PRESENT SITUATION

1.1.1 Water-Borne and Water-Related Diseases

Public health in Thailand is generally satisfactory, with a crude death rate of 5.0 per thousand population and a life expectancy at birth of 60.8 years for males and 64.8 years for females. However, a large number of people are still suffering from pressing health problems related to poor sanitation and an inadequate water supply. Water- and food-borne diseases, specifically gastrointestinal infections and parasitic diseases, affect about one-third of the entire population every year. From 1978-1981, about 40% of all reported cases were attributed to water-borne and water-related diseases.

1.1.2 Water Supply Coverage

Based on the data obtainable from the "National Census of Rural Drinking Water Sources and Latrines" which was undertaken by Mahidol University, and the annual reports of various RTG implementing agencies, it was estimated that, by the end of 1983, only about 5.2 million or 15% of the rural population of Thailand have been served by adequate and sanitary water sources, although approximately 85% of the entire rural population already had access to adequate water sources (see Table 1.1).

Regionwise, in terms of population coverage by adequate sources, the Central region was found to have the lowest (i.e., about 75%); while the Northern region had the highest (i.e., approximately 95%). With respect to access to both adequate and sanitary sources, the situation was found to be worst in the Southern region (i.e., about 11%), and best in the Northern region (i.e., approximately 17%).

Likewise, based on the data from the above census, it was revealed that of the existing rural water supply facilities (with respect to shallow wells, deep wells, piped water supplies and surface water sources) only around 75% were adequate (capable of providing a water supply throughout the year). Furthermore, of the adequate sources, roughly 73% were considered non-sanitary sources (e.g., surface water and shallow wells without handpumps or covers). Piped water supplies, deep wells and shallow wells with handpumps and covers were classified as sanitary sources, and facilities of this sort comprised only 27% of the adequate sources (see Table 1.2).

A complicated network of some 16 RTG agencies have been actively taking part in the provision of rural water supply services in Thailand. Of the 16 RTG agencies, twelve are responsible for the provision of a water supply for drinking and domestic consumption in addition to agricultural irrigation water, i.e., excluding the Royal Irrigation Department (RID), the Department of Fisheries (DOF), the Mobile Agricultural Service Unit (MASU) in the Ministry of Agriculture and Cooperatives, and the National Energy Administration (NEA) in the Ministry of Science, Energy and Technology, as shown in Table 1.3.

Table 1.1 Population Coverage in Terms of Adequate and Sanitary Sources
for Different Regions of Thailand by the End of 1983, in percent

Type of Facility	NORTH		NORTHEAST		CENTRAL		SOUTH		WHOLE KINGDOM	
	Adequate	Adequate and Safe	Adequate	Adequate and Safe	Adequate	Adequate and Safe	Adequate	Adequate and Safe	Adequate	Adequate and Safe
<u>Non-Public</u>										
Shallow Well	15.8	3.0	2.0	0.5	6.5	1.6	32.7	4.0	10.4	1.8
Deep Well	2.5	0.9	1.0	0.3	0.4	0.2	0.7	0.2	1.2	0.4
Piped Water Supply	10.0	3.5	6.0	1.9	3.2	1.6	2.2	0.6	5.7	2.0
<u>Public</u>										
Shallow Well	38.2	3.8	27.3	4.3	19.5	2.2	22.2	2.1	27.3	3.4
Deep Well	10.7	3.7	17.4	5.6	14.1	7.1	8.3	2.3	13.9	5.0
Piped Water Supply	5.4	1.9	4.4	1.4	6.9	3.5	5.2	1.5	5.3	2.0
Surface Water	11.9	-	27.1	-	24.6	-	12.4	-	21.1	-
Total	94.5	16.8	85.2	14.0	75.2	16.2	83.7	10.7	84.9	14.6

NOTE: - "Adequate sources" refer to facilities which provide water throughout the year.
- "Sanitary sources" refer to such facilities as shallow wells with handpumps and covers; deep wells and piped water supply systems (using deep wells as sources) without iron and manganese problems which are believed to provide water supply of acceptable quality but not necessarily meeting the WHO Drinking Water Standards.

Table 1.2 Status of Existing Water Supply Facilities in the Rural Areas of Thailand in Terms of Shallow Wells, Deep Wells and Piped Water Supply Systems

Source		Shallow Well				Deep Well				Piped Water Supply				Surface Water				Total						
		Adequate Sources				Adequate Sources				Adequate Sources				Adequate Sources				Adequate Sources						
		Total No. of Sources	No.	As % of total No. of Sources	As % of total No. of Adequate Sources	No. of Sources	No.	As % of total No. of Sources	As % of total No. of Adequate Sources	No. of Sources	No.	As % of total No. of Sources	As % of total No. of Adequate Sources	Total No. of Sources	No.	As % of total No. of Sources	As % of total No. of Adequate Sources	Total No. of Sources	Total No. of Adequate Sources	As % of total No. of Sources	As % of total No. of Adequate Sources	As % of total Sanitary Sources	As % of total Non-Sanitary Sources	As % of Grand Total
Public	Sanitary	1,651	1,031	62	12	2,633	2,070	79	100	298	296	99	100	-	-	-	-	4,582	3,397	11	19	11	-	3
	Non-Sanitary	11,151	7,454	67	88	-	-	-	-	-	-	-	-	13,993	7,131	51	100	25,144	14,585	49	81	-	19	14
Total Public		12,802	8,485	66	100	2,633	2,070	79	100	298	296	99	100	13,993	7,131	51	100	29,726	17,982	60	100	-	-	17
Non-Public	Sanitary	15,509	12,752	82	17	12,643	10,759	85	100	2,821	2,820	100	100	-	-	-	-	30,973	24,331	85	29	89	-	24
	Non-Sanitary	83,442	63,845	77	83	-	-	-	-	-	-	-	-	-	-	-	-	83,442	63,845	77	71	-	81	59
Total Non-Public		98,951	76,597	77	100	12,643	10,759	85	100	2,821	2,820	100	100	-	-	-	-	114,415	90,176	79	100	-	-	83
Total Sanitary		17,100	13,783	12	16	15,276	12,829	84	100	3,119	3,116	100	100	-	-	-	-	35,555	29,728	21	28	100	-	27
Total Non-Sanitary		94,593	71,299	64	84	-	-	-	-	-	-	-	-	13,993	7,431	51	100	108,586	78,430	54	72	-	100	73
Grand Total		111,753	85,082	76	100	15,276	12,829	84	100	3,115	3,116	100	100	13,993	7,131	51	100	144,141	108,158	75	100	-	-	100

Source : National Census of Drinking Water Sources and Latrines, 1982

Table 1.3 The Pattern of Rural Water Supply Activities
of the Current RTG Agencies

RTG Agencies	Facilities for Rural Drinking and Domestic Use Water				
	Storage Tank (Jar included)	Shallow Well	Deep Well	Ponds	Piped Water System
Ministry of Agriculture (MOAC) : - CPD - LDD - ALRO				● $\frac{1}{}$ ● $\frac{1}{}$ ● $\frac{1}{}$	
Ministry of Interior (MOI) : - DOLA - DPW - PWD - DCD - ARD - PWWA $\frac{2}{}$	● ● ● ●	● ● ● ●	● ● ●	● ● ●	● ● ●
Ministry of Public Health (MOPH) : - DOH	●	●	●		●
Ministry of Industry (MI) : - DMR			●		
Ministry of Defense (MOD) - NSC	●	●	●	●	●

NOTE : $\frac{1}{}$ Service in specific area.
 $\frac{2}{}$ PWWA is a state enterprise.

If those RTG agencies whose services are confined to specific project sites, namely the Cooperatives Promotion Department (CPD), the Land Development Department (LDD), the Agricultural Land Reform Office (ALRO) in the Ministry of Agriculture and Cooperatives and the Public Welfare Department (PWD) in the Ministry of the Interior are also excluded, then only eight RTG agencies can be thought of as being directly engaged in water supply services for drinking and domestic consumption in all rural areas throughout the Kingdom.

The responsibility for system maintenance is usually assumed by the RTG agencies, but generally speaking this service is poor.

1.1.3 Distribution of Sanitation Facilities

The report from the Department of Health showed that only 44% of the rural households in the Kingdom have been installed with pour-flush (PF) latrines up to 1983, although other types of sanitation facilities are also in existence in limited numbers. A summary of the current sanitation facilities in the rural areas of Thailand by region is shown in Table 1.4.

Among the four regions, the Central region has the highest number of installed latrines as compared with the Northern, Northeastern and Southern regions. Approximately one-half of the Northern villagers already have latrines in their homes, whereas in the Northeastern and Southern parts there are still only a small number of people who have these facilities.

The Sanitation Division of the Department of Health in the Ministry of Public Health is the main governmental agency responsible for general sanitation in Thailand. The latest strategy adopted to foster and accelerate the acquisition of latrines by household owners at the village level is through the "sanitation revolving fund", a project which relies to a considerable extent on villagers' participation.

1.1.4 Public Investments

Since the Second National Five-Year Development Plan (1967-1971), the budget allocated for rural water supply and sanitation has amounted to less than 1% of the total outlay. However, the budget allocated to the principal agencies in rural water supply and sanitation in the Third National Five-Year Development Plan (1972-1976) was raised to Baht 1,165 million, compared with Baht 509 million in the Second National Five-Year Development Plan. By 1980, approximately Baht 3,000 million had been spent on the relevant programs of the various implementing agencies of the Royal Thai Government (RTG).

It is noteworthy that from the total allocated amount to the Sanitation Division, which has been increasing significantly every year, the bulk of the funding goes into its own water supply program. Expenditures on its sanitation activities are mainly on

Table 1.4 Distribution of Sanitation Facilities in the Rural Areas of Thailand by the End of 1983

Region	No. of Households outside Municipalities	No. of Biogas Digesters	No. of DVCPF Latrines	PF Latrine	
				No.	%
North	1,645,372	-	-	800,309	48.6
Northeast	2,308,022	-	-	910,763	39.5
Central	1,526,273	-	-	864,380	56.0
South	798,531	-	-	217,210	27.2
Whole Kingdom	6,278,198	2,455	400	2,792,662	44.3

Source: Sanitation Division, DOH, Annual Report 08 R-Ng 514

promotion, training and demonstration, since household owners shoulder the construction expenses of their own latrines by availing themselves of the newly-conceived "sanitation revolving fund".

1.2 RURAL WATER SUPPLY AND SANITATION PLAN UP TO THE YEAR 1991

1.2.1 Scenarios

A. Water Supply

With regard both to the extent of the water supply needs and the resources that can be mobilized to meet those needs in the shortest possible time, the targets which have been set are as follows.

Concerning the accessibility for an adequate and clean drinking water supply, the people must have provision within 1 km of 5 lpcd (liters per capita per day) for drinking purposes whose quality is in accordance with the WHO Drinking Water Standards (in the absence of suitable rural drinking water standards at the moment). To this end, an additional 45 lpcd of the same water quality will be likewise provided for domestic purposes.

The criteria adopted assume that the 5 lpcd of drinking water should be sufficient to cover a person's daily water requirements for drinking, brushing of teeth and cooking; the 45 lpcd, on the other hand, should be adequate for such household water-using activities as bathing, cleaning of kitchen utensils, etc. The walking distance of 1 km to the water source should result in savings of time and energy by the water users.

Three scenarios were envisaged to decide the most appropriate target population coverage in the Masterplan, as below.

Scenario	Population Coverage		Service Level	Feasibility
	For drinking purposes	For domestic purposes		
1	100%	100%	very satisfactory	impossible
2	95%	95%	satisfactory	impossible
3	95%	75%	satisfactory	possible

For planning purposes, it should be pointed out that Scenario 1 is impossible to achieve, as it is estimated that about 5% of the total rural population in 1991 would be practically and economically unreachable, e.g. those living in very remote, mountainous or sensitive areas.

Scenario 2 is likewise not feasible since it is estimated that about 20% of the total rural population in 1991 will be living in villages in which there are no accessible groundwater resources, and treatment of surface water to meet the required standards for these villagers is not economically feasible.

Only Scenario 3 is deemed feasible, both technically and economically. Thus a target population coverage of 95% for drinking purposes and 75% for domestic purposes is recommended for further detailed study in the Masterplan preparation.

In terms of financing the rural water supply services, partial subsidization by government grants is being proposed, since full subsidization is resource-draining on the part of the government, not to mention the fact that no cooperation from the local people can be sought in the process. However, community participation (in terms of cash) can only be expected in the construction and O&M of piped water supplies; hence, the bulk of the financing for water supply services will still have to come from government grants. Regarding the contribution by non-governmental organizations (NGOs), it should be pointed out that this contribution is highly variable and uncertain, and that any contribution expected from these groups to rural water supply development should simply be considered as a bonus.

Based on the recommended target population coverage, it has been estimated, as shown in Table 1.5, that about 33.0 million rural people will require further services up to 1991 due to a lack of adequate and/or sanitary water sources. Out of the total target population, about 87% (28.6 million) are accounted for by those people still unserved and by those having adequate but non-sanitary water sources in 1983, a major segment of which depended on surface water for their drinking and domestic water supply.

B. Sanitation

It is the intention of the government to serve 95% of the rural population with adequate sanitation facilities by 1991. Since only about 44% of the total rural households had been provided with pour-flush (PF) latrines up to 1983, it is necessary to build around 600,000 latrines annually in order to be able to install a total of 4.04 million PF latrines. Looking at the past performance, the target was usually set at 400,000 per year, but it was never achieved. Even if sufficient money and manpower could be poured into the scheme, such a sudden increase in the rate of development would strain the absorptive capacity of the rural population. Processes such as manpower development and community education and motivation take time. Hence, although the 95% target coverage is a very satisfactory service level for the desired improvement in health and for positive environmental benefits to be effected, there are serious limitations to the achievement of this target.

Table 1.5 Estimated Number of Rural People to be Served with Adequate and Sanitary Water Sources between 1983 and 1991 to Meet Target Coverage

No.	Description	North	Northeast	Central	South	Whole Kingdom
1	Projected Rural Population of 1991 (x 1000)	8,903	16,895	8,683	5,751	40,232
2	Projected Rural Population of 1983 (x 1000)	7,982	14,906	7,718	5,054	35,660
3	Population Growth between 1983-1991 (x 1000)	921	1,989	965	697	4,572
4	95% of Population Growth between 1983-1991 to be Served with Adequate and Safe Water Sources (x 1000)	875	1,890	916	662	4,343
5	Remaining % of 1983 Rural Population to be served with Adequate and Safe Water Sources to be Able to Cover 95% of 1983 Population (x 1000)	78.2	81.0	70.9	84.4	80.3
6	Remaining 1983 Rural Population to be Served with Adequate and Safe Water Sources to be Able to Cover 95% of 1983 Population (x 1000)	6,242	12,066	6,092	4,264	28,644
7	Total Rural Population to be Served with Adequate and Safe Water Sources between 1983-1991 (x 1000) (4)+(6)	7,117	13,956	7,009	4,926	33,008

Note: Rural Population figures are based on the Rural Population Projection (1980-2001) developed by AIT Team

On the other hand, a lower target coverage of 75% is a satisfactory service level, and one which could be achieved despite all the drawbacks of implementation.

The various scenarios for achieving the target coverage can be summarized as follows.

Scenario	Household Coverage	Service Level	Feasibility
1	95%	very satisfactory	impossible
2	75%	satisfactory	possible

In terms of financing the program, after considering the attitude and economic status of the rural people, it is necessary that a sensible subsidization scheme should be drawn up and it should preferably be a compromise between (i) no subsidization at all, as is the current practice - a policy which does not provide incentives and encouragement at a time when user awareness is still lacking and motivation needs to be gradually induced as part of a long-term process; and (ii) full subsidization, which leaves no room for developing a sense of ownership and responsibility and at the same time creates huge financial burdens for the authorities.

Thus, all factors taken into consideration, the future sanitation program in relation to the Thailand Decade Plan (1985-1991) calls for a target household coverage of 75% by 1991, and a financing scheme using a combination of subsidies and "revolving funds".

The projected number of households to be provided with latrines in the different regions has been calculated as shown in Table 1.6. According to the estimates, about 5.4 million rural households are expected to have their own latrines by 1991, with an increase of approximately 90% to be effected during the Plan period (1985-1991). It should be noted that targets are suggested at different levels in different regions. (For example, during the Decade Plan (1985-1991) the Northeastern region cannot be expected to achieve the target coverage of 75%, whereas other regions will exceed the target.)

Discrepancies in user awareness and affordability or program feasibility exist between the four regions. While equality among regions should be promoted, exactly equal development among them is not a realistic aim. Furthermore, it may be noted that interest in improved latrines will vary between different sub-groups in a given project area, with the richer and better educated families generally being more anxious and ready to participate. Women are sometimes more interested than men; whereas men, and not women, are involved in decision-making processes. Such differences are likely to affect the types of people that the program will serve initially, and also affect the rate at which the improvements can be expected to take place.

Table 1.6 Estimated Number of Rural Households to be Installed with Toilet Facilities between 1983 and 1991 to Meet Target Coverage

No.	Description	North	North East	Central	South	Whole Kingdom
1	Projected Number of Rural Households in 1991 (x1000)	1,853	2,662	1,741	929	7,185
2	Planned % of 1991 Rural Households to be Installed with Toilet Facilities to Meet Target Coverage	76.6	66.5	84.4	78.6	75.0
3	Planned Number of 1991 Rural Households to be Installed with Toilet Facilities to Meet Target Coverage (x1000)	1,420	1,770	1,469	730	5,389
4	Number of Rural Households Installed with Toilet Facilities up to 1983 (x1000)	800	911	864	217	2,792
5	Assumed Number of Rural Households Installed in 1984 (x1000)	30	29	35	13	107
6	Number of Rural Households to be Installed with Toilet Facilities between 1985 - 1991 to Meet Target Coverage (x1000)	590	830	570	500	2,490
7	Total Number of Rural Households to be Installed with Toilet Facilities between 1983 - 1991 to Meet 75% Coverage (x1000) (5) + (6)	620	859	605	513	2,597

1.2.2 Physical Targets

A. Water Supply

The recommended scenarios given above are achievable through undertaking various planned activities, such as rehabilitation/upgrading of the existing facilities and creating new construction during the Masterplan implementation between 1985 and 1991. These activities can be translated into physical targets based on the population equivalent for each activity to be carried out. The percentage of the target population served by public facilities for drinking purposes between 1985-1991 is expected to be around 70%.

Diagrams showing the accumulative population served by sanitary water sources for both drinking and domestic consumption between 1983 and 1991, as effected by the various planned activities, are given in Figures 1.1 and 1.2. (Please refer to APPENDIX A for details of population coverage by the end of 1984.) A summary of the number of units to be constructed/implemented between 1985 and 1991 is shown in Table 1.7.

B. Sanitation

Like the target for water supply, the target household sanitation coverage by the end of the National Decade Plan can be translated into physical targets in terms of the number of toilet facilities to be installed all over the country.

Figure 1.3 shows the cumulative household coverage up to the year 1991, while Table 1.8 presents the projected number of latrines for construction in the different regions of the Kingdom.

