JAPAN INTERNATIONAL COOPERATION AGENCY
EAST TIMOR TRANSITIONAL ADMINISTRATION

THE STUDY
ON
URGENT IMPROVEMENT PROJECT
FOR
WATER SUPPLY SYSTEM
IN
EAST TIMOR

FINAL REPORT

Volume Ⅰ : SUMMARY REPORT

FEBRUARY 2001

TOKYO ENGINEERING CONSULTANTS, CO., LTD.
PACIFIC CONSULTANTS INTERNATIONAL

SSS
JR
01-040

THE STUDY
ON
URGENT IMPROVEMENT PROJECT
FOR
WATER SUPPLY SYSTEM
IN
EAST TIMOR

FINAL REPORT

CONSTITUENT VOLUMES

VOLUME Ⅰ **SUMMARY REPORT**

VOLUME Ⅱ **MAIN REPORT**

VOLUME Ⅲ **APPENDIX**

VOLUME Ⅳ **QUICK PROJECT IMPLEMENTATION MANUAL**

Foreign Exchange Rate:

USD 1.00 = INDONESIA RUPIAH 9,500
AUD 1.00 = JPY 58.50
USD 1.00 = JPY 111.07
(Status as of the 30 November 2000)

PREFACE

In response to a request from the United Nations Transitional Administration of East Timor, the Government of Japan decided to conduct The Study on Urgent Improvement Project for Water Supply System in East Timor and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Kazufumi Momose of Tokyo Engineering Consultants Co., Ltd. in association with Pacific Consultants International to East Timor, twice between February 2000 and February 2001.

The team held discussions with the officials concerned of the East Timor Transitional Administration and Asian Development Bank which is a trustee of East Timor Trust Fund and conducted field surveys in the study area. Based on the field surveys, the Study Team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of this project and to the enhancement of friendly relationship between Japan and East Timor

Finally, I wish to express my sincere appreciation to the officials concerned of the East Timor Transitional Administration for their close cooperation extended to the Study.

February 2001

Kunihiko SAITO
President
Japan International Cooperation Agency

Mr. Kunihiko Saito
President
Japan International Cooperation Agency

LETTER OF TRANSMITTAL

Dear Sir,

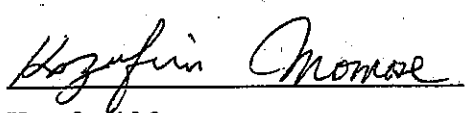
We are pleased to submit you the final report entitled "THE STUDY ON URGENT IMPROVEMENT PROJECT FOR WATER SUPPLY SYSTEM IN EAST TIMOR". This report has been prepared by the Study Team in accordance with the contracts signed on 17 February 2000, between Japan International Cooperation Agency and Tokyo Engineering Consultants Co., Ltd. and Pacific Consultants International.

The report examines the existing conditions concerning water supply system in East Timor, presents urgent improvement projects identified in 15 towns, including conducted Quick Projects

The report consists of the Summary Report, Main Report, Appendix and Quick Project Implementation Manual. The Summery Report summarizes the results of all studies. The Main Report presents the results of the whole study including background conditions, existing water supply situation, selection of priority project and execution of the Quick Project. The Appendix describes in detail the same contents of the Main Report and the Quick Project Implementation Manual shows concrete operation and maintenance procedures of each Quick Project.

All the members of the Study Team wish to acknowledge gratefully to the personnel of your Agency and Ministry of Foreign Affairs, the liaison office of the Government of Japan in East Timor, JICA East Timor Office, and also to the officials and individuals of the East Timor Transitional Administration for their assistance extended to the Study Team. The Study Team sincerely hopes that the results of the study contribute to the improvement of the water supply systems and social and economic development in East Timor.

