THE POTABLE WATER PROJECT IN RURAL THAILAND 1966 - 1972

Report of An Ex-Post Impact Evaluation

Prepared for

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by

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EXECUTIVE SUMMARY

Project Identification. The Potable Water Project was implemented between 1966 and 1972 for a total of $4.8 million dollars ($2.9 million AID funds and $1.9 million Thai funds). It was part of the Accelerated Rural Development Program which began in 1964 with the goal of winning the loyalty of rural populations in parts of Thailand threatened by Communist insurgency. The project was also developed as part of the USAID/Thailand health and sanitation program which began in the early 1950s. Impetus to the project was the recognition, once malaria had been brought under control in the late 1950s, that the majority of illness and death in rural Thailand was attributable to water-borne gastroenteric and diarrheal diseases. The following objectives were therefore set forth for the project: (a) to provide piped potable water in one principle community in each of the 473 subdistricts in the security-sensitive areas of Northeast Thailand and in other selected strategic communities elsewhere until a total of 600 communities had been provided with potable water; (b) to improve the Thai capability to plan, develop, and administer a national program of construction and operation of piped village water systems; and (c) to thereby serve as the spearhead for a much more comprehensive Thai National Potable Water Program aimed at providing piped potable water in 10,000 to 12,000 rural communities over the next 30 years.

Project Implementation. The project was implemented by USAID/Thailand and the Sanitary Engineering Division of the Thai Ministry of Public Health through a contract with the New York engineering firm, Tippetts-Abbett-McCarthy-Stratton. Each system consisted minimally of a water treatment plant, a storage tower, and a piped distribution system with taps. All systems included chlorination. The systems were installed in two types of communities: villages and "sanitary districts" (rural market towns). Communities selected for the systems were supposed to have high interest in obtaining potable water as evidenced by villagers' willingness to assist in construction and to develop a rate structure that would pay for operation and maintenance costs and provide for future expansion. In most villages selected villagers did actually make financial and labor contributions in the construction phase; sanitary districts contributed treasury funds but residents did not make direct contributions. In each village, villagers chose one among them to become the plant operator; after training, these village operators were made responsible for the proper operation of the system and, in most cases, for collecting water fees. It is estimated that project costs for development of surface water sources with treatment and basic distribution piping was less than ten dollars per capita.

Evaluation Sample. The evaluation team visited 52 AID-supported rural water systems over the course of six weeks. This was a random sample drawn from over 200 AID-built systems and was stratified by province. The 52 systems serve 133 communities whose combined population totals approximately 170,000 persons. Thirty-seven of the systems are located in villages and 15 in sanitary districts.

Project Effectiveness. It appears that most of the piped water systems built under the project are continuing to function more than ten years after the first systems were installed. Of the 52 systems visited, only seven were not functioning. The provincial governments, sanitary districts, and village committees each manage their respective systems and generally provide the necessary fiscal and operational management.

With only a few exceptions the elected operators of the systems evaluated are competent, motivated and have received good, consistent support and supervision from the Rural Water Supply Section of the Ministry of Public Health. Most systems are completely self-sufficient financially with users paying full costs of maintenance and operation through fees collected for water delivered (even though fees are higher than those currently charged in Bangkok). Where systems have not continued to function, the reason appears in nearly all cases to have been due to management rather than technical problems per se.

Health Impact. Improved health through consumption of potable water was the intended project consequence. Because of the absence of initial baseline data and of village-specific health data today, no statistical data exists that can be taken as evidence of improved health in communities served by the systems. Villagers and health officials interviewed all asserted, however, that health status had improved in those communities where villagers do not drink the water because they do no like its taste. Local perceptions are that health has improved in large part because of the increased quantity and convenience of piped water permits more raising of vegetables and small livestock for home consumption, more frequent bathing and washing of clothing and cooking utensils, and increased use of water-sealed privies.

Economic Impact. According to villagers receiving the piped water, however, the project's greatest impact has been economic. Villagers are enthusiastic about the convenience of an ample quantity of water being reliably provided close to their homes. This results in considerable time-saving as well as increased water use, which in turn permits more gardening and farming and increased crafts production.

Benefit Incidence. Initially, in the villages served, community-wide access to the piped water was provided by public taps with flat fees being charged per household or person. Under this set of conditions virtually all socio-economic groups benefitted relatively equally but not enough revenue could be collected to sustain operations. Consequently, most systems changed to metered private connections and closed most public taps with the result that they gained financial viability but no longer served all the poorer villagers. There has since been a steady increase, however, in the number of new metered connections. In addition, many systems are extending distribution networks to areas previously unserved. The piped systems have eased the physical burdens of women and children--principle bearers of water in Thailand--and given women more time for income-generating activities. In the sanitary districts it is primarily the commercial sector who have the private taps and who thus benefitted by the systems.