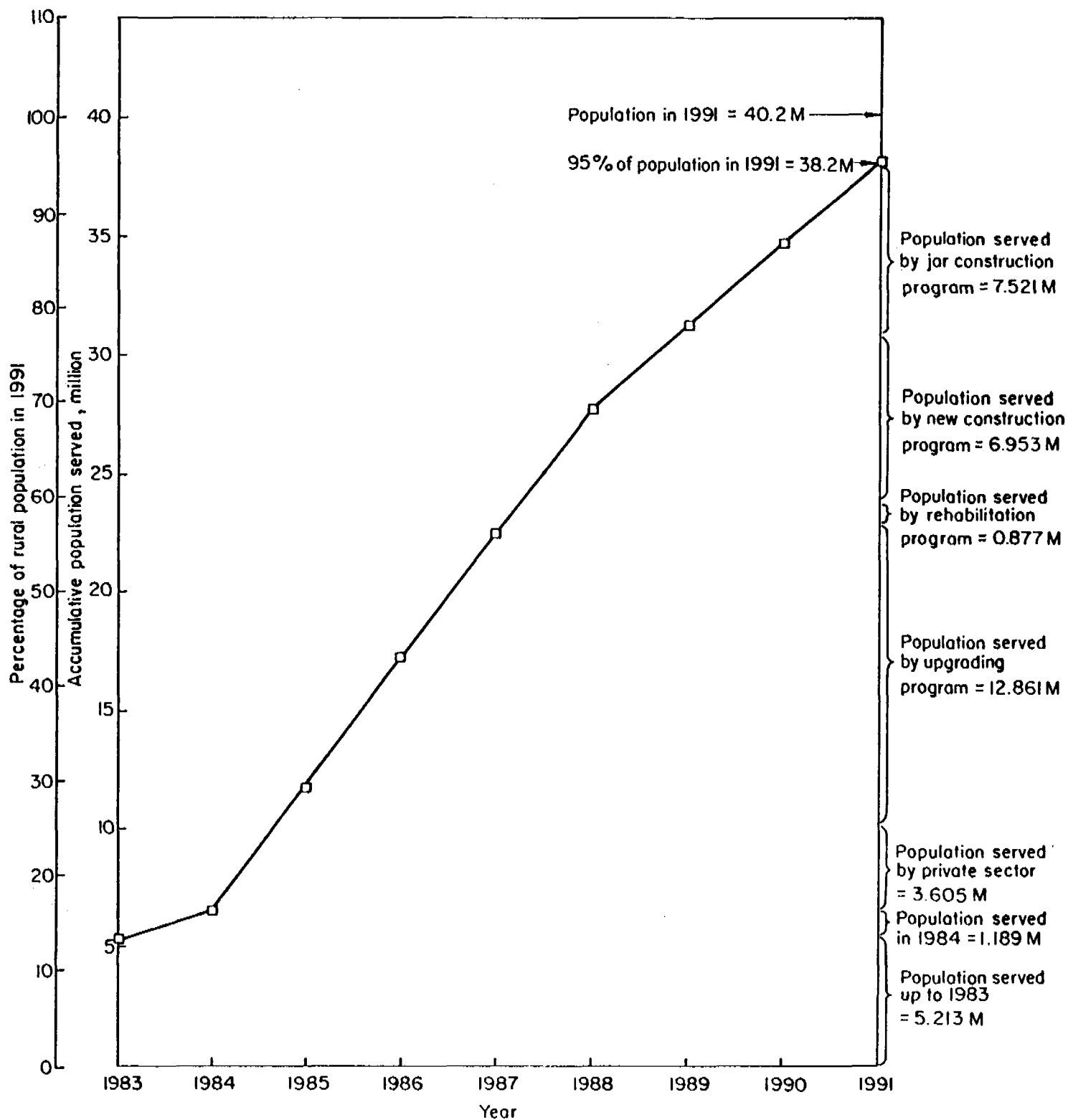


Figure 1.1 Accumulative Number of People Served by Sanitary Water Sources for Drinking Purposes between 1983 and 1991

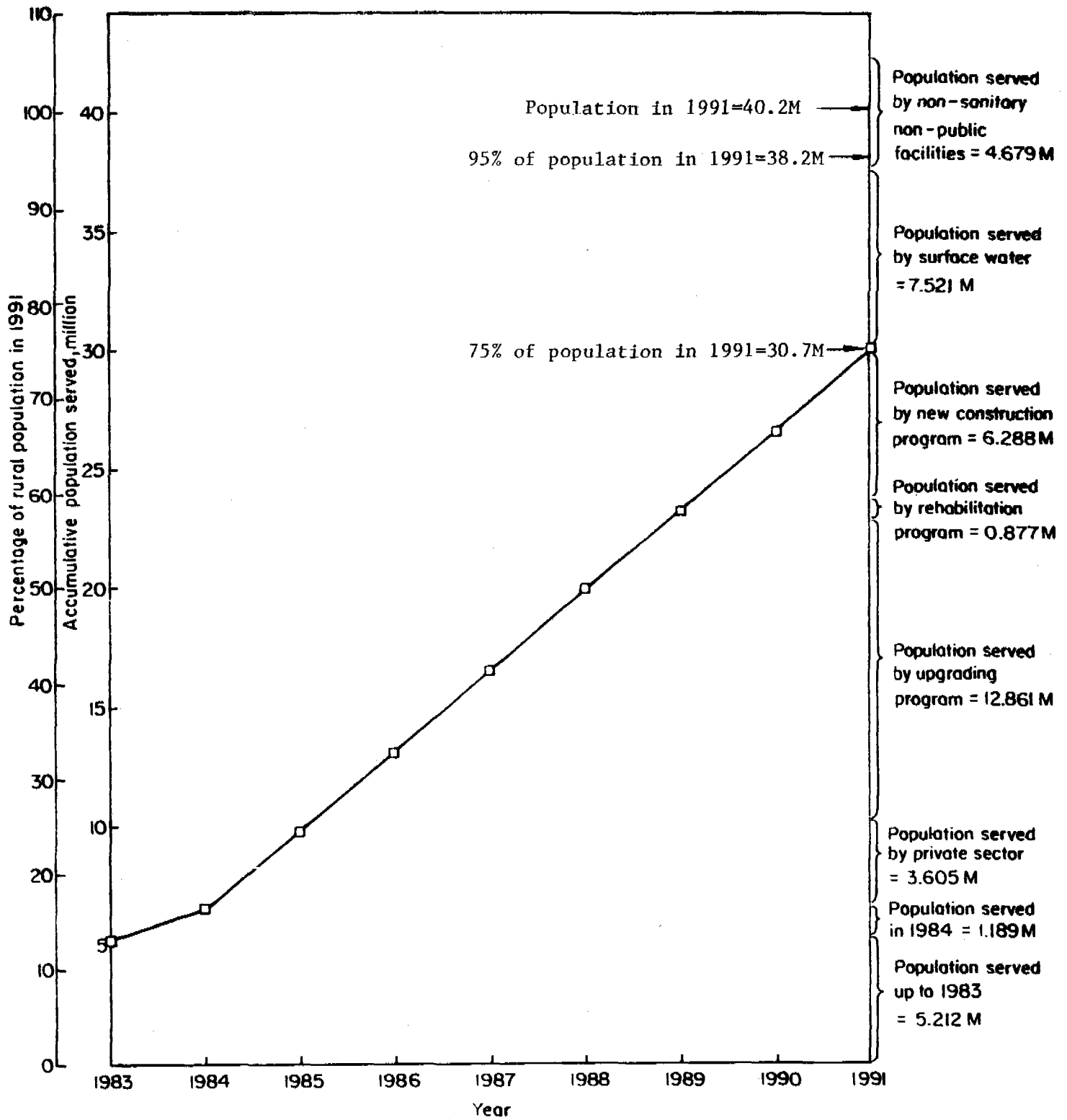


Figure 1.2 Accumulative Number of People Served by Sanitary Water Sources for Domestic Consumption between 1983 and 1991

Table 1.7 Summary of Number of Water Supply Facilities to be Constructed/Implemented between 1985 and 1991

Activity	No. of units to be constructed/ implemented between 1985 and 1991
1) Upgrading Shallow well Deep well PWS (deep well)	 78,183 37,135 2,051
2) Rehabilitation Deep well Piped water supply (deep well)	 7,546 406
3) New Construction Jars: 1 cu m 2 cu m Spring catchment system Sanitary (shallow) well Deep well Piped water supplies: deep well slow sand filter rapid sand filter rainwater	 376,788 4,012,000 63 25,053 21,805 1,316 77 21 6,550

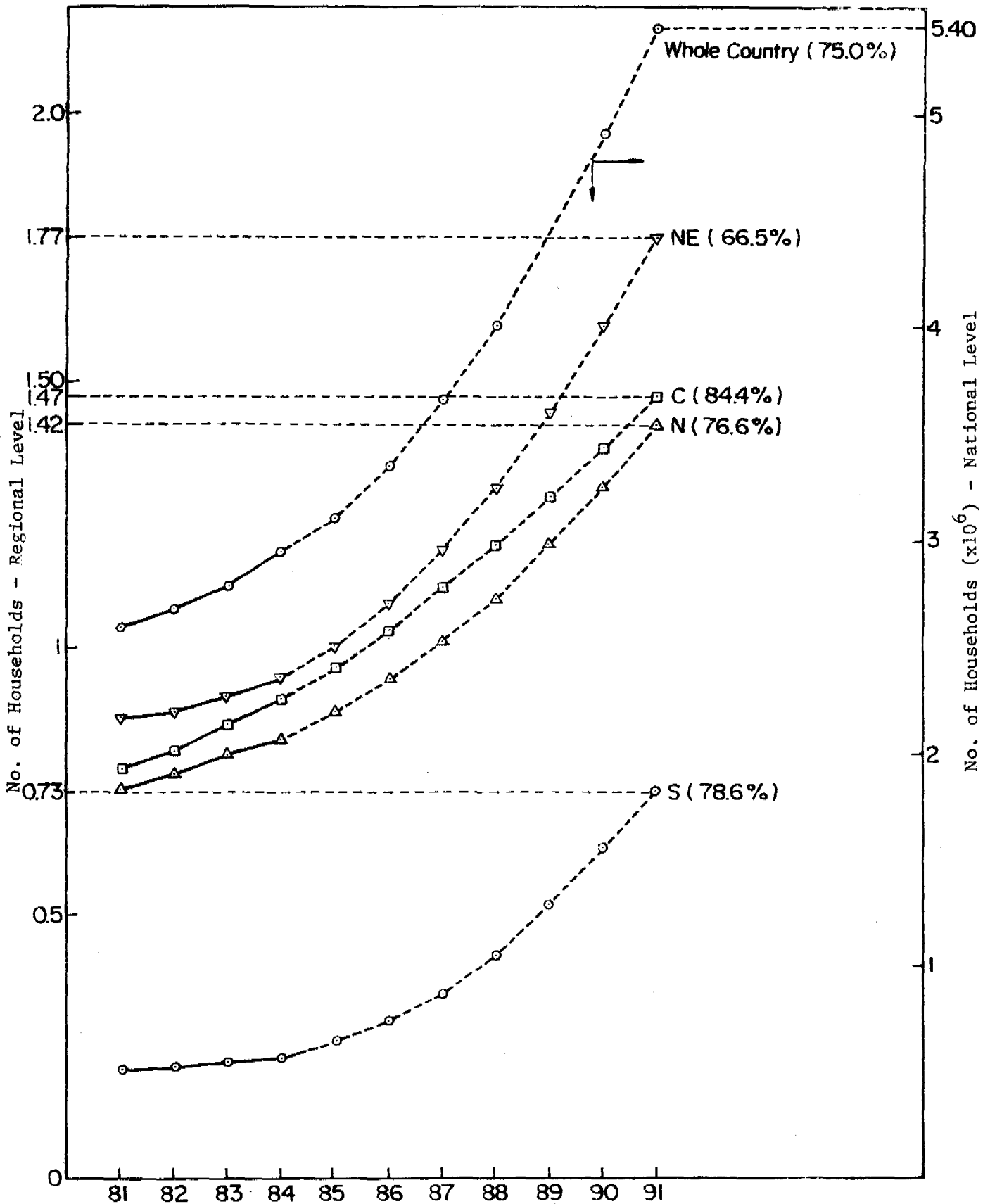


Figure 1.3 Accumulative Number of Households Installed with Toilet Facilities up to the Year 1991

Table 1.8 Summary of Number of Latrines to be Constructed/
Implemented between 1985-1991

Region	Number of Households By the end of 1991	Number of Latrines Needed to Reach 75%
North	1,853,500	590,000
Northeast	2,662,087	830,000
Central	1,741,138	570,000
South	929,022	500,000
Whole Kingdom	7,185,747	2,490,000

Chapter II PLAN OF ACTION

2.1 RURAL WATER SUPPLY PROGRAM

The proposed rural water supply development program will consist of the following activities to be carried out during its implementation:

- rehabilitation/upgrading of existing facilities,
- new construction (rainwater jars and other technical options),
- operation and maintenance (O&M),
- water quality monitoring,
- training of personnel,
- research and development (R&D).

Meeting the target population coverage of the National Decade Plan in terms of an adequate and sanitary water supply will be mainly effected by rehabilitation/upgrading of existing facilities and new construction. All the other activities can be considered as support activities, but are nevertheless essential to the overall attainment of the program objectives.

The implementation of the rural water supply program will be carried out from 1985 to 1991. The program will cover nationwide implementation from the first year in order that the program objectives, methods of implementation and other necessary management techniques can be understood and experienced. Within four years after initiation of the program, practically all of those previously served with surface water sources for drinking purposes will be utilizing rainwater.

The plan of action for these activities is discussed below. The institutional aspects of the envisaged rural water supply program are separately described in Section 2.3 since they involve some rather complicated points.

2.1.1 Rehabilitation of Existing Facilities

At present, there are numerous deep wells and small-scale piped water supply systems with a deep well source which are just lying idle due to clogged pipes and the fact that in most cases aerators were not installed. These particular facilities can be put into working condition again and could supply clean water by simply installing aeration units and "developing" the wells.

About 7,546 of the existing deep wells and 406 of the existing small-scale piped water supply systems, which account for 50% of the present number of each type of facility, can be rehabilitated. The estimated number of existing facilities requiring rehabilitation in the different regions of Thailand between 1985 to 1991 is shown in Table 2.1.

2.1.2 Upgrading of Existing Facilities

Upgrading involves improving the water quality of unprotected shallow wells, deep wells and small-scale piped water supply systems. In the case of shallow wells, this means installation of a cover and handpump in the well; and in the case of deep wells and small-scale piped water supply systems, upgrading involves the removal of iron and manganese from the water by installing aerators.

It has been estimated that there are about 78,183 shallow wells, 37,135 deep wells, and 2,051 small-scale piped water supply systems built in the past whose water quality can be upgraded by making the improvements mentioned above. The implementation schedule for upgrading the existing facilities is given in Table 2.2.

2.1.3 New Construction

In addition to rehabilitation/upgrading of the existing facilities, construction of new (additional) systems will be carried out - largely to serve the remaining population still without adequate and sanitary sources at the present time, and to take into account the population growth between 1985 and 1991.

A. Rainwater Jar

The rainwater jar construction program will aim at accelerating the availability of clean drinking water in the rural areas of Thailand. The 2 cu m size rainwater jars will be promoted in the Central, Northern and Northeastern regions, where rainfall is relatively deficient, and will provide sufficient water to cover the dry months. The 1 cu m size jars will only be promoted in the Southern region, where rainfall is generally abundant. About 4.3 million rainwater jars will be provided within 4 years after the initiation of the program. The implementation schedule for rainwater jar construction in the different regions of Thailand is given in Table 2.3.

The implementation plan for rainwater jar construction can be undertaken in different phases, as outlined below.

Phase 1. Establishment of the Extent of the Program

This phase will determine the exact number of beneficiaries in the participating villages. Request and record forms may be distributed to the village headmen by the community development worker during the tambon council meeting. Details of those eligible and wanting to participate will be reflected on the forms. A summary report from each village and tambon will then be prepared and forwarded to the amphur and finally to the province. The budget allocation will be handled by the Provincial Development Committee.

Table 2.3 Implementation Schedule for Rainwater Jar Construction in the Different Regions of Thailand between 1985 and 1988

Region	1985	1986	1987	1988	Total
<u>NORTH</u>					
Jars (2 m ³)	154,329	154,329	154,329	154,329	617,316
- By Subsidy	102,886	102,886	102,886	102,886	411,544
- By Revolving Fund	51,443	51,443	51,443	51,443	205,772
Molds	514	514	514	514	2,056
<u>NORTHEAST</u>					
Jars (2 m ³)	551,446	551,446	551,446	551,446	2,205,784
- By Subsidy	367,630	367,630	367,630	367,630	1,470,520
- By Revolving Fund	183,816	183,816	183,816	183,816	735,264
Molds	1,838	1,838	1,838	1,838	7,352
<u>CENTRAL</u>					
Jars (2 m ³)	297,225	297,225	297,225	297,225	1,188,900
- By Subsidy	198,150	198,150	198,150	198,150	792,600
- By Revolving Fund	99,075	99,075	99,075	99,075	396,300
Molds	991	991	991	991	3,964
<u>SOUTH</u>					
Jars (1 m ³)	94,197	94,197	94,197	94,197	376,788
- By Subsidy	62,798	62,798	62,798	62,798	251,192
- By Revolving Fund	31,399	31,399	31,399	31,399	125,596
Molds	314	314	314	314	1,256
<u>WHOLE KINGDOM</u>					
Jars (1 m ³)	94,197	94,197	94,197	94,197	376,788
- By Subsidy	62,798	62,798	62,798	62,798	251,192
- By Revolving Fund	31,399	31,399	31,399	31,399	125,596
Jars (2 m ³)	1,003,000	1,003,000	1,003,000	1,003,000	4,012,000
- By Subsidy	668,666	668,666	668,666	668,666	2,674,664
- By Revolving Fund	334,334	334,334	334,334	334,334	1,337,336
Molds	3,657	3,657	3,657	3,657	14,628

Phase 2. Establishment of a Village Development Fund

The allocated budget for subsidies and "revolving funds" will be released through a bank account in the name of the village committee at the nearest bank, probably in the amphur. This will serve as the village development fund, with the village headmen and several village elders acting as joint signatories of the account. The organization of this fund must be handled by the community development worker.

The budget for the village development fund may be taken from the budget presently allocated to the DOH (Department of Health) Rainwater Storage Program, the ARD (Accelerated Rural Development) Jar Construction Program, and the Rural Job Creation Program or alternatively it could be obtained through a new program under the Small-Scale Water Resources Development Committee.

Phase 3. Management and Technical Training

Training in the management of the village development fund and in the administration of the program should be provided to the village headmen of participating villages. This may be incorporated in the training for sanitation projects of the tambon council committee (TCC), of which the village headmen are members. In this case, the community development worker should make the necessary arrangement with the village headmen under his jurisdiction. Technical training in jar construction will also have to be undertaken for those who will be engaged in the actual construction. The village sanitation craftsmen (VSC) would seem to be the most appropriate people for this task, since rainwater jar construction is part of their training course involving both the theoretical and practical aspects of the construction work. This particular group of villagers, with the help of participating householders, will carry out the mass production of rainwater jars in the village.