Yours faithfully,
February 2001



Kazufumi Momose
Team Leader

ABBREVIATIONS USED IN THIS REPORT

ACF	Action Contre la Faim (French)
ADB	Asian Development Bank
AFMET	Alliance of Friends for East Timor
amsl	above mean sea level
AusAID	Australian Agency for International Development
BPAM	Badam Pengelola Air Minum (Bahasa Indonesia) Local Water Utility Agency
CNRT	Conselho Nacional da Resistencia Timorense (Portuguese) National Council of Timorese Resistance
DFID	Department for International Development (United Kingdom)
ETTA	East Timor Transitional Administration
GSP	Galvanized Steel Pipe
GIS	Geographical Information System
GOJ	Government of Japan
GPA	Governance and Public Administration
HP	Horsepower
HDPE	High Density Polyethylene
ICRC	International Committee of the Red Cross
IOM	International Organization for Migration
JICA	Japan International Cooperation Agency
L/s	liters per second
L/c/d	liters per capita per day
NGO	Non Government Organization
OCHA	Office for the Coordination of Humanitarian Affairs
Oxfam	International NGO on environmental health – water, sanitation & public health
PCI	Pacific Consultants International
PKF	Peacekeeping Force
PLN	Perusahaan Listrik Negara (Bahasa Indonesia) Electricity Utility Agency in East Timor
PDAM	Perusahaan Daerah Air Minum (Bahasa Indonesia) Water Utility Agency in Dili
ppm	parts per million
PVC	Polyvinyl Chloride
rpm	revolution per minute
SSF	Slow Sand Filter
TDS	Total Dissolved Solids
TEC	Tokyo Engineering Consultants, Co., Ltd.
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
UNOCHA	United Nations Office for the Coordination of Humanitarian Affairs
UNSRSG	United Nations Special Representative of the Secretary General
UNTAET	United Nations Transitional Administration in East Timor
WAET	Water Authority in East Timor
WB	World Bank
WHO	World Health Organization
WTP	Water Treatment Plant

EXECUTIVE SUMMARY

1. STUDY AREA

The Study covered fifteen (15) towns: the capital of Dili, all district capitals except Oecussi and three sub-district towns. Eleven district capitals in the Study are Aileu, Ainaro, Baucau, Gleno, Liquica, Los Palos, Maliana, Manatuto, Same, Suai, and Viqueque. Three sub-district capitals are Atauro, Ermera and Maubisse. The Study is concentrated on the urban centers of the fifteen towns and occasionally extends into the rural areas mainly due to the geographical location of the water sources.

2. STUDY OBJECTTIVES

The objectives of the Study are the following:

a.) To plan and undertake "Quick Project" (otherwise known as Quick Impact Project of UNTAET).
b.) To prepare a scope of work for an immediate improvement project of a water supply system, which will be funded by the Japanese government and to be implemented by UNDP.
c.) To set up a comprehensive Geographic Information System of the existing water supply system that includes the physical condition in order to facilitate rehabilitation works and future development program.
d.) To make an assessment of the water resources.
e.) To formulate a rehabilitation and improvement plan of the existing/damaged water supply system for the target year 2003.
f.) To promote water supply, sanitation and hygiene in primary schools of peri-urban and rural areas (this part of the Study is limited to Dili, Aileu and Los Palos).
g.) To pursue capacity building and technology transfer to counterpart personnel in the course of the Study.

The Study is carried out in 2 phases namely: Phase I – Asset Mapping and Evaluation of the Existing Water Supply Systems and Phase II – Master Plan on the Rehabilitation/ Improvement of the Water Supply Systems in 15 Towns of East Timor. Phase I, which commenced in mid-February ended up in July. On the other hand, Phase II, which started in October 2001, completed in January 2001.

3. JICA's "QUICK PROJECTS"

JICA extended the following "Quick Projects" for both improvement of water supply system and creation of jobs:

- Leakage Control in Dili
- Construction of the Infiltration Gallery and Transmission Main in Manatuto
- Rehabilitation of Water Supply and sanitation Facilities in selected Primary Schools in Dili, Aileu and Los Palos.

4. EXISTING WATER SUPPLY SYSTEMS

The collected data and information are compiled as GIS data. The facilities are found ineffective, unreliable, and most often damaged. Moreover, they are in poor condition and in a fast pace of deterioration due to lack of routine maintenance.

(1) Water Sources and Intake Facilities

Except for the towns east of the country (Baucau, Los Palos and Viqueque), where spring sources with abundant potential supplies the water needs of the people, the rest of the 12 towns are getting water from a combination of sources such as surface water, spring and groundwater. Most of the surface/spring water sources are normally located in high elevations to allow gravity flow of water to the service area. During rainy season, surface water quality deteriorates due to excessive soil erosion and most often creates serious problems to the water treatment plant and the pipelines. The towns/cities that abstract groundwater to augment water production from other sources are Dili, Liquica and Suai.

(2) Transmission Mains

Transmission mains most often traverse in unstable mountain slopes. The pipelines are exposed above ground making them more vulnerable to damage. Some of the major problems that creates serious damage to the transmission mains are the following:

- Designed and constructed below standard
- Installed in areas vulnerable to damage both natural and made-made.
- Constructed without adequate protection
- In most cases, subjected to flooding, soil erosion, falling rocks and tree branches
- Illegal service connections
- Sand and mud accumulation

- Lack of routine maintenance

The unreliability of the transmission mains created by the above-mentioned factors often lead to the breakdown of the water supply systems in few of the towns of the study area.

(3) Water Treatment Facilities

The water treatment facilities vary from simple slow sand filter units to water treatment units comprising of processes such as: flocculation, sedimentation and filtration. On some occasion, even in the treatment plant with adequate capacity, the operation of the WTP is hampered by the lack of treatment chemicals and routine maintenance thereby reducing the treatment efficiency of the plant that results to the production of water with unacceptable quality. The WTP in Los Palos, Ainaro, Gleno and Liquica are slow sand filter units.

(4) Storage Reservoirs

Generally, the reservoirs are located in high elevations to allow gravity flow of water to the service area. The storage capacities of the existing reservoirs including Dili are well below the desired storage requirement for demand moderators. Except for the AusAID-funded reservoirs and few reservoirs in Dili, most of them are not well equipped with operational devices such as control valves, water meters, and water level gauge. With the lack of regular maintenance and neglect, some of these facilities are in poor condition and in a fast pace of deterioration.

(5) Distribution Network and Service Connections

Most of the distribution and reticulation systems are in constant repair mainly due to the poor workmanship and unacceptable standards employed during construction. Most of these pipes were laid too shallow and above ground making them vulnerable to damage. There are towns, such as in Baucau and Los Palos, where the installations of the distribution network are not complete and left without fittings resulting to fast deterioration of the pipelines and are subject to vandalism.

There exist a large number of illegal connections on the distribution mains. Large volume of water is wasted. The existence of illegal connection makes it difficult to attain optimum flow control in the pipe distribution network. Thus, the water supply condition in critical areas of the distribution network has become miserable.

5. REHABILITATION PLAN

(1) Concept of Rehabilitation

The rehabilitation plan was formulated based on the general idea of rehabilitation with minimal recurrent cost even though big capital investment is incurred. Accordingly, 5 general concepts were proposed such as follows:

- Reliable transmission pipelines
  This is the most upstream part of the water supply system so that failure of this leads to complete shutdown of water supply as experienced in entire Manatuto and Liquica and most part of Aileu, Baucau and Los Palos. Once the transmission pipelines are laid safely, the water supply systems can be run without electricity, giving low operation cost.
- Adequate water treatment facilities
  Treatment plant was previously installed with little attention to raw water quality in each water source. In designing treatment plant, we must consider characteristics of each water source quality such as abrupt change of raw water quality and occasionally high turbidity. Proper design to treatment plants will assure acceptable treated water quality.
- Efficient water distribution management
  The gravitational flow is a good system if properly designed so that we will maintain the gravitational flow. But, if production is smaller than demand or wastage is larger than production, some hydraulically inferior areas are always victims; they are not supplied with water. Therefore, to manage distribution system, we propose zoning system with some control devices.
- Reduction of unaccounted-for-water through leakage control
  Water distribution is in a miserable stage in most of the towns. We have found many clogged pipes and broken pipes even in the distribution mains. Illegal connections are made by unskilled workers and lead to considerable amount of wastage of water.
- Maximize service coverage

(2) Costs for the Project and its Operation and Maintenance

The costs for the present project are summarized as follows:

Project Costs	(Thousand US$)
Construction Costs:	21,001
Engineering Fee:	2,100
Contingencies:	3,465
Total:	26,566

The total project costs for 15 towns is US$ 26.6 million, of which Dili part needs US$ 14.9 million while annual costs for operation and maintenance are 1.2 million US$.