Phase 4. Disbursement of Subsidies and Revolving Funds

An amount equivalent to the cost of two rainwater jars will be disbursed through the subsidization scheme to the recipient householders (identified earlier) by the village committee, provided there is an undertaking to spend the allowance only for the construction of jars. Likewise, a loan equivalent to the cost of one rainwater jar will be granted through the "revolving fund" to interested householders, with the stipulation that this amount will be returned within one year. A household should not be allowed a second loan until the first is fully reimbursed. Similarly, no household should be allowed a third loan until the second has been repaid. Also, no household should be allowed a third loan until all those eligible for a second loan have been provided with the loan. Money for this scheme should not be used to build more than three jars for any one household unless there are more than eight persons in the household.

The amount for purchasing molds will be taken from the village development fund, and will be the responsibility of the village committee. In all undertakings, records should be kept by the village headman for administrative purposes.

For construction purposes, the village craftsmen will have to be provided with the names of all the recipients in the village, and will make the necessary arrangements regarding the most appropriate time for construction.

Phase 5. Monitoring

This phase is essential for assessing the progress of the program, and for ensuring that targets are met as scheduled. Thus, record sheets and accounting forms - one for expenditures, one for income, a statement of accounts, and one for recording the number of rainwater jars completed - should be maintained by the village development committee and presented periodically to the tambon council. Summary reports from each tambon must be forwarded to the amphur and changwat offices. Random audits will be conducted either by the tambon or the amphur staff.

B. Other Proposed Technical Options

These include spring catchment systems, sanitary shallow wells, deep wells, small-scale piped water supply systems (using a deep well as a source), village piped water supply systems (using surface water as a source) with slow or rapid sand filters for treatment, and small-scale rainwater supply systems.

The projected number of facilities by type to be constructed during the National Decade Plan (1985-1991) in the different regions of the Kingdom is given in Table 2.4, and a summary of the various technical options including the investment cost of each is presented in Table 2.5.

The construction of these types of facilities in the village will be undertaken at the request of the villagers as part of the village development plan, depending on the technical feasibility of constructing the required facility in the locality. An algorithm is presented in Figure 2.1 which can be used as a guide in the selection of the most appropriate water supply system to be built in a particular village.

It must be noted that all proposed technical options, with the exception of the rainwater collectors, can be utilized both for drinking and domestic purposes, since it is assumed that the water quality will be in accordance with WHO Drinking Water Quality Standards.

Table 2.5 Summary of Number of Facilities by Type to be Constructed during the National Decade Plan (1985-1991)

Type of Facility	Unit Cost (Baht)	Total No. of Units to be Constructed (1985 - 1991)
1. Rainwater jars		
- 1 cu m	280	376,788
- 2 cu m	470	4,011,000
2. Spring catchment system	88,700	63
3. Sanitary shallow well	16,000	25,053
4. Deep well	71,100	21,805
5. Small-scale piped water supply system	201,000	1,316
6. Village piped water supply system		
- slow sand filter	3,476,600	77
- rapid sand filter	3,325,300	21
7. Small-scale rainwater supply system	48,100	6,650

Note: 1 U.S. dollar is equivalent to approximately 27 Baht.

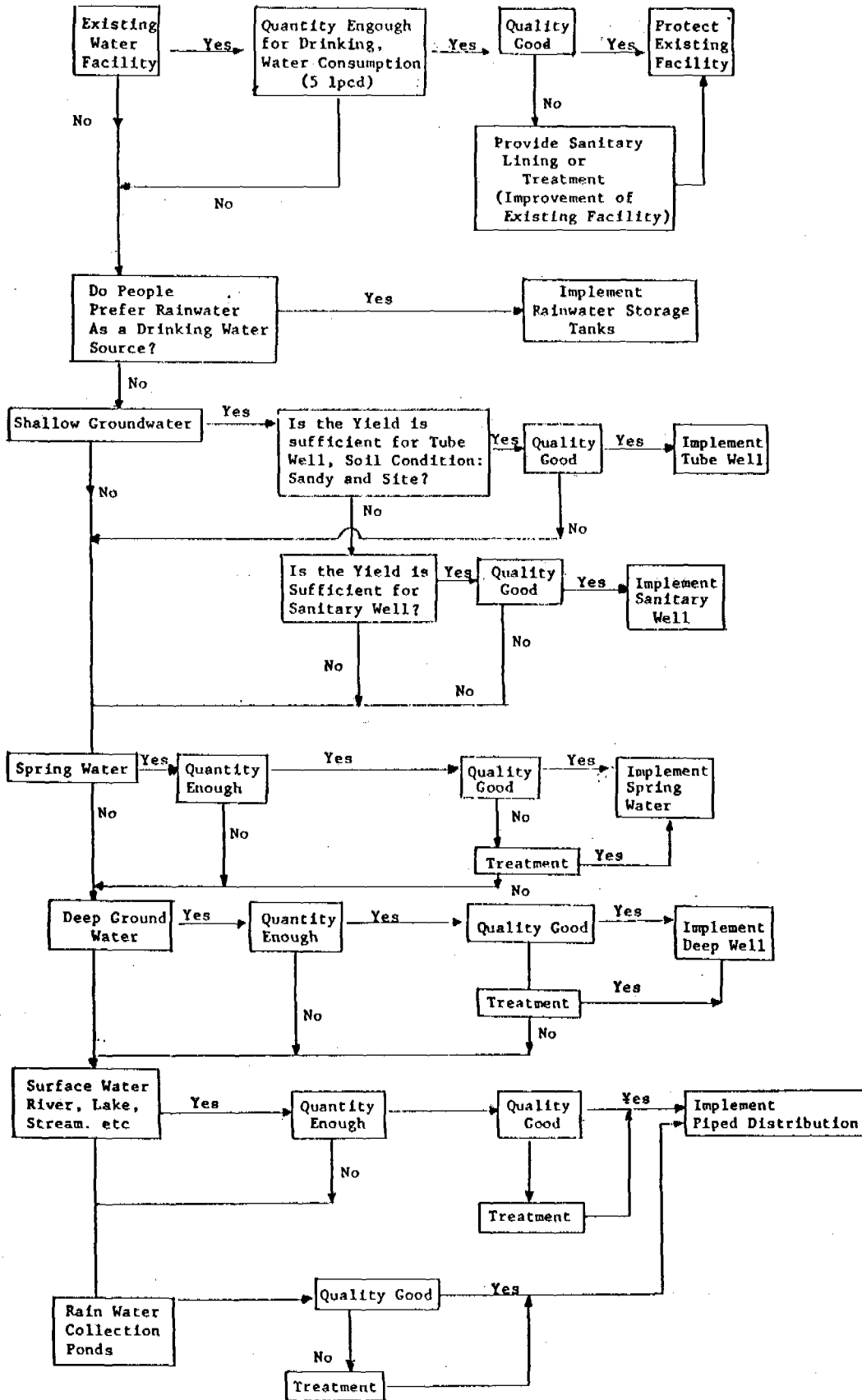


Figure 2.1 Algorithm for Water Facility Selection

2.1.4 Operation and Maintenance (O&M)

The O&M program of the National Decade Plan calls for the involvement of water users in the operation and maintenance of public facilities by teaching them the correct way of operating the systems. Generally, a caretaker or an operator, chosen by the village development committee (VDC), will be assigned to each facility to oversee its condition and to report any breakdown to the VDC so that immediate technical assistance can be requested.

It is deemed best that the O&M program for sanitary wells and deep wells should be handled by private firms, who would consequently be obliged to render technical assistance to the villagers as well. For a piped water supply and other distribution systems, the relevant RTG agencies will continue to provide technical support, especially in the form of training operators for these systems. For ponds, since this is a simple technology, maintenance can be undertaken by the villagers themselves through the motivation of the community development workers.

It is further assumed that the O&M cost for piped water supply systems and ponds will be borne by the villagers themselves through the village development fund.

A summary of the various components of the O&M program is given in Tables 2.6 and 2.7.

2.1.5 Water Quality Monitoring

In the Decade Plan, emphasis will be placed not only on achieving the goal of providing an adequate water supply to the rural population but also in ensuring that the water used by these people is safe for drinking and domestic consumption. With the target population coverage in terms of water quantity expected to be fully attained during the Plan implementation (1985-1991), the importance of monitoring the water quality from various water sources in the villages will become very apparent.

The proposed monitoring program will be carried out in two parts in order to achieve these objectives.

Part I - Surveillance Program

This program needs to be undertaken in order to identify the potential sources of polluted water by means of indicative tests.

Surveillance of village water sources will be carried out mainly by the tambon health officers. Indicative tests for bacteriological contamination will be undertaken by taking samples from the villages under each tambon. Sources which are found to be contaminated will be immediately disinfected using chlorine powder, with the help of village health volunteers or well caretakers. Requests for chlorine powder and other necessary operational materials should be sent

Table 2.6 Estimated Number of Facilities Scheduled for O&M Program
in the Different Regions of Thailand between 1985 and 1991

Sources	1985	1986	1987	1988	1989	1990	1991
<u>Northern Region</u>							
Sanitary Well	3,588	8,357	13,126	17,895	22,664	27,433	32,202
Deep Well	6,750	8,435	10,120	11,805	13,490	15,175	16,860
<u>Northeastern Region</u>							
Sanitary Well	6,825	12,525	18,225	23,925	29,625	35,325	41,025
Deep Well	16,203	20,726	25,249	29,772	34,295	38,818	43,341
<u>Central Region</u>							
Sanitary Well	1,560	3,701	5,842	7,983	10,124	12,265	14,406
Deep Well	5,266	7,460	9,654	11,848	14,042	16,236	18,430
<u>Southern Region</u>							
Sanitary Well	1,399	3,537	5,675	7,813	9,951	12,089	14,227
Deep Well	2,617	3,713	4,809	5,905	7,001	8,097	9,193
<u>Whole Kingdom</u>							
Sanitary Well	13,372	28,120	42,868	57,616	72,364	87,112	101,860
Deep Well	30,836	40,334	49,832	59,330	68,828	78,326	87,824

NOTE: These figures are based on existing facilities in 1983, facilities built in 1984, and those to be implemented under the new construction, rehabilitation and upgrading programs between 1985 and 1991. The total number in the preceding year will be the estimated number in the current year, e.g., the estimated total number of facilities (adequate and sanitary sources only) in 1984 will be the number to be covered in 1985, etc.

Table 2.7 Estimated Number of Village Operators to be Trained Annually in the Different Regions of Thailand between 1985 and 1991

Village Operators	1985	1986	1987	1988	1989	1990	1991	Total	Training Courses
<u>Northern Region</u>									
- For PWS:DW	116	116	116	116	116	116	116	812	
SS	2	2	2	2	2	2	2	14	
RS	1	1	1	1	1	1	1	7	
- For spring catchment	3	3	3	3	3	3	3	21	
Sub-Total	122	122	122	122	122	122	122	854	4
<u>Northeastern Region</u>									
- For PWS:DW	177	177	177	177	177	177	177	1,239	
SS	3	3	3	3	3	3	3	21	
RS	-	-	-	-	-	-	-	-	
- For spring catchment	3	3	3	3	3	3	3	21	
Sub-Total	183	183	183	183	183	183	183	1,281	6
<u>Central Region</u>									
- For PWS:DW	145	145	145	145	145	145	145	1,015	
SS	4	4	4	4	4	4	4	28	
RS	1	1	1	1	1	1	1	7	
- For spring catchment	-	-	-	-	-	-	-	-	
Sub-Total	150	150	150	150	150	150	150	1,050	5
<u>Southern Region</u>									
- For PWS:DW	101	101	101	101	101	101	101	707	
SS	2	2	2	2	2	2	2	14	
RS	1	1	1	1	1	1	1	7	
- For spring catchment	3	3	3	3	3	3	3	21	
Sub-Total	107	107	107	107	107	107	107	749	4
<u>Whole Kingdom</u>									
- For PWS:DW	539	539	539	539	539	539	539	3,773	
SS	11	11	11	11	11	11	11	77	
RS	3	3	3	3	3	3	3	21	
- For spring catchment	9	9	9	9	9	9	9	63	
Grand Total	562	562	562	562	562	562	562	3,934	19

NOTE: - For the O&M training courses, only newly-constructed and rehabilitated/upgraded piped water supply systems will be covered.

- The total number of piped water supply systems will determine the total number of village operators to be trained, and correspondingly the number of training courses to be undertaken.
- A training course will consist of 30 participants at a cost of Baht 47,500.
- Annual O&M cost for a sanitary well and a deep well is estimated at Baht 800 and Baht 3,500 respectively.

directly to the respective Regional Offices. Sampling and testing must be carried out once every three months.

Part 2 - Assessment Program

This program needs to be undertaken in order to assess the water quality situation for national planning purposes by means of detailed tests of water samples taken from the villages.

In the assessment program, unlike in the surveillance program, the collected water samples will be analyzed for their chemical, physical and bacteriological quality according to WHO Drinking Water Standards. The results will be stored for an evaluation of the general water characteristics of different facilities in the rural areas of the Kingdom. This aspect of water quality monitoring will be carried out mainly by the Regional Offices in coordination with the Central Office. Random sampling of water sources in the villages of a given amphur will be made once a year by the amphur health officers. The total number of samples to be taken from all amphurs and forwarded to the regional center laboratory is roughly 6,400 per year.

The Central Office will likewise serve as a reference laboratory, where requests can be made for chemicals and other laboratory apparatus to be used at the Regional Offices. Moreover, the Central Office will, in the future, provide guidelines for the appropriate water standards to be adopted in the rural areas of Thailand.

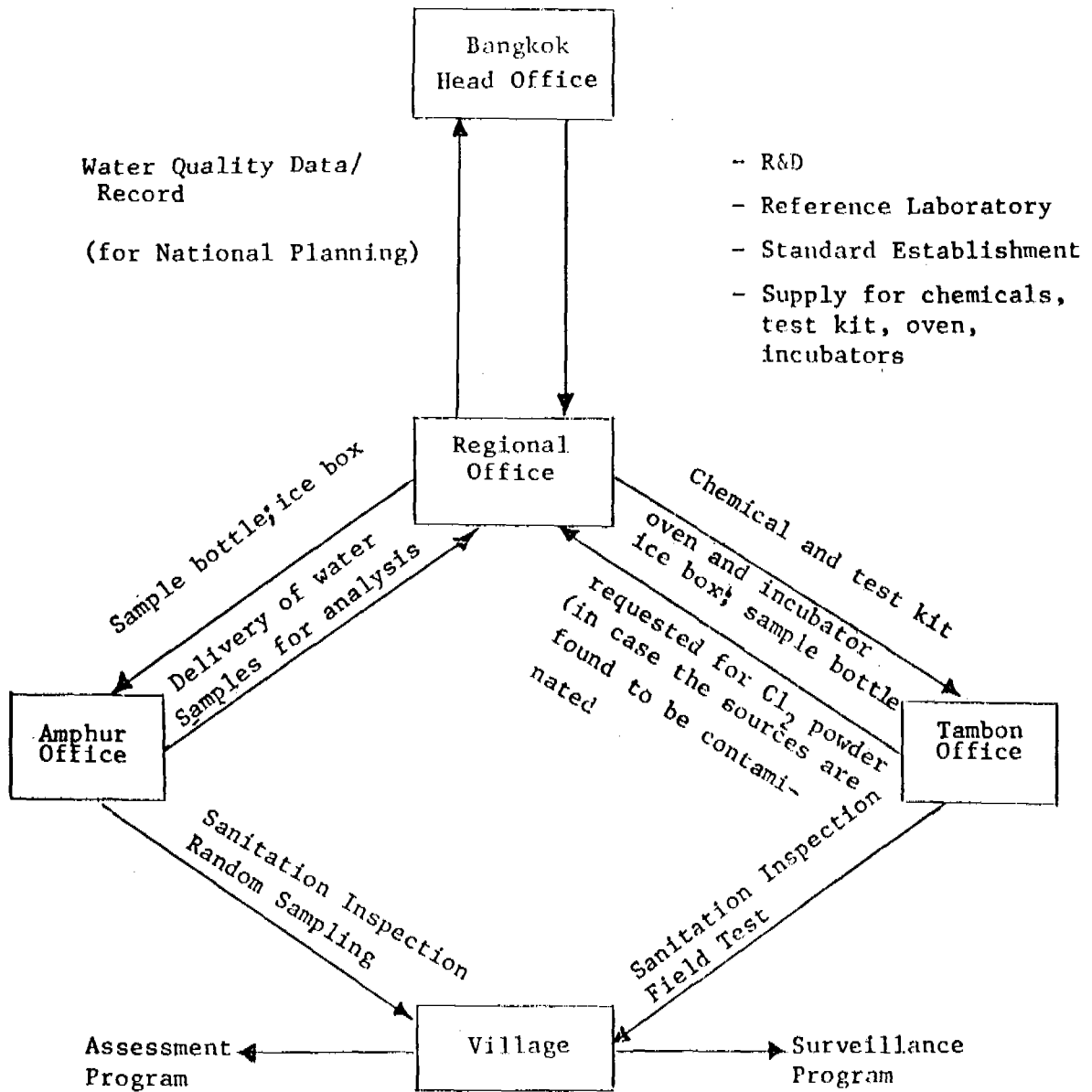
The structure and detailed plan of the proposed water quality monitoring program are given in Figure 2.2 and Table 2.8, respectively.

It is envisaged that all villages will be covered within two years after initiation of the National Decade Plan, and accordingly training of the required manpower (see Table 2.9) and provision of the necessary investment requirements will take effect within the same period. The operational cost will be continuously provided throughout the Plan period.

2.1.6 Research and Development (R&D)

Continuous research and development (R&D) activities will be pursued to further improve the effectiveness and efficiency of water facilities and applied construction technologies; to evaluate the suitability of new materials, equipment and technology; to develop/improve the strategies for community involvement in all stages of water supply projects; and also to enhance village participation.

The various components of the implementation plan for the rural water supply program during the Decade Plan (1985-1991) are summarized in Table 2.10.