6. INSTITUTIONAL DEVELOPMENT

Water and Sanitation Service (WSS) of East Timor Transitional Administration was established and expected to launch the services as nation building is being accelerated. However, constraints are:

- Globally deteriorated water supply facilities,
- Limited financial resources,
- Total lack of technical and management disciplines, and
- Lack of comprehensive laws and regulations to define the services.

WSS had to start its organization building and daily operations with the 150 national and some international personnel. It will be operated for the time being with a heavy central core in Dili, district subcenters with several intermediate functions and mere system operators at each system site. This centralized organization may be a product of underresourced circumstances and yet to be tested by a longer time application. The TFET funded Project Management Unit will also help enhance technical and managerial capacities and develop regulatory requirements.

The course of WSS's institution building will not be obviously streamlined. The target, however, would be clear. It should evolve itself to a public service provider managed and operated in accordance with modern utility efficiency standards and practices. To achieve this, various trainings, planning exercises and upgrading the operating systems are requisites. In addition, daily field operations are required to check escalating aggravation of the supply facilities. Now, exercise in the immediate action should be brought in. But, which action to be done at first?

The prime mover is the execution of the universal tariff.

- Bill by volume that is metered.
- Low collection rate may be allowed, but should be improved.
- Flexible cross subsidization will ease development of tariff collection.
- Tariff collection can be easily started when system is effectively renovated.
- Let everybody know that someone must pay the cost of water supply.
- Ban, preferably criminally, the unauthorized tapping of water pipes.
- Sell water from the public taps as well.
- Enact all the necessary laws and regulations.

This exercise is a challenge and the shortest path to the eventual cost recovery. It will bring about a forceful evolvement of organization, operation and manpower of the water supply service provider.

7. FINANCIAL PLANNING

The fundamental issues when we develop a financial plan of water supply are current economic turmoil and low per capita GDP. During Indonesian era, eighty five percent of financial resources of East Timor provincial government were subsidized from central government. According to recent ADB survey (June 2000), per capita GDP of East Timor was estimated as USD 113. Among 15 cities of study area, only the water supply in Dili collected water tariff at insufficient level to cover the water cost.

With assistance from international organizations and foreign countries and self-effort of residents, the economy is showing a trend to be stabilized and grow. We expect that the per capita GDP will recover to the before the East Asian financial crisis level at the target year of 2003. As for economic forecast, we considered two stories. The one is that the GDP per capita in 2003 will recover to the one in 1996. The other is it will recover to the one in 1994 because the GDP in 1996 was inflated with bubble economy of that time. Regarding real economic growth rate, we adopted two cases (6% or 4%). Population will increase at 1.5% annually (= Indonesian era) and inflation rate will be 3% annually.

Applying above assumption we have developed three cases. Case A is standard case. Case B is conservative case. Case C is worst case. In case of typical financial analysis, we develop fund flow tables, loan repayment schedule and pro forma financial statements including balance sheet and FIRR. But, as it is very clear that financially it cannot be independent for substantial period, we compare only the tariff revenue from

the proposed systems with the cost associated with the proposed systems (O&M cost and depreciation cost).

In Dili water tariff collection will start on July 2001. We recommend tariff collection in other 14 cities at early stage when it becomes possible. As to tariff level, we assumed 1.4 % (= water charge of Dili in Indonesian era) of per capita GDP as whole water revenue. The examination of tariff structure will be done during 2001. We expect the accommodation of cross subsidy among residents and among districts and application of progressive tariff rate and the separation of domestic tariff and institutional and commercial tariff. Collection rate will increase as time goes.

According to the result of revenue and cost, the year that tariff revenue exceeds O&M cost will be 2014 in Case A and 2022 in Case B. Even in 2030, subsidy from general budget or other resources is required in Case C. The year that tariff revenue exceeds whole water cost including depreciation expense will be 2021 in Case A and 2026 in Case B.

Therefore, regarding financial prospect of proposed plan, the crucial factor is the level of GDP per capita. The tariff level and collection rate are important also but not the key to the financial sustainability.

8. OVERALL EVALUATION AND RECOMMENDATIONS

(1) Overall Evaluation

To prepare for the national government of East Timor, UNTAET is developing the institutions for public administration and the public infrastructure including water supply. With substantial absence of natural resources and industry other than agriculture, political and economic independence of a country of small land and population is greatly challenging. In the Study, the rehabilitation plan was formulated on the water supply system in 15 towns which were either damaged directly after a post-referendum violence or not functioned adequately due to low-standard of planning and construction. The plan was formulated taking into account of socio-economic condition such as adoption of energy-saved gravitational flow and of avoiding over-yield of groundwater. Besides, implementation of the rehabilitation plan will bring the stable water supply, resulting in the following socio-economic and environmental effects;

1) Socioeconomic Evaluation

The service areas of the 15 towns rehabilitation plan include the national capital and 11 district towns, which are major population centers of East Timor. A quarter of East Timorese population, i.e., approximately 200 thousand will be the direct beneficiaries. These service areas are centers of the regional socioeconomic activities. Populations from their hinterlands, who come to their marketplaces, are assumed indirect beneficiaries. Supply of clean and safe water does not only provide a basic human need, reduce the water-fetching labor and improve the sanitation, but also contribute to stabilize and promote regional economies by helping production and supply of the better food products, etc. It is thus expected to provide a basis for economic development of the entire land. Since rehabilitation of facility and operation thereof were designed on the basis of the lease cost, a large benefit/cost ratio is expected.

2) Environmental Evaluation

The water supply rehabilitation program as such is intended to improve the sanitation environment, and therefore improve environmental features of the region. During the implementation, however, some adverse impacts are temporarily possible. Environmental consideration on the following issues are desirably taken:

- Relocation of residents
- Traffic hazards
- Water pollution
- Residents participation

(2) Recommendations

The water supply sector, as well as other sectors of public infrastructure, has various problems as stated in the preceding chapters. To overcome these problems and to structure sustainable water supply system, recommendations suggested in the other chapters are hereby reiterated for integration.

1) Establishment of Organization

Regarding the institutional and operational setup of the water supply services of East Timor, the JICA Study Team has been discussing among itself, and with the Water and Sanitation Service (WSS) of UNTAET, with Project Management Unit of Asian Development Bank that is implementing the "Trust Fund for East Timor (TFET)," and with personnel of AusAID, who are helping mainly in capacity building.

2) Development of Human Resources

Institutional/human resources development including several training programs, development of legal and financial arrangements is scheduled to be implemented in cooperation with Australian technical assistance. It is necessary to urgently strengthen its organization in the short term. To achieve this, exercises are required not only by the classroom training but also by training in actual application.

3) Development of Laws, Regulations and Standards

The water supply service provider should acquire most effective means to eliminate leakages, check unauthorized connections, collect tariff by volume-based billing and thereby minimize unaccounted-for water and wasteful water use. To achieve these exercises, the service provider needs to be regulated, technically upgraded, ethically esteemed and publicly monitored. It should be suggested that the financially autonomous service provider be eventually pursued as the modern public utility standards. It would be also essential that it should be monitored by and accountable to the public.

4) Financial Planning

The national government is expected to make a start in a few years. The government's revenue will not be optimistic. It is necessary to make the water supply service be operated without depending the government's subsidy. It is, therefore, proposed to initiate the tariff collection in the early stage.

Execution of tariff collection throughout the country is important. Even in a small-scale water supply operated by local community, the costs for operation and maintenance and also for replacement of equipment should be collected. For example, water supply from a public tap should be charged, too. In short, it should be understood by everyone that piped water supply has price and someone has to pay it. For propagation of this principle, comprehensive publicity activity is required and should be started right now.

5) Sustainable Water Supply Facilities

To obtain water without electric power and chemicals, water sources were located far beyond the mountain jungles and transmission pipes were laid up to the town struggling steep landforms. Reconstruction and protection of transmission mains that tends to be damaged by flood or landslide were selected in the rehabilitation plan.

From the viewpoint of the sound water supply services, the existing systems do not have the proper control on water distribution. Water distribution control system must be adopted into the rehabilitation plan in terms of sound management of water supply services.