No. of Regional Offices = 9
 No. of Amphur Offices = 723
 No. of Tambon Offices = 6,325
 No. of Villages = 56,404

Average No. of Amphur Offices/Regional Office = 80
 Average No. of Villages/Tambon Office = 9

Figure 2.2 Structure of the Proposed Water Quality Monitoring Program

Table 2.8 Detailed Plan for the Proposed Water Quality Monitoring Program

Type of Program	Level	Manpower	Sources	Activities	Frequency	Type of Water Quality Test /Sampling	No. of Samples
Surveillance	1. Tambon	Tambon Health Officer (1)	All types of water sources - SW, TW & DW - RWS - RWC (Public and Private)	1. Sanitary Inspection	once/year	-	-
				2. Water Quality Testing Fecal Coliform, residual chlorine	once/3 months	Indicative Test	180/3 months
Assessment	2. Amphur	Amphur Health Officer (1)	All types of water sources	1. Sanitary Inspection	once/year	-	-
				2. Sampling and Delivery to the regional office	once/year	Random Sampling	80/year
	3. Regional	Scientist (4) Assistant Scientist (4)	All types of water sources	1. Test of water quality samples, for detailed physical bacteriological and chemical analysis according to WHO Drinking Water Standards (1971)	once/year	Detailed Analysis	6,400/year
				2. Report the analysis results to the Head Office for National Planning	once/year	-	-
4. Central	Scientists (20) Assistant Scientists (15) Workers (5)		1. R&D work 2. Reference Laboratory (Standardization) Water Quality) 3. Establishment of Standards 4. Supply for Chemicals test kit, oven, incubator 5. Data Processing 6. Personnel Development	-	-	-	

() Number of Personnel Required

Table 2.9 Estimated Number of Training Courses to be Conducted for Different Categories of Personnel in Relation to the Water Quality Monitoring Program

Categories	1985	1986	Total
Regional Officers	1	1	2
Amphur Officers	16	20	36
Tambon Officers	288	345	633

Table 2.10 Summary of Implementation Schedule for Various Activities of the Rural Water Supply Program (1985-1991), in number of units

Activities	1985	1986	1987	1988	1989	1990	1991	Total
1. New Construction								
<u>Rainwater Jars</u>								
By subsidy: 1 m ³	62,798	62,798	62,798	62,798	-	-	-	251,192
2 m ³	668,666	668,666	668,666	668,666	-	-	-	2,674,664
By revolving fund: 1 m ³	31,399	31,399	31,399	31,399	-	-	-	125,596
2 m ³	334,334	334,334	334,334	334,334	-	-	-	1,337,336
Molds	3,657	3,657	3,657	3,657	-	-	-	14,628
<u>Other Proposed Technical Options</u>								
Spring catchment system	9	9	9	9	9	9	9	63
Sanitary well	3,579	3,579	3,579	3,579	3,579	3,579	3,579	25,053
Deep well	3,115	3,115	3,115	3,115	3,115	3,115	3,115	21,805
Small-scale piped water supply system	188	188	188	188	188	188	188	1,316
Slow sand filter	11	11	11	11	11	11	11	77
Rapid sand filter	3	3	3	3	3	3	3	21
Small-scale rainwater Supply System	950	950	950	950	950	950	950	6,650
2. Upgrading								
Shallow well	11,169	11,169	11,169	11,169	11,169	11,169	11,169	78,183
Deep well	5,305	5,305	5,305	5,305	5,305	5,305	5,305	37,135
Small-scale Piped Water Supply System	293	293	293	293	293	293	293	2,051
3. Rehabilitation								
Deep well	1,078	1,078	1,078	1,078	1,078	1,078	1,078	7,546
Small-scale piped water supply system	58	58	58	58	58	58	58	406
4. Operation and Maintenance (O&M)								
Sanitary well	13,372	28,120	42,868	57,618	72,364	87,112	101,860	101,860
Deep well	30,836	40,334	49,832	59,330	68,828	78,326	87,824	87,824
small-scale piped water supply system	539	539	539	539	539	539	539	3,773
Slow sand filter	11	11	11	11	11	11	11	77
Rapid sand filter	3	3	3	3	3	3	3	21
Spring catchment system	9	9	9	9	9	9	9	63
Training courses for village operators	19	19	19	19	19	19	19	133
5. Monitoring of Water Quality								
<u>Levels</u>								
Region	4	5	-	-	-	-	-	9
Amphur	320	403	-	-	-	-	-	723
Tambon	2,880	3,445	-	-	-	-	-	3,445
<u>Training Courses</u>								
Regional officers	1	1	-	-	-	-	-	2
Amphur officers	16	20	← as appropriate →					36
Tambon officers	288	345	← as appropriate →					633
6. Research and Development (R&D)			← as appropriate →					-

2.2 RURAL SANITATION PROGRAM

The proposed sanitation program comprises the following activities which will be carried out during its implementation between 1985-1991:

- toilet construction,
- training,
- health education, information and communication,
- research and development (R&D),
- operation and maintenance (O&M).

The detailed plan of action for the above activities are elaborated below.

2.2.1 Toilet Construction

The proposed toilet construction program will aim at increasing the availability and use of sanitary latrines by the installation of about 2.5 million pour-flush (PF) latrines in the rural areas of the Kingdom between 1985 and 1991.

The implementation plan for latrine construction in the different regions of Thailand is presented in Table 2.11.

In selecting the communities for sanitation improvements, a list of villages with a percentage of latrines which is less than 75% of the total number of households in a particular village will be prepared by the Sanitation Division of the Department of Health. Identification of individual villages will be made through the DOH Report 08-R-Ng 514. Among the names of villages on the list, priority may be given to those with established water supply systems since the proposed sanitation option, i.e., a PF latrine, requires a considerable amount of water for operation and maintenance.

Project staging at the village level may have to be undertaken in the following phases:

Phase 1. Motivation and Demonstration

This phase will commence with the calling of introductory meetings in each of the target villages. These meetings should be followed immediately by the selection and training of village sanitation craftsmen (VSC). This phase culminates with the construction of demonstration latrines at selected sites in each village. Finally, a second meeting should be called, just before people return to their lands, to look at the demonstration latrines and to explain the construction process, the overall cost for individual latrine, and the method of payment of the revolving fund.

Table 2.11 Implementation Schedule for Latrine Construction in the Different Regions of Thailand between 1985 and 1991 (x 1,000)

Region	1985	1986	1987	1988	1989	1990	1991	Total
North	50	60	70	80	100	110	120	590
Northeast	60	80	100	120	140	160	170	830
Central	60	70	80	80	90	90	100	570
South	30	40	50	70	90	110	110	500
Whole Kingdom	200	250	300	350	420	470	500	2,490

Phase 2. Preparation for Construction

During this phase, slabs, squatting plates, cement rings and vent pipes should be centrally manufactured and distributed to the villages for stockpiling along with other local construction materials. The village headman (puyai ban) should be encouraged to keep the list of householders who want to avail themselves of the "revolving fund" and commence the collection of payments when the village committee for such action has not yet been established.

Phase 3. Construction

The individual householders will undertake the construction of their latrines, assisted by the village craftsmen. Also, the village craftsmen or village committee should ensure that loans are paid back according to the stipulated time after the construction is completed.

2.2.2 Training

To achieve a successful implementation of the sanitation plan, several training programs must be conducted for different groups of participants.

During the period between 1985 and 1991, there will be about 635,000 village health communicators (VHCs), 54,600 village health volunteers (VHVs), 5,421 tambon health workers (THWs), 91,000 tambon council committees (TCCs) and 46,008 village sanitation craftsmen (VSCs) to be trained according to the varying tasks they will perform during the Decade Plan (see Tables 2.12, 2.13 and 2.14).

Training of VHVs will be under the responsibility of the Primary Health Care Office in the Office of the Undersecretary of State for Public Health. The Sanitation Division of the Department of Health will be responsible for the proper training of TCCs, THWs and VSCs.

2.2.3 Health Education, Information and Communication

Most of the sanitation activities are largely dependent on community participation, and therefore health education plays a very important role in community participation as well as in the implementation of the sanitation program.

For health education, information and communication, the following guidelines must be observed:

- The health education curriculum will be designed by the Health Education Division in the Office of the Undersecretary of State for Public Health, in close coordination with the Ministry of Education. Basic hygiene practices, such as proper toilet utilization, must be highlighted.

Table 2.12 Target Number of VHV/VHCs, TCCs, VSCs and THWs to be Trained per Year between 1985 and 1991

Type of Trainees	1985	1986	1987	1988	1989	1990	1991	Total
VHV/VHC	107,800	107,800	94,800	94,800	94,800	94,800	94,800	689,600
TCC	12,000	12,000	13,000	13,000	13,000	14,000	14,000	91,000
VSC	6,000	6,000	6,500	6,500	7,000	7,000	7,008	46,008
THW	600	700	800	800	800	850	871	5,421

Table 2.14 Estimated Number of Training Courses to be Conducted per Year
in the Categories of TCCs, VSCs and THWs between 1985 and 1991

Number of	1985	1986	1987	1988	1989	1990	1991	Total
TCCs training courses per year	12,000 240	12,000 240	13,000 260	13,000 260	13,000 260	14,000 280	14,000 280	91,000 1 820
VSCs training courses per year	6,000 200	6,000 200	6 500 217	6,500 217	7,000 234	7 000 234	7 008 234	46.008 1,536
THWs training courses per year	600 20	700 24	800 27	800 27	800 27	850 29	871 29	5 421 183

- Construction of latrines in all primary schools will be undertaken by the Sanitation Division of the Department of Health in collaboration with local schools and government officials. Actual use of these facilities by school children must be encouraged. It will be the duty of school teachers to teach proper defecation habits and maintenance of toilet facilities.
- Design and preparation of radio programs, shows, posters, leaflets, and comics will be carried out by the Sanitation Division of the Department of Health. Cooperation from the local government officials and other personnel must be sought in the distribution of educational materials to the community. Radio programs and films to be shown must be made in such a way that the program objectives are reflected.
- Information dissemination by personal contacts, with a view to changing local attitude, will be conducted by the VHVs and VHCs at the villages through the Primary Health Care program. In addition, the VHVs/VHCs may be utilized to distribute the educational materials to the villagers during their household visits.

2.2.4 Research and Development (R&D)

Research and development (R&D) is an associated practice of all the technical and administrative aspect of the program. The program will give priority to appropriate technology to be applied in the source of implementation of the program activities.

Work may be done by contracting with reputable institutions, or by experts within the Sanitation Division of the Department of Health. Researches at the regional level must be also encouraged.

Research proposals from the Regional Sanitation Centers (RSC), with the endorsement of the Regional Director, will be forwarded to the central office for study and approval. Written report must be a requirement for each completed study and must be made available to all interested parties, especially planners and policy makers.

2.2.5 Operation and Maintenance (O&M)

Maintenance of individual toilet facilities will be the responsibility of the owner. However, from time-to-time, health workers in the area should advise the owner on proper maintenance of the toilet.

A summary of the implementation schedule for various sanitation activities of the Decade Plan (1985-1991) is presented in Table 2.15.

Table 2.15 Summary of Implementation Schedule for Various Activities of the Sanitation Program (1985-1991), in number of units

Activity	Number to be implemented in							
	1985	1986	1987	1988	1989	1990	1991	Total
A. Toilet Construction (PF latrines)	200,000	250,000	300,000	350,000	420,000	470,000	500,000	2,490,000
B. Training								
- VHC, VHV	107,800	107,800	94,800	94,800	94,800	94,800	94,800	689,600
- TCC, VSC, THW	18,600	18,700	20,300	20,300	20,800	21,850	21,879	142,429
- Seminar/workshop/coordination, etc.	← as appropriate →							
C. Health Education								
- Posters	480,000	480,000	480,000	480,000	480,000	480,000	480,000	3,360,000
- Handouts/leaflets	1,400,000	1,400,000	1,400,000	1,400,000	1,400,000	1,400,000	1,400,000	9,800,000
- Comics	1,400,000	1,400,000	1,400,000	1,400,000	1,400,000	1,400,000	1,400,000	9,800,000
D. Research and Development	← as appropriate →							

2.3 INSTITUTIONAL ASPECTS

In light of the proposed rural water supply and sanitation programs outlined in the preceding sections, it is apparent that the institutional needs of each sector vary considerably from each other.

The sanitation sector is already organized within a well-defined, comprehensive and centralized structure with a number of workable schemes of decentralization and local participation underway. Moreover, the proposed sanitation program for the national Decade Plan does not require any drastic departure from the existing one. In short, the current institutional set-up is quite capable of accommodating the proposed sanitation program without any critical change. Hence, while remedial adjustments of the present institutional set-up for rural water supply (RWS) services are recommended for the proposed long-term program, no similar change will be suggested regarding the organizational structure for sanitation.

2.3.1 Proposed Institutional Arrangement for the Rural Water Supply (RWS) Program

The existing structure of the RWS program is an improvement on the previous fragmented and duplicated structure. The Center for Integrated Plan of Operations (CIPO) has actively been acting as a secretariat responsible for integrating, allocating, scheduling and facilitating the budgetary process of the RWS services of the various implementing RIG agencies. However, the effort is generally understood to be a temporary measure in a transitional period from the former structure to the emerging institutional pattern to be explored and proposed. Besides, CIPO's role in this enterprise tends to be more limited due to its multiple pressing responsibilities in other crucial development activities.

The proposed organizational arrangement, as shown in Figure 2.3, is an attempt to reconcile the RWS program with a number of principal development values, such as decentralization, appropriate technology, integration, local participation, as well as the comprehensive effectiveness of the Plan.

The set-up is divided into five levels ranging from the national, regional, provincial, district and village levels with a number of agencies responsible for either similar or different functions at each level.

A. National Level

At the national level, the institutional set-up dealing with the planning and integration of the nationwide RWS services can be viewed as consisting of two major components: the overall policy planning and integrating bodies, and the implementing agencies. This, however, does not necessarily mean that the implementing departments do not take part in the policy planning process.

NATIONAL
 REGIONAL
 PROVINCIAL
 DISTRICT
 VILLAGE

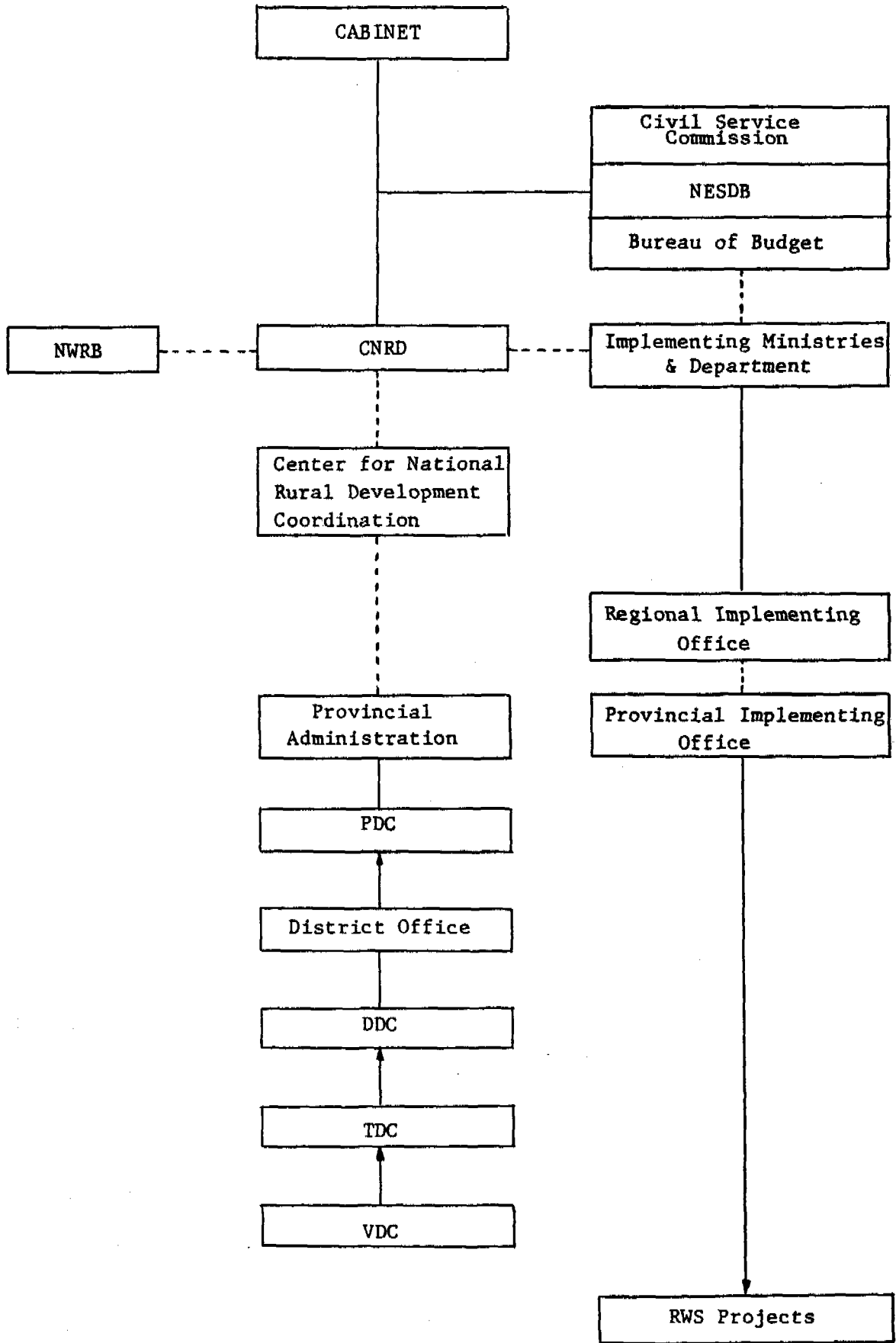


Figure 2.3 Proposed Organizational Set-up for the Rural Water Supply (RWS) Component of the Thailand Decade Plan (1985-1991)

Actually, the implementing departments have been involved in the initiation, suggestion and formulation of various RWS related policies and plans, but mainly with regard to their respective domain of responsibility.

A-1. Policy Planning and Integrating Bodies

Other than the regular overall policy-making bodies like the Cabinet, the Council of Economic Ministers, the National Economic and Social Development Board (NESDB), the Budget Bureau (BB), and the Civil Service Commission (CSC), the bodies that are more directly related to RWS services are national level committees, of which there are quite a number. Outstanding among the committees in the proposed organizational scheme are the National Water Resources Board (NWRB) and the Committee for National Rural Development (CNRD). Functionally, the RWS policy seems to be a common interest for the two national level committees depicted in Figure 2.4.

Actually, the CNRD and NWRB appear to be strong candidates to take over the central role in RWS policy planning and integration. After a careful review of the situation, the CNRD would seem to be the organization most likely to take over the leading role. The reason is simple and straightforward: the CNRD is equipped with a powerful secretariat organization - the Center for National Rural Development Coordination that has already been in action for sometime. Hopefully, the more familiar and experienced CNRD will be able to include the RWS service as another important component of its multi-functional activities in rural development and run it effectively. The NWRB is not in such a good position to promote RWS activities since it does not yet have a permanent secretariat organization.

The Committee for National Rural Development (CNRD)

The CNRD is a national level committee with the responsibility of organizing overall national rural development, which includes the provision of RWS services. Since the Committee is chaired by the Prime Minister, it is considered as a powerful and effective organ to facilitate the national Decade Plan. As a central body, it will help in eliminating any unnecessary, fragmented and overlapping policy planning and implementation works by the RTG agencies involved in the Plan, and hence will enhance the efficiency of implementing the Plan.

The CNRD's expanding responsibilities include the policy planning and coordination of a wide range of rural development projects sponsored mainly by principal ministries, such as the Ministry of the Interior (MOI), the Ministry of Agriculture and Cooperatives (MOAC), the Ministry of Education (MOE) and the Ministry of Public Health (MOPH), for which the rural water supply has become an essential aspect. Through the

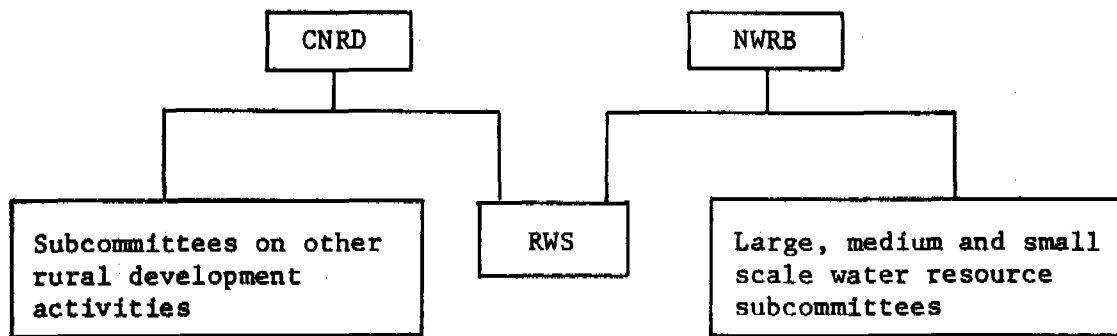


Figure 2.4 Common Responsibilities of the CNRD and NWRB

Center for National Rural Development Coordination (CNRDC), a unit under the NESDB acting as the CNRD secretariat, the CNRD's roles in the coordination of rural water supply services will be considerably increased, to encompass those functions which will be gradually phased out from the Rural Job Creation Committee (RJCC).

Finally, even the rural water supply projects currently processed under the P.N. system are expected to come under the CNRD. The transition will not be a complicated one since the systems are very similar. The CNRD (or the G-Ch-Ch) system and procedures have actually been patterned after the P.N. system.

The National Water Resources Board (NWRB)

The creation of the National Water Resources Board is a direct response to the fragmentation and complications which characterize the overall structure of the RTG organizations dealing with water resources. In addition to the fact that the NWRB has not been armed with a competent and permanent secretariat office, it is also doubtful whether or not the rural water supply problems will be able to attract the Board's interest and rank as high priority issues when competing with the size, significance and impact of the large, medium or even small-scale water resource projects which come under the same organization. In addition, the limited scale, the multiplicity, the limited technical problems and the remote and scattered locations of rural water supply facilities in the rural communities throughout the country tend to challenge the idea at organizing, planning and running the rural water supply services permanently as a single and centralized national system. Rather, the rural water supply scenario should be conceptualized and analyzed in the framework of rural development efforts. In point of fact, the national policy planning body takes an active part in deciding when and where the construction of rural water supply facilities should take place in the countryside so as to ensure that the limited resources are channelled to the most pressing areas. Some RTG organizations are even responsible for the construction of certain categories of highly technical rural water supply facilities.

At this stage, the NWRB or any of its relevant subcommittees is in a position to contribute enormously to the services especially with regard to water resource policy and technical matters. Once the RWS facilities are constructed in the villages, the design and management of the services should be carried out on the basis of a rural development concept in which the software aspects as well as human factor are highlighted.

Development principles such as self-reliance, decentralization, and local participation should underlie the rural water supply projects in rural development. Networks are expected to foster participation by the villagers or village organizations, and through comprehensive and properly designed training programs for the villagers' organizations, simple technical and communication skills should be gradually developed. Even a village fund can be initiated to finance the projects.

A-2. National Implementing Agencies

Sixteen agencies of six ministries have been and will continue to be active participants in small-scale water resources development and rural water supply activities. Of these agencies, however, only eight agencies will be considered as directly involved with rural water supply for drinking and domestic consumption (as also stated earlier in Section 1.1). These agencies, namely the Department of Public Works (DPW), the Department of Local Administration (DOLA), the Office of Accelerated Rural Development (ARD), the Department of Community Development (DCD), the Department of Health (DOH) both the Sanitation Division (DOH-SD) and the Rural Water Supply Division (DOH-RWSD), the Department of Mineral Resources (DMR), the National Security Council (NSC) and the Provincial Water Works Authority (PWWA) will continue to be engaged in a variety of rural water supply activities, e.g. the provision of facilities. An attempt to restructure and allocate the rural water supply facilities, activities and operating areas in such a way that inefficient utilization of resources or duplication of efforts will be minimized has been made, and is presented in Table 2.16.

Projects in general are usually discrete and relatively autonomous in their organization and management. However, the degree of independence should not be so high that the RWS activities in those specific areas are totally excluded and ignored by the Decade Plan. In order to get the complete RWS scenario of the entire rural areas of Thailand, it is suggested that the initial and follow-up information system should also include data on RWS facilities and as many other related features as possible.

On the other hand, the RWS planning and implementation in each specific development project site should also be kept informed at least about the scope of service, the organizational chart, the work flow chart, the conditions, the locations and schedules of such services as rehabilitation/upgrading of existing facilities, new construction, and operation and maintenance of the technical aspects. By so doing, a certain degree of independent tradition will be developed and subsequently the system will result in the saving of both the investment costs and the operating costs for special development projects.

Table 2.16 Proposed Delineation of Responsibilities of RTG Agencies for a Particular Type of Facilities, by Region

Proposed Facilities	North	Northeast	Central	South	Sensitive Areas
1) Spring Catchment System	DMR	DMR	DMR	DMR	-
2) Sanitary Well	ARD	ARD	DOH-RWSD	DOH-RWSD	-
3) Tube Well	DOLA	DOLA	DOLA	DOLA	-
4) Deep Well	ARD	DMR	DPW	DPW	NSC
5) Rainwater Collectors					
a. Domestic Jars	DOH-SD	DOH-SD	DOH-SD	DOH-SD	-
b. RFC Tanks	DCD	DCD	DCD	DCD	-
6) Small-Scale Rainwater Supply (Piped water in schools, temples and hospitals)	DOH-SD	DOH-SD	DOH-SD	DOH-SD	-
7) Small-Scale Piped Water Supply (Deep Well Source)	DOH-RWSD	DOH-RWSD	DPW	DPW	-
8) Village Piped Water Supply (Slow/rapid Sand Filters)	PWWA	PWWA	PWWA	PWWA	

NOTE: These agencies were determined by considering agency capability for construction (units/year) and broadness of their areas of operation.

Some agencies have special competence in dealing with particular problems, and it is useful to look into the current and prospective trends of their responsibilities. The NSC's services and operations, for example, play a role in the development of many facilities, but their sites have been mainly limited to sensitive areas. It is generally understood that once insurgency activities subside and the general situation normalizes, the NSC's RWS responsibilities should be turned over to the agencies responsible for their regular administration.

Also notable is PWWA's piped water supply projects. It is understood that this type of project is relatively costly and the communities are required to shoulder a very large portion of both the investment cost and the operation and maintenance (O&M) cost. On the other hand, it is also natural that a state enterprise like the PWWA, which provides a remuneration service, should be self-supporting. Consequently, it is difficult to draw up a delicate plan of the facility since the "when" and the "where" of the services depend almost entirely on the organizational and financial capability of the counterpart communities.

B. Regional Organizations

Most central RTG implementing departments in Bangkok have a number of regional offices to perform some or all of the following functions:

- to furnish technical advice and guidance to the field operating units in the regions;
- to supervise and coordinate the operation of provincial offices in the region;
- to take direct action in such operations as construction, upgrading or rehabilitation of certain facilities which are usually of a highly technical nature.

Officially, the actual status of the regional office is a subdivision of the central administration. Thus, they are supposed to serve in policy, planning and coordinating or in providing technical assistance, rather than in undertaking direct operation responsibilities. The existence of a regional office is theoretically justified by the needs for closer technical supervision and coordination of the operating units of various provinces in the region.

However, operations of the regional offices can also be justified on practical and economic grounds, since the cost of setting up a service center for a highly technical operation is normally very high. In terms of economies of scale, it is obviously more cost-effective to set up or run a highly technical service center on a regional rather than on a provincial basis.

Active agencies participating at the regional level will no longer be confined exclusively to RTG agencies. In the long run, it is suggested that private firms be introduced into the scene at either the regional or provincial level to take care of highly technical servicing activities, such as the rehabilitation/upgrading and operation and maintenance (O&M) of some relatively complicated facilities (e.g. deep wells, shallow wells with handpumps and piped water supply systems). The reason for introducing private firms to take over this burden is evident in that most RTG agencies have long been ineffective in the struggle to cope with the rehabilitation/upgrading or operation and maintenance (O&M) of the increasing number of facilities once they are constructed. The problems are far more serious when the facilities are numerous and their locations are scattered and remote from each other.

Consequently, the responsibilities for operating and maintaining the facilities will be handed over not only to trained villagers or village organizations, but will also be assigned to private firms, in line with the principle of privatization. However, the bidding process and the supervision of private firms will still be carried out by the relevant implementing agencies.

B-1. Provincial Level

Traditionally, the role of the provincial administration is mainly to supervise and coordinate the activities of representative field offices of several central departments operating in the provincial limits. Its role in policy planning and initiation has been limited. Recently, when the idea of development from below was strengthened to reinforce the development guidance given at the provincial level, the policy formulating role of the provincial administration was greatly enhanced.

In order for a recently formed Provincial Development Committee (PDC) to play a more active and effective part in the planning, implementation and coordination of rural water supply services at the provincial level, it is suggested that a PDC Subcommittee on RWS should be set up and equipped with a competent secretariat component. Initially, the Provincial RWS office would be responsible for screening and integrating the RWS plans submitted by the lower echelon of the administration. Later on, the office should be gradually strengthened in such areas as information transfer, technical manpower, equipment, and financial capability, to the extent that most planning, implementation and coordination responsibilities of the RWS services would be decentralized from the central CNRD and become the responsibility of the provincial administration.

B-2. Sub-provincial Levels

There are three layers of vertical administration echelons under a provincial administration: districts, tambons and villages. The district administration, a subdivision of provincial administration, is virtually the lowest echelon of the national bureaucracy. Village headmen and tambon headmen are not members of the public bureaucracy, but are locally elected positions.

As far as the RWS services are concerned, such bodies as the village development committee (VDC), the tambon council and the district development committee (DDC) will continue to play a central role in the screening and formulation of rural development plans, of which the RWS services constitute one of the major parts. Based on the principles of self-reliance and maximum local participation, local organizations are increasingly expected to be initiated, developed, strengthened and equipped to be able to take over more and more RWS-related activities, such as project identification, construction of less complicated facilities like rain collection jars, operation and maintenance (O&M), water quality monitoring, etc.

2.3.2 Transition and Phasing of the RWS Institutional Set-up

It is proposed that the transitional period for the reorganization of the current RWS institutional structure should consist of three steps, as follows:

- (1) the current structure,
- (2) the CNRDC takeover,
- (3) the decentralization structure.

In the forthcoming phasing, the CNRD - which has already been engaged partially in some RWS business - will be prepared to take over far more extensive and comprehensive responsibilities. In order for the Committee to handle the business effectively, it is suggested that a Subcommittee on Rural Water Supply be established and that a specific unit dealing with RWS matters should be set up in the CNRDC. Also, the Institute of Information Processing for Education and Development will be restructured in order to accommodate the additional information system needed for RWS activities.

At the provincial level, it is also suggested that the PDC Subcommittee on RWS be formed and an exclusive secretariat unit be set up to take care of policy planning and coordination of implementation activities at the provincial level.

Concurrently, an attempt should also be made to explore the potential contribution of a number of interesting private firms which could act as prospective contractors responsible for the upgrading and operation and maintenance (O&M) of highly technical RWS facilities in the countryside.

As for long-term phasing, it is generally expected that the scenario of the RWS system will be transformed from a relatively centralized structure to a more centralized one. Once the entire national system dealing with the RWS service has already been restructured and undergone enough practical experience, the private firms and local organizations are expected to be strengthened and institutionalized. At that stage, it is hoped that the RWS offices at the provincial level will be strong and experienced enough to take over more and more of the responsibilities currently centralized in Bangkok.

In the long run, when the provincial administrations acquire more authority and responsibilities in terms of discretionary powers, notably with regard to the control over personnel as well as budgetary powers, the provincial administration will step in to take a far larger role in the RWS business in both policy planning and implementation in the provinces.

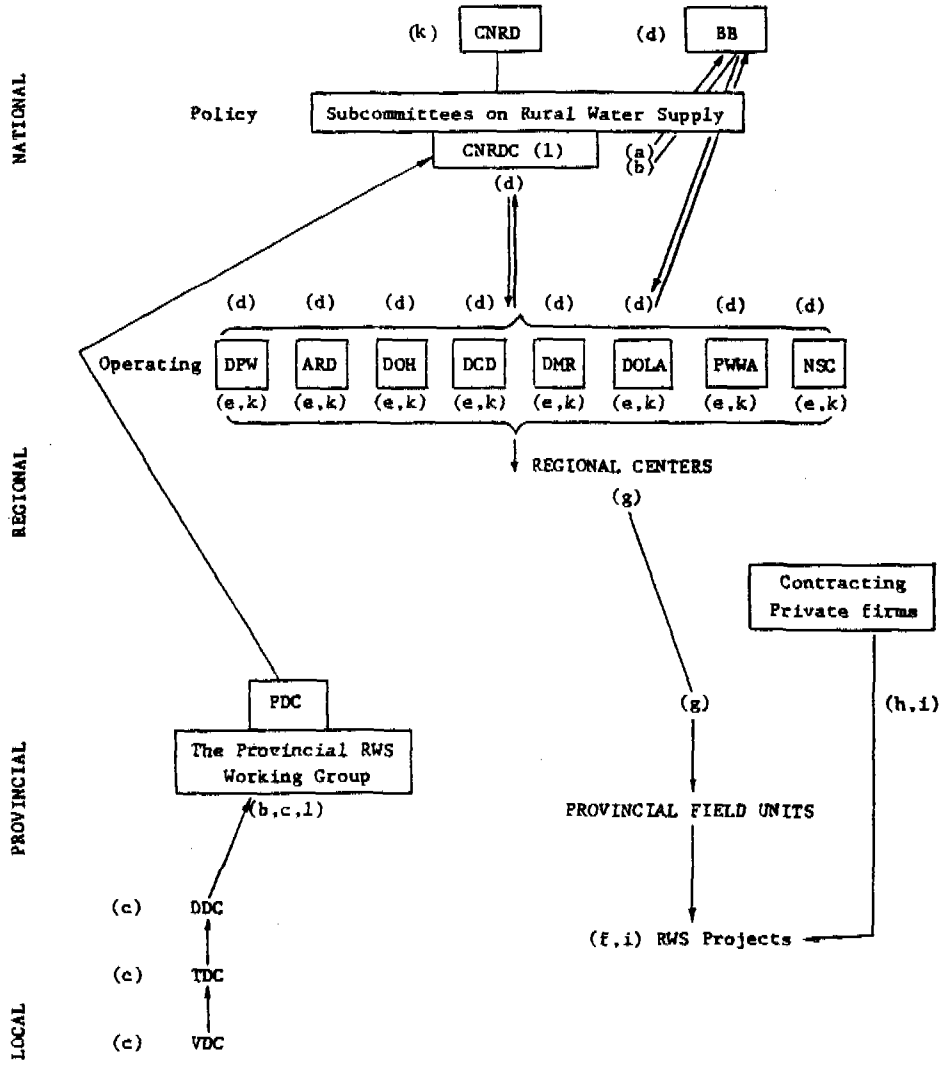
2.3.3 The Proposed Rural Water Supply (RWS) Planning and Implementation

Having evaluated the existing structure and loops of the rural water supply (RWS) planning and management, the future RWS planning and management cycle in relation to the envisaged National Decade Plan (1985-1991) can now put in its proper perspective. It is felt that a centrally planned and integrated system is more appropriate to the objective of optimally utilizing valuable resources as well as channeling them to the most needed locations, particularly at the initial stage. Such a centralized RWS planning and management, said to consist of multifarious activities, is graphically illustrated in Figure 2.5.

A. Information Collection and Processing

The strategies and decisions necessary to obtain the maximum use of further resources of the RWS services have to be formulated on the basis of information regarding the number, the type, the coverage, and the extent to which the functioning facilities are operating in thousands of rural village locations all over the country. Obviously, a centrally organized information system as well as a reliable updating mechanism is required for a comprehensive RWS plan. As government units of all levels are assigned to information collection and/or processing of some forms, an effective management information system (MIS) should be organized in each province to serve as a useful basis for a provincial development plan, of which RWS projects constitute a part.

At the national level, a computerized management information system is necessary. The MIS will eventually be incorporated as a major part of the Institute of Information Processing for Education and Development at Thammasat University. In the meantime, the CIPO, which is currently working as a secretariat of the NWRB, can temporarily assume the responsibility.



- (a) Information Collection and Processing
- (b) Policy Planning
- (c) Project Identification and Preparation
- (d) Project Approval and Budgeting
- (e) Training
- (f) Local Participation and Institution
- (g) Construction, Rehabilitation
- (h) Upgrading
- (i) Operation and Maintenance
- (j) Monitoring of Water Quality
- (k) Research and Development
- (l) Monitoring and Evaluation of Decade Plan Implementation

Figure 2.5 The Rural Water Supply (RWS) Planning and Implementation Process, by Levels and Agencies

B. Policy Planning

The objectives and targets of the rural water supply (RWS) and sanitation programs may have already been set forth as the general policy of the rural sector in the national long-term plan. The more detailed strategies and schedule, however, have to be worked out accordingly by the relevant policy planning committees and implementing RTG agencies.

The future RWS policy and planning lies mainly on the establishment of the CNRD Subcommittee on Rural Water Supply, the availability of a reliable information system, and also on a strong determination to launch a large-scale centralized planning system. Once the Center for National Rural Development Coordination (CNRDC) is fully prepared to take over RWS policy planning information, notably by assessing what, where, how and how many of the existing facilities are available, the more rigorous strategic and operational plans can be devised and implemented.

In this regard, even if the existing structure of committees and agencies continues to function or have their roles modified in one way or another, the CNRDC is in the position to take charge and ensure the continuous functioning of the system without breakdown or interruption.

Equipped with an adequate information system, the CNRDC will be responsible for the long-term policy and planning of the RWS. As regards the annual operating plans, the CNRDC will also serve as a clearinghouse and broker to streamline RWS requests from all over the country and then assemble, classify, decide, budget and distribute the workload properly among the implementing agencies. Of course, the Center will also oversee the overall monitoring and evaluation of the entire enterprise.

C. Project Identification and Preparation

For the most part, identification of any new RWS project is initially done at the village level by the village development committee (VDC). The village RWS projects of each tambon, along with several other village development proposals, are screened, endorsed and reformulated by the tambon development committee (TDC), with the collaboration and advisory services of the Tambon Council Advisory Committee, as part of the annual tambon development plan. The plan is then submitted again and reformulated by the district development committee (DDC).

Project identification and screening at the village and tambon levels are carried out by so-called "development from below" efforts. Apparently, the VDC is in the right position to spell out the villagers' needs. Also, it is generally recognized that the villagers' needs, however significant they may be, have to be refined and appraised in terms of technical feasibility, local priorities, resource availability and, finally, the "top down" developmental objectives, policies, strategies and targets. In this

regard, the district office - as a sufficiently staffed, trained and equipped agency of the national public administrative system at the lowest level - should seriously review and screen the projects submitted by the local communities. Some previous studies and observations have noted some interesting cases where the villagers did not always identify the right RWS facilities to suit their specific problems. (For example, there was a request for a pond as a solution to the lack of drinking water.)