6) Flexibility of Project Management and Possibility of Japan's Cooperation

It is essential to ensure proper operation and maintenance of facilities in implementing the water supply rehabilitation projects for 15 towns. This implies that success of the rehabilitation projects depends on the success of the capacity building programs being planned and carried out by PMU. To follow up this, institutional, organizational and financial reviews shall be made during stages of rehabilitation project, and if it is found necessary, technical and financial experts will be inputted and additional organization strengthening measure will be suggested.

Among suggested proposals, the following will be the ones for that Japanese cooperation may be possible and such may bring positive effects:

- Preparation of Water Service Ledger in Dili
- Operation of Treatment Process and Water Quality Analysis
- Leakage Control
- Awareness Uplifting Activity

TABLE OF CONTENTS

LIST OF FIGURES

LISTS OF TABLES

SUMMARY

1. INTRODUCTION

On February 17, 2000 in response to the Government of Japan's (GOJ) commitment to the restoration of East Timor's damaged water supply system, the Japan International Cooperation Agency (JICA) commissioned Tokyo Engineering Consultants and Pacific Consultants International to carry out the project "The Study on Urgent Improvement Project for the Water supply System in East Timor", hereinafter referred to as the Study. However, few months prior to the commencement of the Study, JICA sent a mission to make a rapid assessment on the condition of the country's water supply system. The results of the JICA Mission were used as basis in the formulation of the Scope of Work, which was signed on January 12, 2000 by the SRSG of UNTAET and JICA Mission. Due to the lack of available data and information that best describe the existing condition of East Timor's water supply system amendments were made to the original Scope of Work. This revised Scope of Work was later signed on March 10, 2000.

1.1 The Study Area

In accordance to the Scope of Work, the Study covered fifteen (15) towns (refer to Figure 1.1); the capital of Dili, all district capitals except Oecussi and three sub-district towns. Eleven district capitals in the Study are Aileu, Ainaro, Baucau, Gleno, Liquica, Los Palos, Maliana, Manatuto, Same, Suai, and Viqueque. Three sub-district capitals are Atauro, Ermera and Maubisse. The Study is concentrated on the urban centers of the fifteen towns and occasionally extends into the rural areas mainly due to the geographical location of the water sources.

1.2 The Objectives of the Study

The objectives of the Study are the following:

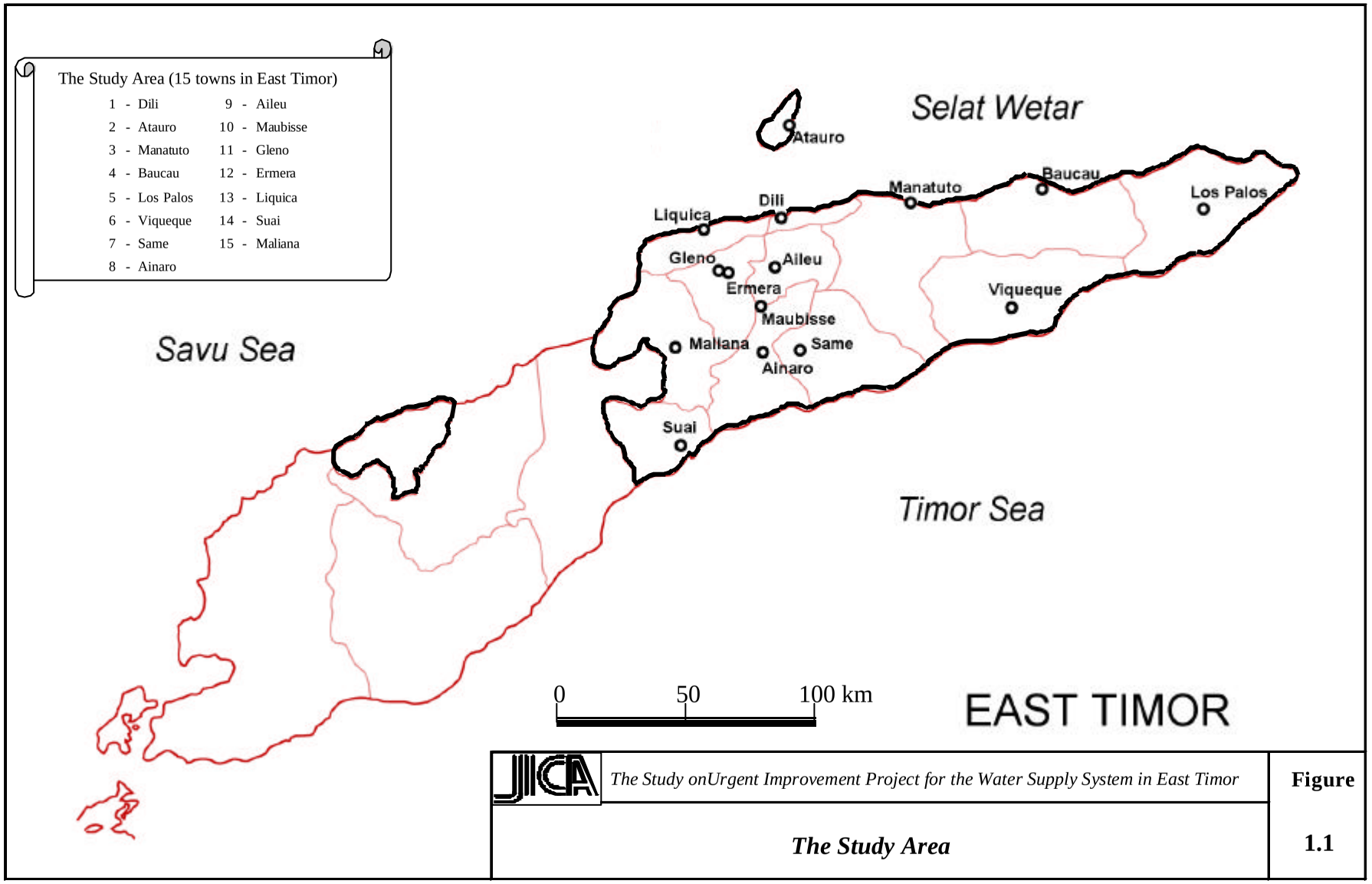
a.) To plan and undertake "Quick Project" (otherwise known as Quick Impact Project of UNTAET).
b.) To prepare a scope of work for an immediate improvement project of a water supply system, which will be funded by the Japanese government and to be implemented by UNDP.

c.) To set up a comprehensive Geographic Information System of the existing water supply system that includes the physical condition in order to facilitate rehabilitation works and future development program.
d.) To make an assessment of the water resources.
e.) To formulate a rehabilitation and improvement plan of the existing/damaged water supply system for the target year 2003.
f.) To promote water supply, sanitation and hygiene in primary schools of peri-urban and rural areas (this part of the Study is limited to Dili, Aileu and Los Palos).
g.) To pursue capacity building and technology transfer to counterpart personnel in the course of the Study.

The Study is carried out in 2 phases namely: Phase I – Asset Mapping and Evaluation of the Existing Water Supply Systems and Phase II – Master Plan on the Rehabilitation/ Improvement of the Water Supply Systems in 15 Towns of East Timor. Phase I, which commenced in mid-February ended up in July. On the other hand, Phase II, which started in October, will be completed in January 2001. Refer to Figure 2.1 for the Plan of Operation.

In most cases, due to the unavailability of records, drawings and other related information of the water supply system in the study area, on-site data gathering and investigations are necessary. Stage I includes extensive on-site survey for asset mapping evaluation of the existing water supply facilities. Investigations of major water supply facilities include water sources and intake structures, transmission and distribution mains, treatment works, storage facilities and service connections. The field data and information gathered was superimposed on the GIS maps (either scale 1:2,000 or 1:5,000) to be completed towards the end of Phase II. This GIS activity has started in Dili of which the scale 1:2,000 has been completed. The GIS map of Dili has been very helpful in the implementation of the Leakage Control Program (one of the JICA "Quick Project"). Likewise, this map will be a vital tool in the operation and maintenance of the water supply system.

In the duration of Phase I, the Study Team investigated the existing water sources in terms of quantity and quality that helped in the evaluation for their adequacy of the present and future water requirements. Otherwise, possible alternative or additional water sources were considered for investigation. All data and information collected in Phase I served as basis for the 3-Year Rehabilitation Plan and for the identification of Quick Projects. Although a number of Quick Projects were identified as mentioned below, these projects, which started in Phase I continued until Phase II.



The Study onUrgent Improvement Project for the Water Supply System in East Timor

The Study Area

Figure 1.1

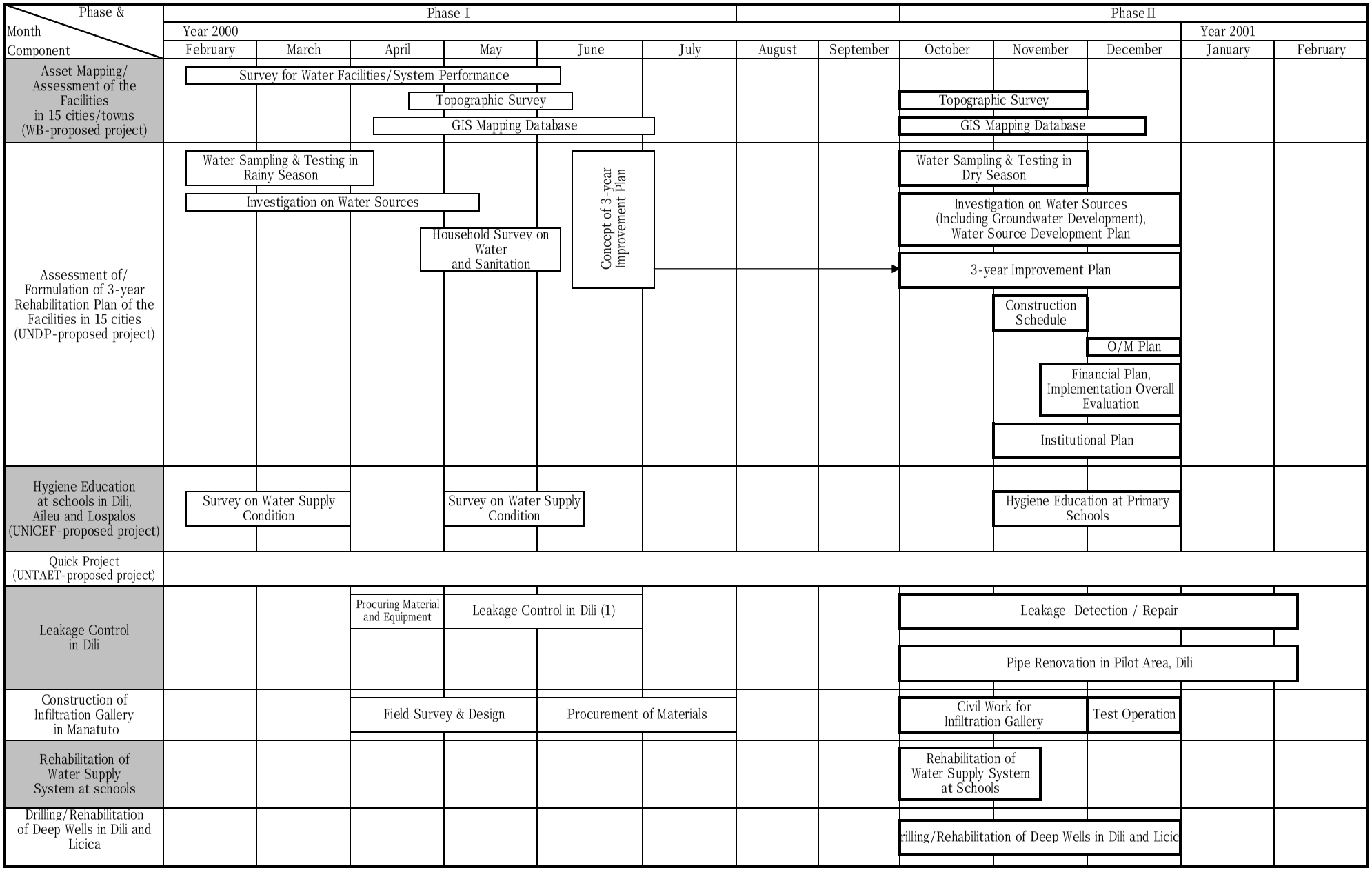


Fig. 1.2 Plan of Operation