As the DDC is charged with the responsibilities to review, appraise and modify the RWS projects submitted to them by the TDC, the PDC should play an even more active role in the project analysis. In order to strengthen RWS planning, implementation and coordination at the provincial level, the PDC should be provided with a special staff directly trained and equipped to appraise, analyze, modify or even introduce appropriate RWS projects in the province. At the provincial level, the project analysis is conducted in even greater detail than at the district level. For example, the analysis and evaluation of RWS projects should take into account the characteristics and conditions of the existing facilities, the suitability of the proposed facilities in terms of the specific needs of each particular community, the availability and viability of local organization and participation, etc. It is suggested that at the provincial level:

- RWS projects, although they constitute a part of the entire provincial development, should be organized as an identifiable and separate package;
- RWS projects in each province should be ranked or grouped in such a way that their order of priority is known at the phase of project approval and budget allocation.

The RWS staff to be stationed at the provincial level can be either civil servants or special employees. Special arrangements should be made to recruit competent personnel to join the staff and also to retain them as long as possible.

D. Project Approval and Budgeting

Once the RWS projects have been scrutinized, rearranged, classified, grouped and ranked by the provincial RWS working group and then the PDC, as a separate report extracted from the whole annual provincial development plan, they will subsequently be forwarded to the CNRDC where they will be processed. The document will be especially routed to the RWS Division. (Currently, the CIPO is acting as the secretariat office and consequently will in the meantime be responsible for the information system, policy planning, final approval and budget allocation for RWS projects at the national level, until the CNRDC takes over these functions.)

It is notable that not all RWS projects have to be processed by the central government for approval and budget allocation. The construction projects of some simple RWS facilities, such as shallow wells, ponds, or rainwater jars, can be approved and implemented by other sources of funds and local autonomous or semi-autonomous organizations or mechanisms. However, the PDC has yet to report the completed information to the central information center in order to keep the information system updated.

As for RWS projects involving relatively sophisticated facilities, such as deep wells with handpumps, shallow wells with handpumps, or piped water supply systems, that have always required the services of the central RTG agencies and their regional branches in terms of technical, financial or policy integration, the CNRDC office (currently the CIPO), will serve as the policy planning and integrating body. After receiving the requests and information on RWS projects annually submitted by the PDC, the Office will then serve as a broker for the various RTG agencies concerned and the Budget Bureau. The workload for RWS projects is then negotiated and properly allocated among the responsible RTG agencies, according to such criteria as the location of regional or field offices, the agreed operating areas, the location of project sites, the capacity of the operating units, etc. Each agency later on proceeds to submit the budget requests to the Budget Bureau to finance the allocated projects.

E. Training

Despite its indirect and supplementary role in the RWS system, the significance of the training function has become widely recognized among all parties concerned. The increasing popularity and acceptance of the role of training points to the fact that the RWS service is no longer narrowly conceived in terms of the construction activities alone. Rather, the objective of the project is put in a clearer perspective when it is appreciated that the actual utilization of the project depends strongly upon the proper operation and maintenance (O&M) of the facilities to ensure a long life expectancy for the project. Moreover, an RWS project in a village cannot be considered as successful unless its output is fully and properly utilized in such a way that the village public health and sanitation are upgraded. In other words, a successful RWS service has to be accompanied by an effective and extensive training program.

The training responsibilities can be separately or collaboratively organized by a number of relevant agencies, such as the DCD and DOH. The training program can be designed to cover a wide variety of material ranging from very specific topics to very broad and general topics.

Although DCD and DOH assume a leading role in RWS and sanitation related projects, this does not rule out the participation of other agencies in the area. In order to ensure comprehensive and coordinated training activities, a Subcommittee on Training should be formed and entrusted with the following responsibilities:

- to set up general policies and objectives for RWS-related training activities;
- to draw up overall and operating plans for training;
- to arrange and oversee a proper division of training activities between the DCD, the DOH and some other relevant agencies;
- to review the existing structure of the education, continuing education and public relations programs, and explore the possibility of additional direct or indirect promotion of RWS services;
- to integrate and facilitate the planning and implementation of training projects regarding the approval or coordination of the curriculum, the formulation of overall operating plans, the arrangement of training target groups, and also the scheduling and review of the budget allocation for all training components of the Decade Plan.

F. Local Participation and Institutionalization

Training programs are provisional in nature with the limited objective of providing the general and specific RWS-related information and skills required for a collaborative service in the village. In order to ensure a successful RWS service, the training projects have to be accompanied by the institutionalization of responsible village organizations or mechanisms, or the voluntary incorporation of RWS-related activities into the existing institutions, such as the VDC or the village development funds.

Ideally speaking, the effective training and the presence of conscious local organizations and mechanisms should be regarded as a necessary precondition for any RWS facilities to be constructed/rehabilitated/upgraded in any community. However, the realization of the idea is unlikely, due to the fact that a definite target for achieving overall RWS services to satisfy the basic needs of the entire rural communities has not been made explicit. Moreover, a large number and variety of RWS facilities already exist; therefore the formation and training of the village organizations and relevant villagers may have actually accompanied the already existing facilities.

G. New Construction and Rehabilitation of Existing Facilities

Construction and rehabilitation activities can be grouped according to the degree of sophistication or mechanization of the facilities. Facilities that are technically simple, and consequently involve labor intensive construction can naturally be decentralized and effectively handled by local institutions or with a high degree of local participation. This is compatible with the general development policy to encourage maximum privatization or local participation in most public services or enterprises that they are capable of handling.

As for highly technical facilities, whose construction have traditionally been the responsibility of various RTG agencies, these are likely to remain with their traditional base in the transformation period. The temporary continuation of the tradition, with the rehabilitation of existing facilities as an added responsibility, is necessary because these RTG agencies have actually been equipped with adequate organizational backing, manpower, technical knowhow and machinery, and also have a long working experience in the field. Also, according to the survey, there are still quite a number of additional facilities to be constructed and rehabilitated throughout the country.

In the long run, particularly after 1991, when most projected construction activities will have been completed, the construction workload will be considerably decreased. By that time, the principal activities of the RWS system will certainly be shifted from construction to operation and maintenance (O&M) activities. Thus, it has been suggested that the number of agencies involved in the construction business should also be minimized. If the normal number of constructions drops consistently from the earlier large number, the high cost of maintaining and operating various overlapping headquarters and the regional centers of numerous agencies can no longer be justified. The restructuring of the responsibilities of these agencies should be gradually modified in light of the original objectives, the temporary or emergency nature and rational consistency of the construction, and also its relation to the central goals of the superordinate agencies.

In general, guidelines can be laid down for the restructuring of agencies involved in the construction of RWS projects:

- The general policy which applies in reconsidering and restructuring the existing numerous and overlapping construction agencies is simply that the decrease in the number of functioning agencies and overlapping activities will presumably minimize the operating costs, since the volume of future construction, according to the technical findings, is expected to drop considerably soon.
- The operation and maintenance (O&M) activities, particularly of the highly technical facilities, which are currently under the jurisdiction of the constructing agencies, will be restructured so that they can be undertaken through the system of contracting by private companies.
- The agencies, whose current involvement in the construction and O&M of RWS facilities has explicitly been on an indirect and/or temporary basis (such as NSC), should work on a definite plan of phasing out of the business and handing over the relevant construction operations. Also, the termination can take place on a voluntary basis after any agency seriously has reevaluated its major roles, and may decide to refrain from this business so as to concentrate their efforts more on their direct responsibilities.

- The agencies who decide to phase out, while they continue to be engaged in current RWS activities, should stop ordering or purchasing new machinery or equipment. They should be contented to use the existing sets of equipment until they are worn out.

H-I. Operation and Maintenance (O&M) and Upgrading of Existing Facilities

The O&M and upgrading activities will become more and more crucial as a way of replacing the decreasing construction activities in the RWS system. As the O&M of many simple facilities can be left to local institutions, the focus would seem to be on the O&M of more sophisticated facilities whose long procedures and wide scope are complicated, cumbersome and costly. In view of the current high rates for O&M and the upgrading of such facilities as deep wells currently operated by RTG agencies, it is suggested that these responsibilities should be contracted out so that they are entirely carried out by private firms under carefully stipulated conditions.

J. Monitoring of Water Quality

As soon as facilities have been built and are being properly operated and maintained in the rural areas, the next activity of major concern in the RWS system during the Decade Plan implementation is the monitoring of the water quality of these facilities. This is to ensure that safe water for drinking and domestic consumption is continuously available to the villagers throughout the year and thus will enable the desired health improvement in the rural areas to take place. It is felt that at present the most capable RTG agency for handling this job is the Environmental Health Division of the Department of Health, due to its well-established network.

K. Research and Development (R&D)

This activity has the important role of finding simple, workable and economic solutions for a reliable community water supply. Furthermore, this endeavor will improve the effectiveness and efficiency of the technologies applied in the villages through research studies. All implementing RTG agencies must be encouraged to take note of their experiences and study in detail important aspects of their work, e.g. efficiency of pumps, acceptability of technical options, etc. Research requiring highly-specialized studies can be contracted out to reputable research institutions.

L. Monitoring and Evaluation of Decade Plan Implementation

It is essential that monitoring and evaluation should be carried out periodically by CNRD to ascertain whether the envisaged targets and objectives of the Plan are met or not, so that proper corrective measures can be taken. The progress of some activities may be worth assessing annually, while in other cases a less frequent assessment may be in order.

Chapter III INVESTMENT REQUIREMENTS

3.1 RURAL WATER SUPPLY PROGRAM

3.1.1 Rehabilitation of Existing Facilities

The estimated unit cost for the rehabilitation of deep wells and small-scale piped water supply systems is about Baht 20,200. For nationwide implementation, a total budget of Baht 160.58 million will be needed, as shown in Table 3.1. The major outlay will go to the Northeastern region, which will receive approximately 62% of the total budget for the rehabilitation program.

3.1.2 Upgrading of Existing Facilities

Cost estimates for upgrading the different types of facilities are given as follows:

Shallow well	Baht 7,200/well
Deep well	4,100/well
Piped water supply	4,100/system

Based on the implementation schedule for the different regions and the assumed unit cost, the yearly budget requirements for the upgrading program were calculated, and are shown in Table 3.2. A total of Baht 723.59 million will be needed to implement the schedule in the different regions of the Kingdom.

3.1.3 New Construction

A. Rainwater Jar

Using the estimated cost of Baht 470, Baht 280 and Baht 1,400 for each 2 cu m size jar, 1 cu m size jar and mold respectively, the yearly budget requirements for the various components of the rainwater jar construction program have been computed, and are shown in Table 3.3. The total budget required in subsidies amounts to Baht 1,327.4 million, or an annual budget allocation of about Baht 331.9 million. Baht 331.9 million will also be required for the "revolving funds," which will be good for only two years since this assumes a repayment period of one year.

The total investment requirement for the rainwater jar construction program amounts to roughly Baht 1,679.8 million. The biggest outlay will be for the Northeastern region, which will require about Baht 874.2 million. Only 5% of the total estimated budget will be allocated to the Southern region, due mainly to the smaller size of the jars to be promoted in this region.

Table 3.3 Investment Requirement for Rainwater Jar Construction in the Different Regions of Thailand (1985-1988), in million Baht

Region	1985	1986	1987	1988	Total
<u>NORTH</u>					
Jars (2 m ³)					
- By Subsidy	48.36	48.36	48.36	48.36	193.44
- By Revolving Fund	24.18	24.18	-	-	48.36
Molds	0.72	0.72	0.72	0.72	2.88
Total	73.26	73.26	49.08	49.08	244.68
<u>NORTHEAST</u>					
Jars (2 m ³)					
- By Subsidy	172.79	172.79	172.79	172.79	691.16
- By Revolving Fund	86.39	86.39	-	-	172.78
Molds	2.57	2.57	2.57	2.57	10.28
Total	261.75	261.75	175.36	175.36	874.22
<u>CENTRAL</u>					
Jars (2 m ³)					
- By Subsidy	93.13	93.13	93.13	93.13	372.52
- By Revolving Fund	46.57	46.57	-	-	93.14
Molds	1.39	1.39	1.39	1.39	5.56
Total	141.09	141.09	94.52	94.52	471.22
<u>SOUTH</u>					
Jars (1 m ³)					
- By Subsidy	17.58	17.58	17.58	17.58	70.32
- By Revolving Fund	8.79	8.79	-	-	17.58
Molds	0.44	0.44	0.44	0.44	1.76
Total	26.81	26.81	18.02	18.02	89.66
<u>WHOLE KINGDOM</u>					
Jars (1 m ³)					
- By Subsidy	17.58	17.58	17.58	17.58	70.32
- By Revolving Fund	8.79	8.79	-	-	17.58
Jars (2 m ³)					
- By Subsidy	314.28	314.28	314.28	314.28	1,257.12
- By Revolving Fund	157.14	157.14	-	-	314.28
Molds	5.12	5.12	5.12	5.12	20.48
Total	502.91	502.91	336.98	336.98	1,679.78

B. Other Proposed Technical Options

The yearly budget requirement for the construction of new public facilities, besides rainwater jars, in the different regions of Thailand has been estimated, and is summarized in Table 3.4. The results show that the new construction program will need Baht 2,878.75 million for implementation. The biggest outlay will go to the Central region with about Baht 1,044.19 million, while the smallest share will be received by the Northern region, which will account for only Baht 445.76 million.

3.1.4 Operation and Maintenance (O&M)

The yearly maintenance budget for each sanitary well and deep well, and also the cost per training course (for village operators), is estimated below.

Sanitary well

- Handpump and spare parts	Baht 60
- Labor for monthly check-up (at Baht 60/mo	720

Total	Baht 780/year

say, Baht 800/year, which is 5% of total construction cost.

Deep well

- Handpump and spare parts	Baht 1,000
- Well development (average)	1,300
- Labor for monthly check-up	1,200

Total	Baht 3,500/year

This is 5% of the total construction cost.

Training course (as adopted by PWWA, DPW and ARD)

- No. of participants	30 persons
- Duration	5 days
- Trainers (from regional or central office)	10 engineers
- Estimated cost:	
* Per diem and accommodation	Baht 22,500
* Transportation (average)	4,500
* Per diem for trainer (Baht 180 x 10 x 5)	9,000
* Materials and administrative expenses	3,600

Sub-Total	Baht 39,600
Plus 20% for miscellaneous	7,920

Total	Baht 47,520

The yearly budget allocation for the implementation of the various components of the O&M program has been computed using the given unit estimates, as shown in Table 3.5. The results indicate that a total budget of Baht 1,782.63 million will be required for improvement of the O&M program in the rural areas of the country.

3.1.5 Water Quality Monitoring

At different administrative levels, the required investment and operational cost has been estimated, and is shown in Table 3.6. Similarly, the cost per training course for the different categories of trainees is summarized in Table 3.7.

Based on the estimated cost and implementation schedule of each component, the yearly budget requirement for the water quality monitoring program has been computed, and is shown in Table 3.8. The results indicate that a total budget allocation of Baht 1,294.35 will be required for nationwide implementation.

It should be noted that the operational cost at the tambon level is obtained by assuming that a sampling frequency will be made once every three months, but it could be reduced by 67% if the sampling was only made once a year. This would result in about 45% reduction in the total budget requirement for the water quality monitoring program. However, to ensure the continual delivery of safe drinking and domestic water supply, a sampling frequency of once every three months is strongly recommended.

3.1.6 Research and Development (R&D)

A budget amounting to about Baht 70 million will be allocated to R&D activities, which accounts for approximately 1% of the total investment requirement of the rural water supply program of the Decade Plan.

A summary of the investment requirements for the various activities of the rural water supply program of the Decade Plan is given in Table 3.9.

Table 3.5 Yearly Budget Requirement for O&M Program (1985-1991),
in million Baht

O&M Program	1985	1986	1987	1988	1989	1990	1991	Total
<u>Northern Region</u>								
For Sanitary Wells	2.87	6.69	10.50	14.32	18.13	21.95	25.76	100.22
For Deep Wells	23.63	29.52	35.42	41.32	47.22	53.11	59.01	289.23
Training of Operators	0.19	0.19	0.19	0.19	0.19	0.19	0.19	1.33
Sub-Total	26.69	36.40	46.11	55.83	65.54	75.25	84.96	390.78
<u>Northeastern Region</u>								
For Sanitary Wells	5.46	10.02	14.58	19.14	23.70	28.26	32.82	133.98
For Deep Wells	56.71	72.54	88.37	104.20	120.03	135.86	151.69	729.40
Training of Operators	0.29	0.29	0.29	0.29	0.29	0.29	0.29	2.03
Sub-Total	62.46	82.85	103.24	123.63	144.02	164.41	184.80	865.41
<u>Central Region</u>								
For Sanitary Wells	1.25	2.96	4.67	6.39	8.10	9.81	11.53	44.71
For Deep Wells	18.43	26.11	33.79	41.47	49.15	56.83	64.51	290.29
Training of Operators	0.24	0.24	0.24	0.24	0.24	0.24	0.24	1.68
Sub-Total	19.92	29.31	38.70	48.10	57.49	66.88	76.28	336.68
<u>Southern Region</u>								
For Sanitary Wells	1.12	2.83	4.54	6.25	7.96	9.67	11.38	43.75
For Deep Wells	9.16	13.00	16.83	20.67	24.50	28.34	32.18	144.68
Training of Operators	0.19	0.19	0.19	0.19	0.19	0.19	0.19	1.33
Sub-Total	10.47	16.02	21.56	27.11	32.65	38.20	43.75	189.76
<u>Whole Kingdom</u>								
For Sanitary Wells	10.70	22.60	34.29	46.10	69.69	81.49	81.49	322.66
For Deep Wells	107.93	141.17	174.41	207.66	240.90	274.14	307.39	1,453.60
Training of Pperators	0.91	0.91	0.91	0.91	0.91	0.91	0.91	6.37
GRAND TOTAL	119.54	164.58	209.61	254.67	299.70	344.74	389.79	1,782.63

Table 3.6 Water Quality Monitoring Program Investment and Operational Cost per Year at Different Levels

Level	Investment Cost/Year(Baht)	Operation Cost/Year(Baht)		
1. Tambon	Incubator	5,000	Media for bacteriological Test	10,000
	Oven	4,000	Chemicals (including chlorine)	3,000
	Test kit (Coliform, Cl ₂)	4,000	Sample bottles	1,000
	Ice box	1,000	Ice box	1,000
	Pump (for chlorination)	4,000	Fuel	2,000
			Document	1,000
		18,000		18,000
	10% miscellaneous	<u>1,800</u>	20% miscellaneous	<u>3,600</u>
Total Cost	<u>19,800</u>	Total Cost	<u>21,600</u>	
2. Amphur	Ice box	1,000	Sample bottles	2,000
			Ice	1,000
			Delivery charge	4,000
			Fuel	2,000
			Documents	1,000
				10,000
		20% miscellaneous	<u>2,000</u>	
		Total Cost	<u>12,000</u>	
3. Regional	Equipment	4,000,000	Scientific Apparatus	600,000
	Lab set-up	600,000	Follow-up (Assessment and Evaluation)	200,000
		4,600,000	Chemicals and Maintenance	100,000
	10% miscellaneous	<u>460,000</u>	Document	300,000
		5,060,000	Salary	400,000
				1,600,000
			20% miscellaneous	<u>320,000</u>
			<u>1,920,000</u>	
4. Central	Equipment	7,000,000	Scientific Apparatus and Office	3,000,000
	Laboratory improvement	<u>5,000,000</u>	Chemical and Maintenance	200,000
		12,000,000	R&D	500,000
	10% miscellaneous	<u>1,200,000</u>	Follow-up Inspection	600,000
		<u>13,200,000</u>	Evaluation and Assessment	500,000
			Documents	200,000
				5,000,000
			Salary	<u>2,500,000</u>
				7,500,000
			20% miscellaneous	<u>150,000</u>
			<u>7,650,000</u>	

Table 3.7 Estimated Training Cost for Different Categories of Trainees
(by Level) in Relation to Water Quality Monitoring Program

Category	Trainer			Duration Day	No. of Parti- cipants	Unit Cost ฿
	Qualification	From	No.			
1. Tambon Officer	Asst. Scientist	Regional Office	1	3	10	Trainee per diem and accom- modation 3x10x100 = 3,000 Transportation 10x300 = 3,000 Material and Adm. Work = 600 6,600 20% miscellaneous = 1,400 <u>8,000</u>
2. Amphur Officer	Asst. Scientist	Regional Office	1	1	20	Trainee per diem and accom- modation 1x20x100 = 2,000 Transportation 20x300 = 6,000 Material and Adm. Work = 1,600 9,600 20% miscellaneous = 1,920 <u>11,520</u>
3. Regional Officer	Scientist	Central Office	1	5	4x8 = 32	Trainee per diem and accom- modation 5x32x130 = 20,800 Transportation 82x300 = 9,600 Material and Adm. Work = 3,040 33,440 20% miscellaneous = 6,660 <u>40,100</u>

Table 3.9 Summary of Investment Requirements for Various Activities of the Rural Water Supply Program (1985-1991), in million Baht

Activities	1985	1986	1987	1988	1989	1990	1991	Total
1. NEW CONSTRUCTION								
<u>Rainwater Jars</u>								
By subsidy: 1 m ³	17.58	17.58	17.58	17.58	-	-	-	70.32
2 m ³	314.28	314.28	314.28	314.28	-	-	-	1,257.12
By revolving 1 m ³	8.79	8.79	-	-	-	-	-	17.58
fund: 2 m ³	157.14	157.14	-	-	-	-	-	314.28
Molds:	5.12	5.12	5.12	5.12	-	-	-	20.48
Sub-Total	502.91	502.91	336.98	336.98	-	-	-	1,679.78
<u>Other Proposed Technical Options</u>								
Spring Catchment System	0.81	0.81	0.81	0.81	0.81	0.81	0.81	5.67
Sanitary Well	57.26	57.26	57.26	57.26	57.26	57.26	57.26	400.82
Deep Well	221.48	221.48	221.48	221.48	221.48	221.48	221.48	1,550.36
Small-Scale Piped Water Supply System	37.79	37.79	37.79	37.79	37.79	37.79	37.79	264.53
Slow Sand Filter	38.24	38.24	38.24	38.24	38.24	38.24	38.24	267.68
Rapid Sand Filter	9.99	9.99	9.99	9.99	9.99	9.99	9.99	69.93
Small-Scale Rainwater Supply System	45.68	45.68	45.68	45.68	45.68	45.68	45.68	319.76
Sub-Total	411.25	411.25	411.25	411.25	411.25	411.25	411.25	2,878.75
2. UPGRADING								
Shallow Well	80.42	80.42	80.42	80.42	80.42	80.42	80.42	562.94
Deep Well	21.75	21.75	21.75	21.75	21.75	21.75	21.75	152.25
Small-Scale Piped Water Supply System	1.20	1.20	1.20	1.20	1.20	1.20	1.20	8.40
Sub-Total	103.37	103.37	103.37	103.37	103.37	103.37	103.37	723.59
3. REHABILITATION								
Deep Well	21.78	21.78	21.78	21.78	21.78	21.78	21.78	152.46
Small-Scale Piped Water Supply System	1.16	1.16	1.16	1.16	1.16	1.16	1.16	8.12
Sub-Total	22.94	22.94	22.94	22.94	22.94	22.94	22.94	160.58
4. OPERATION AND MAINTENANCE (O&M)								
Sanitary Well	10.70	22.50	34.29	46.10	57.89	69.69	81.49	322.66
Deep Well	107.93	141.17	174.41	207.66	240.90	274.14	307.39	1,453.60
Training of Village Operators	0.91	0.91	0.91	0.91	0.91	0.91	0.91	6.37
Sub-Total	119.54	164.58	209.61	254.67	299.70	344.74	389.79	1,782.63
5. MONITORING OF WATER QUALITY								
<u>Investment Cost</u>								
Central Office	13.20	-	-	-	-	-	-	13.20
Regional Office	20.24	25.30	-	-	-	-	-	45.54
Amphur Office	0.32	0.40	-	-	-	-	-	0.72
Tambon Office	57.02	68.21	-	-	-	-	-	125.23
<u>Operational Cost</u>								
Central Office	7.65	7.65	7.65	7.65	7.65	7.65	7.65	53.55
Regional Office	7.68	17.28	17.28	17.28	17.28	17.28	17.28	111.36
Amphur Office	3.84	8.68	8.68	8.68	8.68	8.68	8.68	55.92
Tambon Office	62.21	136.62	136.62	136.62	136.62	136.62	136.62	881.93
<u>Training</u>								
Regional Level	0.04	0.04	-	-	-	-	-	0.08
Amphur Level*	0.18	0.23	0.02	0.02	0.02	0.02	0.02	0.51
Tambon Level*	2.30	2.76	0.25	0.25	0.25	0.25	0.25	6.31
Sub-Total	174.68	267.17	170.50	170.50	170.50	170.50	170.50	1,294.35
6. RESEARCH AND DEVELOPMENT (R&D)								
Sub-Total	10.00	10.00	10.00	10.00	10.00	10.00	10.00	70.00
GRAND TOTAL	1,344.69	1,482.22	1,264.65	1,309.71	1,017.76	1,062.80	1,107.85	8,589.68

* Training Cost from 1987 - 1991 is for any replacement to be made.

3.2 RURAL SANITATION PROGRAM

3.2.1 Toilet Construction

A. Material Subsidy

There are four essential parts for PF latrine construction to be distributed to recipient householders, viz:

1 squatting plate	Baht 110
1 cover slab	50
5 concrete rings (at Baht 50 each)	250
1 connecting concrete pipe	30

Total	Baht 440

It is presumed that the superstructure and labor cost will be shouldered by the householders.

Based on the estimated cost given above and the number of latrines to be built in the different regions between 1985 and 1991, the budget to be allocated for material subsidy can be estimated, as shown in Table 3.10.

B. Revolving Fund

A revolving fund of Baht 10,000 will be established per target village consisting of 20 shares at Baht 500/share. Hence, 20 households can avail themselves of the fund at the start. If the turnover period is ten months (at Baht 50 per month), within seven years, approximately 140 households per target village will be able to make use of the fund.

Estimates of the revolving fund to be allocated to the different regions of Thailand is given in Table 3.11.

3.2.2 Training

A. VHVs and VHCs

There are three types of training for VHVs and VHCs, as follows:

- Type 1 - training for new personnel;
- Type 2 - training for replacement;
- Type 3 - training for refreshment.

Accordingly, the cost for each category of trainee varies. In this case, cost estimates were based on the current practice of the Primary Health Care Office of the Ministry of Public Health, as follows:

Table 3.10 Estimated Subsidy for Pour-Flush (PF) Latrine Construction in the Different Regions of Thailand between 1985 and 1991, in million Baht

Region	1985	1986	1987	1988	1989	1990	1991	Total
North	22.0	26.4	30.8	35.2	44.0	48.4	52.8	259.6
Northeast	26.4	35.2	44.0	52.8	61.6	70.4	74.8	365.2
Central	26.4	30.8	35.2	35.2	39.6	39.6	44.0	250.8
South	13.2	17.6	22.0	30.8	39.6	48.4	48.4	220.0
Whole Kingdom	88.0	110.0	132.0	154.0	184.8	206.8	220.0	1,095.6

Table 3.11 Yearly Budget Allocation for Sanitation Revolving Fund
in the Different Regions of Thailand between 1985 and 1991,
in million Baht

Region	No. of Target Villages		Revolving Fund to be Allocated, ฿ (million)	
	1985	1986	1985	1986
North	3,400	3,400	34	34
Northeast	8,000	8,200	80	82
Central	3,100	3,200	31	32
South	2,500	2,700	25	27
Whole Kingdom	17,000	18,000	170	180

	<u>VHC</u>	<u>VHV</u>
Type 1	Baht 257.5	Baht 769.25
Type 2	235.0	645.0
Type 3	55.7	104.25

There are three types of trainers for VHVs and VHCs as well, who need training before they can themselves train the VHVs/VHCs.

Type 1 - training of amphur/provincial trainers. The cost to be spent for each trainee is Baht 1,210.

Type 2 - training of new trainers at tambon level. The training cost for each trainee is Baht 730.

Type 3 - training for refreshment of the tambon level trainers. This requires Baht 620 to be spent for each trainee.

The cost to be spent for training of VHVs and VHCs by category is summarized in Table 3.12.

B. TCCs, VSCs and THWs

Training for these groups of local personnel varies in terms of the training course involved and the cost to be spent per trainee. The cost estimate for each category of trainees is given below.

TCC Training

- No. of participants	50 persons
- No. of trainers	4 persons
- Duration	3 days
- Estimated cost:	
* trainees (Baht 400 x 50)	Baht 20,000
* trainers (Baht 490 x 4)	1,960

Total	Baht 21,960

VSC Training

- No. of participants	30 persons
- No. of trainers	4 persons
- Duration	10 days
- Estimated cost:	
* trainees (Baht 1,000 x 30)	Baht 30,000
* trainers (Baht 1,400 x 4)	5,600

Total	Baht 35,600

THW Training

- No. of participants	30 persons
- No. of trainers	4 persons
- Duration	5 days
- Estimated cost:	
* trainees (Baht 750 x 30)	Baht 22,500
* trainers (Baht 950 x 4)	3,800
	<hr/>
Total	Baht 26,300

C. Training Materials

Besides training manuals, supplementary training materials will be needed for demonstration purposes. The cost is estimated at about Baht 3 million per year.

Table 3.13 gives the yearly budget requirement for the training of TCCs, VSCs and THWs between 1985 and 1991.

D. Workshop/Meeting/Seminar/Orientation/Supervision

Personnel of related agencies and target groups at different levels will be called for meetings/workshops in relation to program objectives, policies, and organization and management. Approximately 10% of the total budget for the sanitation training component is allocated for these purposes.

3.2.3 Health Education, Information and Communication**A. Incentives for VHVs/VHCs**

Alternative incentives, such as government stipends, community donations, graded rewards for activities accomplished, educational opportunities, etc., should be studied and offered.

B. Latrines in Public Schools

The idea of giving a material subsidy is again adopted here. Every school in each tambon should be provided with four sets of the free necessary construction materials (i.e., squatting plate, cover slab, concrete pipe and concrete rings). The cost for building the superstructure, including labor, should be shouldered by the school and the community itself. In this case, the material subsidy amounts to Baht 1,600 (Baht 400 x 4).

Approximately 900 schools will have to be served annually for seven years, hence the annual cost for the construction of latrines in rural public schools will amount to about Baht 1.6 million.

Table 3.13 Yearly Budget Requirement for Training of TCCs, VSCs and THWs (1985-1991), in million Baht

Type	1985	1986	1987	1988	1989	1990	1991	Total
TCC	5.3	5.3	5.7	5.7	5.7	6.2	6.2	40.1
VSC	7.1	7.1	7.7	7.7	8.3	8.3	8.3	54.5
THW	0.5	0.6	0.7	0.7	0.7	0.8	0.8	4.8
Training Materials	3.0	3.1	3.3	3.3	3.3	3.4	3.5	23.1
Total	15.9	16.1	17.4	17.4	18.0	18.7	18.8	122.3

C. Posters, Leaflets, Radio Programs, etc.

Baht 1.0 million is required annually for the purposes of information dissemination via radio programs, film shows, posters, leaflets and comics. Educational materials to be distributed to the rural communities will include the following:

<u>Type of Materials</u>	<u>Number</u>	<u>Target</u>
Posters regarding the Decade Program	240,000	4 sheets for each village
Posters on excreta disposal and personal hygiene	240,000	4 sheets for each village
Instruction handouts/leaflets	1,400,000	Midwives, THWs, target households (200 copies for each village)
Comics in relation to the Decade Program	1,400,000	Target villages (200 copies for each village)

D. Mobile Units

In order to generate awareness and interest through leaders' meetings, film shows, exhibitions, dramas, group teachings, etc., it is necessary to have mobile units to carry out this task. A budget of Baht 2.0 million per year should be allocated for gas and other miscellaneous expenses.

3.2.4 Research and Development (R&D)

Research work, such as KAP studies, etc. should be made as a continuing activity of the program, if it is to succeed. For these purposes, Baht 1.0 million should be allocated yearly.

A summary of the investment requirements for the various activities of the sanitation program of the Decade Plan (1985-1991) is presented in Table 3.14.

Table 3.14 Summary of Investment Requirements for Various Activities of the Rural Sanitation Program (1985-1991), in million Baht

Activities	1985	1986	1987	1988	1989	1990	1991	Total
A. Toilet Construction								
- Material subsidy	88.0	110.0	132.0	154.0	184.8	206.8	220.0	1,095.6
- Revolving fund	170.0	180.0	(Use initial fund to revolve)					350.0
B. Training								
- VHC, VHV	26.3	26.3	23.8	23.8	23.8	23.8	23.8	171.6
- TCC, VSC, THW	15.9	16.1	17.4	17.4	18.0	18.8	18.8	122.3
- Seminar/workshop/ coordination, etc.	1.8	1.9	1.9	2.0	2.0	2.1	2.1	13.8
C. Health Education								
- Incentive for VHCs and VHVs	(To be studied, with option to offer a substantial one)							
- Latrine in school	1.6	1.6	1.6	1.6	1.6	1.6	1.6	11.2
- Posters, leaflets, radio programs, etc.	1.0	1.0	1.0	1.0	1.0	1.0	1.0	7.0
- Mobile units	2.0	2.0	2.0	2.0	2.0	2.0	2.0	14.0
D. Research and Development								
	1.0	1.0	1.0	1.0	1.0	1.0	1.0	7.0
T O T A L	307.6	339.9	180.7	202.8	234.2	257.0	270.3	1,792.5

3.3 FINANCIAL ASPECTS

In relation to the envisaged National Decade Plan (1985-1991), a total investment of about Baht 10,382.2 million (not including overheads) will be required, or an annual budget allocation of roughly Baht 1,500 million, as shown below.

Year	Water Supply	Sanitation	Total
1985	1,344.7	307.6	1,652.3
1986	1,482.2	399.9	1,822.1
1987	1,264.6	180.9	1,445.3
1988	1,309.7	202.8	1,512.5
1989	1,017.8	234.2	1,252.0
1990	1,062.8	257.0	1,319.8
1991	1,107.9	270.3	1,378.2
Grand Total	8,589.7	1,792.5	10,382.2

To finance the requirements of the Thailand Decade Plan, as set out in this Masterplan, the current fund sources will be maintained, viz: loans, grants, and purely local sources. Additional loans and grants will be arranged from several financing institutions to help support the foreign exchange component of the project. Such loans and grants will generally cover the procurement of various equipments, chemicals, etc. Local counterpart funds will generally finance the civil works portion. It is estimated that the total foreign exchange component will be around Baht 1,281 million, i.e., roughly 12% of the total outlay for the Masterplan. From this, about Baht 1,248 million, i.e., around 97% of the foreign exchange component, is allocated for rural water supply program.

The breakdown of foreign exchange and local components of the Decade Plan (in million Baht) is shown below.

Component	Foreign Exchange	Local	Total
Rural water supply	1,248.18	7,341.50	8,589.68
Rural sanitation	32.55	1,759.95	1,792.50
Total	1,280.73	9,101.45	10,382.18

At present, no specific and regular revenue has been raised to meet the recurrent and capital expenditures of the rural water supply and sanitation sector in Thailand. The development of this sector has been financed entirely by the government.

Although many international financing institutions have expressed their willingness to provide financial aid to the Government of Thailand in its sector development, future investment requirements of the National Decade Plan could be met without external aid if the present government grant (approximately Baht 3,000 million every year for rural water supply alone) holds.

Chapter IV CONCLUSIONS AND RECOMMENDATIONS

The envisaged national rural water supply and sanitation program, otherwise known as the Thailand Decade Plan (1985-1991), will be seen as a government responsibility. The government will ensure the distribution of social services for the promotion of primary health care through the provision of an adequate water supply and sanitation services on an accelerated basis to meet the demand of the rural population. This will also fulfill Thailand's commitment to the International Drinking Water Supply and Sanitation Decade (IDWSSD) of the United Nations.

The formulated Masterplan in relation to the Thailand Decade Plan, as set out in the previous sections and summarized in APPENDICES B and C, which clearly delineates the role of each of RTG agency directly concerned with sector development, as well as other relevant components of the program, in accordance with the government's target to make water supply and sanitation services available to the majority of the rural population by the year 1991, is deemed feasible in many of its aspects.

- The Plan is considered to be a manageable project which can be implemented under the control of the various RTG implementing agencies and the contracting private sector. The government sector is technically capable of implementing the Plan in consideration of the equipment and personnel which is has at its disposal.
- There are adequate government organizations to implement the projects, and to operate and maintain the systems.
- The program is within the financing capacity of the government.
- The program will significantly improve the health and sanitation conditions of the rural population, reduce medical expenses and raise nutritional standards for children, thereby increasing the labor productivity of the people who are benefitting and enhancing their socio-economic circumstances. The provision of a water supply within easy reach will also lessen the loss of useful time in fetching water.

However, several assumptions have been made in the formulation of the Masterplan, thus necessitating new policies and strategies for its successful implementation. Based on the findings of the study, the following recommendations are put forward:

Technical Aspects

- 1) At present, there are about 15,000 deep wells and 800 small-scale piped water supply systems with minor technical problems, e.g. clogged pipes and no aerators. The strategy calls for the rehabilitation of about 50% of these types of facilities to further augment the availability of an adequate and safe water supply in the rural areas.
- 2) Many rural areas already have open-dug shallow wells, deep wells and small-scale piped water supply systems which provide a year-round water supply but which are not sanitized, i.e., there are no covers and

handpumps for shallow wells and no aerators for deep wells and small-scale piped water supply systems. For cost-effectiveness, the upgrading of the existing open-dug shallow wells, deep wells and small-scale piped water supply systems in these categories numbering about 78,000, 37,000 and 2,000 respectively, should be given high priority.

- 3) Due to a large number of rural people to be served by adequate and sanitary water sources (roughly 33.0 million between 1983 and 1991), it is necessary to construct additional public water supply facilities in many villages.

To make clean drinking water available immediately in the rural areas of Thailand, particularly those villages whose drinking water supply comes from surface water sources (like unprotected ponds, streams, etc.), a four-year rainwater jar construction program must be initiated at the start of the implementation of the Plan.

Moreover, to be able to achieve a long-term rural water supply development program, the construction of other technical options such as sanitary shallow wells, deep wells, spring catchment systems, piped water supply systems, etc. must be vigorously promoted during the Decade Plan. Water supply projects in the villages must be implemented at the villagers' request, as part of the village development plan, using the G-Ch-Ch system. Also, the project request has to be checked for its technical feasibility in the locality.

- 4) Generally it has been found that system maintenance of public water supply facilities is poor. In order to ensure continuous delivery of an adequate and safe water supply in the rural areas, all water users must be involved in the operation and maintenance (O&M) of public facilities by teaching them the correct way of operating these facilities. A caretaker or an operator, chosen by the village development committee (VDC), should be assigned to each facility to oversee its condition and to report any breakdown to the VDC so that immediate technical assistance can be requested. The training of village operators, especially for piped water supply systems, must be part of the O&M program.
- 5) To safeguard public health by making sure that only sanitary water is utilized for consumption by the villagers, monitoring of water quality must be effected nationwide. The bacteriological quality of water sources in the villages must be tested by taking samples once every three months, and based on the findings, appropriate disinfection measures must be carried out, i.e., the use of chlorine powder.

In addition, an overall assessment of rural drinking water sources should be conducted once a year by random sampling of water sources with a view to analyzing their chemical, bacteriological and physical characteristics to ensure that they meet the WHO Drinking Water Standards (in the absence of suitable rural drinking water standards for Thailand at the moment). Training of the required manpower at different levels must be carried out.

- 6) Regarding sanitation, the pour-flush (PF) latrine has been found to be the most acceptable technical option to the rural people of the Kingdom. However, up to 1983, only 44% of the total number of rural households in the country had been installed with this sanitation facility.

Considering the socio-economic condition of most Thai villages, the most appropriate strategy to be adopted in order to foster and accelerate the acquisition of latrines by household owners in the rural areas must be a combination of material subsidies and "revolving funds". This will not only enable the government to fulfill its responsibility to the people, but will also inculcate the "sense of ownership" for these facilities amongst the villagers. Training of more VSC, in coordination with adequately trained TCCs and THWs, can greatly help in achieving the target household coverage.

- 7) The defecation and ablution habits of the rural people result in the contamination of water supplies and spreading of diseases. To produce a positive change in local habits, attitudes and behavior patterns, a more vigorous health education, information and communication program must be effected. This requires the construction of latrines in all public schools, training of more VHVs and VHCs, and a wider distribution of educational materials.
- 8) In the past, research and development (R&D) undertakings by RTG agencies aiming at finding simple, workable and economic solutions for a reliable community water supply and the improvement of community sanitation have not been made compulsory activities. In the Decade Plan, these endeavors with these aims in mind should be carried out - preferably by the concerned agencies, or in certain circumstances contracted out to reputable research institutions for highly specialized studies.

Institutional Aspects

- 1) The involvement of some 16 implementing RTG agencies in rural water supply services results in the overlapping of functions and the duplication of efforts. This is due to a lack of proper coordination among the agencies involved. In addition, the administration of the budget allocation for rural water supply development is handled by the respective Ministries of the various RTG agencies.

It is thus strongly recommended that the Committee for National Rural Development (CNRD) - Subcommittee of Rural Water Supply should be given the central role in rural water supply planning and integration, and should be provided with adequate powers to re-delineate the responsibilities of the RTG implementing agencies (as proposed in the Master-plan), and to manage the budget allocation intended for sector development on a large-scale centralized planning system.

- 2) At the national level, no comprehensive baseline information on the rural water supply and sanitation sector is available at present from which the central agencies can develop their long-term policy and planning. This is also the main reason why no proper exchange of information between the concerned RTG agencies has taken place to date.

The establishment of a computerized management information system (MIS) to be designed and incorporated as a major part of the existing Institute of Information Processing for Education and Development at Thammasat University is recommended, so as to enable the policy-makers at the central level to streamline all RWS requests from all over the country, and then to assemble, classify, decide the budget and distribute the workload properly among the implementing agencies. Furthermore, this will also enable the Center for National Rural Development Coordination (CNRDC), once it has been established to monitor and to periodically evaluate the extent of sector development.

- 3) The operation and maintenance (O&M) of water supply facilities has always been the responsibility of the respective constructing RTG agencies, but most of these agencies do not have the necessary manpower support, and this results in many unrepaired handpumps. During the Decade Plan, it is proposed that the O&M activities, particularly those concerning highly technical facilities (such as deep wells), will be restructured and undertaken through the system of contracting by private firms.
- 4) It has been found not only that trained personnel are inadequate, particularly for sanitation activities, but also that training courses focused on environmental sanitation are lacking. Since many personnel in different categories are expected to be trained during the implementation of the Decade Plan, training courses must be further improved, probably with the help of special consultants. Also, after training, the trained personnel must be duty-bound to render the required services.

In the case of the rural water supply, in order to ensure more comprehensive and coordinated training activities, a Subcommittee on Training should be formed and entrusted with all training-related responsibilities, with DCD and DOH assuming the leading role.

- 5) Many government programs in the past have not fully succeeded due to the failure to elicit proper community participation. Community participation, especially from women, is recognized as an important factor for the success of the Decade. Hence, this aspect must be highlighted in all activities.

Financial Aspects

- 1) Past O&M programs mainly covered the budget for deep wells, and totally ignored the budget for shallow wells. In the future, an O&M budget must be provided for both shallow wells and deep wells annually, and provide Baht 800 and Baht 3,500 respectively for continuous delivery of an adequate and safe water supply in the villages.
- 2) Further development of R&D activities with a view to improving Plan implementation must be encouraged by allocating an annual budget of Baht 10.0 million and Baht 1.0 million for the rural water supply program and the rural sanitation program respectively.
- 3) As in the past, a contribution from the villagers in terms of cash and labor for the construction of piped water supply systems, especially slow and rapid sand filters, must be secured.
- 4) The investment requirements of the Decade Plan, namely Baht 10,382.18 as set forth in the Masterplan, must be raised by the Royal Thai Government through current fund sources, viz.: loans, grants, and purely local sources. Additional loans and grants should be arranged from several financing institutions to help support the foreign exchange component, accounting for roughly 12% of the total outlay for the Masterplan.

APPENDICES

APPENDIX A Population Served by the Existing Adequate Facilities
by the End of 1984

Source	Whole Kingdom		Northern Region		Northeastern Region		Central Region		Southern Region	
	No. of Facilities	Pop. Served	No. of Facilities	Pop. Served	No. of Facilities	Pop. Served	No. of Facilities	Pop. Served	No. of Facilities	Pop. Served
<u>Non-Public:*</u>										
Shallow well -Sanitary	123,705	631,899	49,755	238,826	11,981	69,487	24,244	123,645	37,725	199,941
-Non-Sanitary	598,970	3,072,961	212,463	1,019,822	38,980	226,081	74,175	378,294	273,352	1,448,764
Deep well -Sanitary	27,826	144,027	14,429	69,259	8,686	50,378	2,897	14,775	1,814	9,615
-Non-Sanitary	52,793	275,017	26,787	128,578	18,367	106,526	2,874	14,656	4,765	25,257
PWS -Sanitary	7,934	718,759	3,876	279,041	2,471	286,634	1,196	122,030	391	31,054
-Non-Sanitary	14,679	1,330,709	7,210	519,098	5,231	606,771	1,196	122,030	1,042	82,810
Total (Non-Public)		6,173,372		2,254,624		1,345,877		775,430		1,797,441
<u>Public:</u>										
Shallow well -Sanitary	13,771	1,563,560	3,645	363,574	7,176	846,006	1,560	198,247	1,399	155,733
-Non-Sanitary	78,183	8,521,886	28,611	2,746,638	29,491	3,420,999	10,498	1,338,444	9,583	1,015,805
Deep well -Sanitary	25,697	2,309,535	5,202	403,975	12,352	1,110,476	6,134	624,050	2,009	171,034
-Non-Sanitary	37,135	3,165,841	7,713	555,346	20,292	1,765,407	5,302	540,761	3,828	304,327
PWS -Sanitary	2,421	1,034,099	555	202,863	814	328,543	688	375,684	364	127,009
-Non-Sanitary	2,045	1,173,666	579	2,278,129	770	446,703	340	260,211	356	188,623
Surface water-Non-Sanitary	74,556	7,520,664	13,147	946,551	34,861	4,043,901	18,649	1,902,235	7,899	627,977
Total (Public)		25,289,251		5,497,076		11,962,035		5,239,632		2,590,508

* These numbers do not include the facilities built in 1984.

APPENDIX B Summary Table for the Rural Water Supply Masterplan

A. EXISTING POPULATION COVERAGE	WHOLE KINGDOM		NORTH	NORTHEAST	CENTRAL	SOUTH				
By the End of 1983	% of Population		% of Population		% of Population					
Total Estimated Rural Population	35,660,000		7,982,000	14,906,000	7,718,000	5,504,000				
Population Served (By Sanitary & Non-Sanitary Sources)	30,273,623	84.9	7,535,200	12,711,362	5,796,612	4,230,449				
By Sanitary Sources : Public	3,718,194	10.4	753,912	1,688,475	979,531	296,216				
: Non - Public	1,494,685	4.2	587,126	406,499	260,450	240,610				
Total	5,212,879	14.6	1,341,038	2,094,974	1,239,981	536,886				
By Non - Sanitary Sources : Public	20,302,057	57.2	4,526,664	9,677,010	4,041,657	2,136,737				
: Non - Public	4,678,687	13.1	1,667,498	939,378	514,980	1,556,831				
Total	25,060,744	70.3	6,194,162	10,616,388	4,529,637	3,693,563				
By the End of 1984	% of Population		% of Population		% of Population					
Total Estimated Rural Population	36,267,393		8,092,681	15,182,996	7,848,084	5,143,632				
Population Served (By Sanitary Source Only)	6,401,879	17.7	1,557,538	2,691,524	1,458,431	694,386				
Population Not Served by Sanitary Sources *	29,865,514	82.3	6,535,143	12,491,472	6,389,653	4,449,246				
* These figures include the population served by non - sanitary sources										
B. TARGET COVERAGE (1985 - 1991)	% of Population		% of Population		% of Population					
Total Estimated Rural Population	40,232,000		8,903,000	16,895,000	8,683,000	5,751,000				
Total Population To Be Served	38,219,215	95.0	8,457,163	16,050,640	8,249,418	5,461,994				
Less Population Already Served by Sanitary Sources in 1984	6,401,879	15.9	1,557,538	2,691,524	1,458,431	694,386				
Population To Be Served by All Facilities between 1985 - 1991	31,817,336	79.1	6,899,625	13,359,116	6,790,987	4,767,608				
Non - Public Facilities	3,605,000	8.9	1,071,000	733,999	593,999	1,206,002				
Public Facilities	28,212,336	70.2	5,828,625	12,625,117	6,196,988	3,561,606				
By Upgrading	12,861,394	32.0	3,580,115	5,635,110	2,139,417	1,508,752				
By Rehabilitation	877,247	2.2	144,361	493,671	139,741	99,274				
By New Construction	14,473,695	36.0	2,104,149	6,496,336	3,917,830	1,953,580				
IMPLEMENTATION SCHEDULE AND INVESTMENT REQUIREMENTS (1985 - 1991)										
1) UPGRADING	No. of Units	FOREX	LOCAL	TOTAL COST	No. of Units	Cost	No. of Units	Cost	No. of Units	Cost
Shallow Well	78,183	43.79 M	519.15 M	562.94 M	28,609	\$206.01 M	29,191	\$212.31 M	10,500	\$75.60 M
Deep Well	37,135	11.51 M	140.74 M	152.25 M	7,714	\$1.64 M	20,293	\$3.23 M	5,299	\$21.70 M
PWS (Deep Well)	2,051	0.64 M	7.76 M	8.40 M	581	2.38 M	770	\$1.15 M	343	1.40 M
		\$55.94 M	\$667.65 M	\$723.59 M		\$240.03 M		\$298.69 M		\$98.70 M
2) REHABILITATION										
Deep Well	7,546	2.36 M	150.10 M	152.46 M	1,246	\$25.20 M	4,753	\$96.04 M	707	\$4.28 M
PWS (Deep Well)	406	0.12 M	8.0 M	8.12 M	112	2.24 M	140	2.80 M	91	1.82 M
		\$2.48 M	\$158.10 M	\$160.58 M		\$27.44 M		\$98.84 M		\$6.10 M
3) NEW CONSTRUCTION										
Jars										
1 m ³										
2 m ³										
By Subsidy	251,192	—	70.32 M	70.32 M	617,316	\$244.68 M	2,205,784	\$874.22 M	1,188,900	\$471.22 M
By Revolving Fund	2,674,664	—	1,257.12 M	1,257.12 M	411,544	193.44 M	1,470,520	691.16 M	792,600	372.52 M
	125,596	—	17.58 M	17.58 M	205,772	48.36 M	735,264	172.78 M	396,300	93.14 M
	1,337,336	—	314.28 M	314.28 M	2,056	2.88 M	7,352	10.28 M	3,964	5.56 M
Molds :	14,628	—	20.48 M	20.48 M	21	1.89 M	21	1.89 M	—	—
Spring Catchment System	63	0.38 M	5.29 M	5.67 M	21	1.89 M	21	1.89 M	—	—
Shallow Well	25,053	24.30 M	376.52 M	400.82 M	4,774	76.37 M	10,409	166.53 M	4,487	71.82 M
Deep Well	21,805	86.26 M	1,464.10 M	1,550.36 M	2,835	201.60 M	6,615	470.33 M	9,352	664.93 M
PWS : Deep Well	1,316	17.88 M	246.65 M	264.53 M	119	23.94 M	329	66.15 M	581	116.76 M
Slow Sand Filter	77	12.72 M	254.96 M	267.68 M	14	6.95 M	21	73.01 M	28	97.37 M
Rapid Sand Filter	21	2.35 M	67.58 M	69.93 M	7	3.33 M	—	—	7	23.31 M
Rainwater	6,650	25.01 M	294.75 M	319.76 M	1,456	10.00 M	2,492	119.84 M	1,456	70.00 M
		\$168.90 M	\$4,389.63 M	\$4,558.53 M		\$690.44 M		\$1,771.97 M		\$1,515.41 M
4) OPERATION AND MAINTENANCE										
Sanitary Well	101,860	—	322.66 M	322.66 M	32,202	\$100.22 M	41,025	\$133.98 M	14,406	\$44.71 M
Deep Well	87,824	—	1,453.60 M	1,453.60 M	16,860	289.23 M	43,341	729.40 M	18,430	290.29 M
Training Courses for Village Operators	133	0.59 M	5.73 M	6.37 M	28	1.33 M	42	2.03 M	35	1.68 M
		\$0.59 M	\$1,782.04 M	\$1,782.63 M		\$390.78 M		\$865.41 M		\$336.68 M
5) MONITORING OF WATER QUALITY										
Investment (Equipment & Lab. Set Up)										
Central		13.20 M	—	13.20 M						
Regional	9	45.54 M	—	45.54 M						
Amphur	723	—	0.72 M	0.72 M						
Tamboon	3,445	118.28 M	6.95 M	125.23 M						
Operational (Water Quality Analysis)										
Central	9	31.08 M	22.47 M	53.55 M						
Regional	723	41.44 M	69.92 M	111.36 M						
Amphur	3,115	33.56 M	22.36 M	55.92 M						
Tamboon		734.94 M	146.99 M	881.93 M						
Training Courses (Personnel)										
Regional	2	0.02 M	0.06 M	0.08 M						
Amphur	36	0.26 M	0.25 M	0.51 M						
Tamboon	633	1.95 M	4.36 M	6.31 M						
		\$1020.27 M	\$274.08 M	\$1,294.35 M						
6) RESEARCH AND DEVELOPMENT										
Regional and Central Levels			70.00	70.00 †				As appropriate		
				70.00 †						
TOTAL		(Grand Total)	\$1,248.18 M	\$7341.50 M	\$8,589.68 M	\$1,348.69 M	\$5,034.91 M	\$1,966.89 M		\$874.84 M

† This budget allocation will be handled by the Central Agency

APPENDIX C Summary Table for the Rural Sanitation Masterplan

A. HOUSEHOLD COVERAGE				WHOLE KINGDOM			NORTH			NORTHEAST			CENTRAL			SOUTH		
	Households Served	No. of Households	%	Households Served	No. of Households	%	Households Served	No. of Households	%	Households Served	No. of Households	%	Households Served	No. of Households	%			
1) EXISTING (By the End of 1983)	2,792,062	6,278,198	44.3	800,309	1,645,372	48.6	910,163	2,308,022	39.5	864,380	1,526,273	56.8	217,210	798,531	27.2			
(By the End of 1984)	2,899,200			829,781			939,688			899,520			230,211					
2) TARGET (1985 - 1991)	2,490,000			590,000			830,000			570,000			500,000					
3) TOTAL (By the End of 1991)	5,389,200	7,185,747	75.0	1,419,781	1,853,500	76.6	1,769,688	2,662,087	66.5	1,469,520	1,741,138	84.4	730,211	929,022	78.6			
B. IMPLEMENTATION SCHEDULE AND INVESTMENT REQUIREMENTS																		
	No. of Units	FOREX	LOCAL	TOTAL COST	No. of Units	Cost	No. of Units	Cost	No. of Units	Cost	No. of Units	Cost						
1) TOILET CONSTRUCTION	2,490,000				590,000		830,000		570,000		500,000							
By Subsidy		—	1,095.6 M	1,095.6 M		฿ 259.6 M		฿ 365.2 M		฿ 250.8 M		฿ 220.0 M						
By Revolving Fund		—	350.0 M	350.0 M		68.0 M		162.0 M		63.0 M		57.0 M						
			฿ 1,445.6 M	฿ 1,445.6 M		฿ 372.6 M		฿ 527.2 M		฿ 313.8 M		฿ 277.0 M						
2) TRAINING	No. of Personnel																	
VHVs / VHCs	689,600	—	171.6 M	171.6 M														
Tambon Health Workers	5,421	0.77 M	4.03 M	4.8 M														
Tambon Council Committee	91,000	12.56 M	27.54 M	40.1 M														
Village Sanitation Craftsmen	46,008	5.22 M	49.28 M	54.5 M														
Training Materials	—	—	22.90 M	22.9 M						As appropriate								
Seminar, Workshop, etc.	—	—	13.80 M	13.8 M						As appropriate								
		฿ 18.55 M	฿ 289.15 M	฿ 307.7 M														
3) HEALTH EDUCATION INFORMATION AND COMMUNICATION																		
Latrine in School		—	11.2 M	11.2 M						As appropriate								
Posters, Leaflets, Radio Programs, etc.		—	7.0 M	7.0 M						As appropriate								
Mobile Units		14.0 M	—	14.0 M						As appropriate								
		฿ 14.0 M	฿ 18.2 M	฿ 32.2 M														
4) RESEARCH AND DEVELOPMENT																		
Central and Regional Levels			7.0 M	7.0 M *						As appropriate								
			7.0 M	7.0 M *														
TOTAL	(Grand Total)	฿ 32.55 M	฿ 1,759.95 M	฿ 1,792.5 M		฿ 372.6 M		฿ 527.2 M		฿ 313.8 M		฿ 277.0 M						

* This budget allocation will be handled by the central agency.