Spread and Replicability. Under the AID project about 250 systems were installed. Since then the National Potable Water Program has brought this number to nearly 800, a large proportion of which were built according to the AID contractor's basic designs. It is estimated that 17 percent of the rural Thai population is now served by piped potable water as compared to only three percent prior to the project. It is the conclusion of the evaluation team that the Potable Water Project has been successful in many regards and more successful than many other water projects in rural Thailand.

I. PROJECT IDENTIFICATION

A. Basic Project Identification Data

1. Country: Thailand
2. Project title: Potable Water Project
3. Project number: 493-11-590-186
4. Project implementation
   a. First project agreement: FY 66
   b. Final obligation: FY 70
   c. Final input delivery: FY 72
5. Project Completion--Final Disbursement: FY 72
6. Project funding:

	Total
a. AID	$ 2,976,185 (grant)
b. Other donor: none	
c. Host Country (counterpart funds):	1,900,651 (= 38,013,020 baht)
d. Grand total:	$ 4,876,836

7. Mode of implementation:
   a. Project Agreement between USAID/Thailand and Sanitary Engineering Division (SED) of Thai Ministry of Public Health.
   b. AID-financed cost-plus-fee contract ($617,626) between SED and Tippetts-Appett-McCarthy-Stratton engineering firm.
   c. PASA between USAID/Thailand and U.S. Public Health Service.
8. Evaluations
   a. Regular PAR/PES evaluations
   b. Special evaluations
      1) GAO Audit Report No. 69-12 (June 9, 1969)
      2) GAO East Asia Audit Report No. 8-493-73-3 (July 19, 1972).
9. Responsible mission officials during life of project
   a. Mission director: Rey M. Hill, Acting Director, 1969-1972
   b. Project officers: Capt. William McQuary (sanitary engineer on PASA to USAID/Thailand from U.S. Public Health Service, 1965-1968), and John W. Neave, P.E. (direct-hire, sanitary engineering advisor, 1968-end of project)
10. Host Country Exchange Rates
    a. Name of currency: Baht (฿)
    b. Exchange rate at time of project: ฿20 = $1

B. Basic Project Identification Narrative

1. Objectives

The potable water project was part of the Accelerated Rural Development (ARD) program which began in 1964, as a method of winning and holding the loyalty of rural villagers in the parts of Thailand threatened by communist insurgency. The Potable Water Project like other projects in the program, was to demonstrate government concern for the villagers' welfare, to increase economic development, and to strengthen local government institutions.

Specifically, the principal project objectives were the following:

a. to provide piped potable water to one principal community (of over 500 but not more than 10,000 inhabitants) in each of the 473 subdistricts (tambons) in the security-sensitive areas of Northeast Thailand and other selected strategic communities in the North and the South until a total of 600 communities received potable water;

b. to improve the Thai capability to plan, develop, and administer a national program of construction and operation of piped village water systems;[1]

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[1] Each piped water system consists of: (a) a source of water (stream or well); (b) a water treatment plant; (c) a water storage tower; (d) a distribution system (pipes and taps); and (e) pumps to move the water between source, treatment plant, and taps.

c. to provide in-service training for 150 personnel of the Sanitary Engineering Division (SED) of the Thai Ministry of Public Health (MOPH), as well as U.S. Engineering Training for 10 Thai engineers; and

d. to serve as the"spearhead and pilot project" for a much more comprehensive National Potable Water Program aimed at providing piped potable water facilities in 10,000 to 12,000 rural communities in the next 30 years.

2. Implementation

The project was developed in large part by a mission sanitary engineer and the director of the Sanitary Engineering Division.[1] The project agreement was signed by the mission and the Department of Technical and Economic Cooperation (DTEC) of the Royal Thai Government in April, 1966. In August, 1966, SED signed an AID-financed contract with the New York engineering firm of Tippetts-Abbett-McCarthy-Stratton (TAMS) to provide services over the initially outlined three-year project period. The TAMS staff reached a peak of nine American engineers and five Thai staff. The project was initially managed by the mission's Office of Health and Population Planning, then by its Office of Capital Development, and finally transferred to its Office of Field Operations.[2]

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[1]The mission sanitary engineer was William A. McQuary; Somnuek Unakul was the director of SED and SED's director for the Potable Water Project.

[2]Fourteen U.S. Peace Corps volunteers, eight of whom were engineers, also worked on the project.

A field office was established in the Northeast municipality of Khon Kaen and 12 young Thai engineers were recruited to direct operations in the six provinces. Each provincial team included two engineers, three construction technicians and a driver.

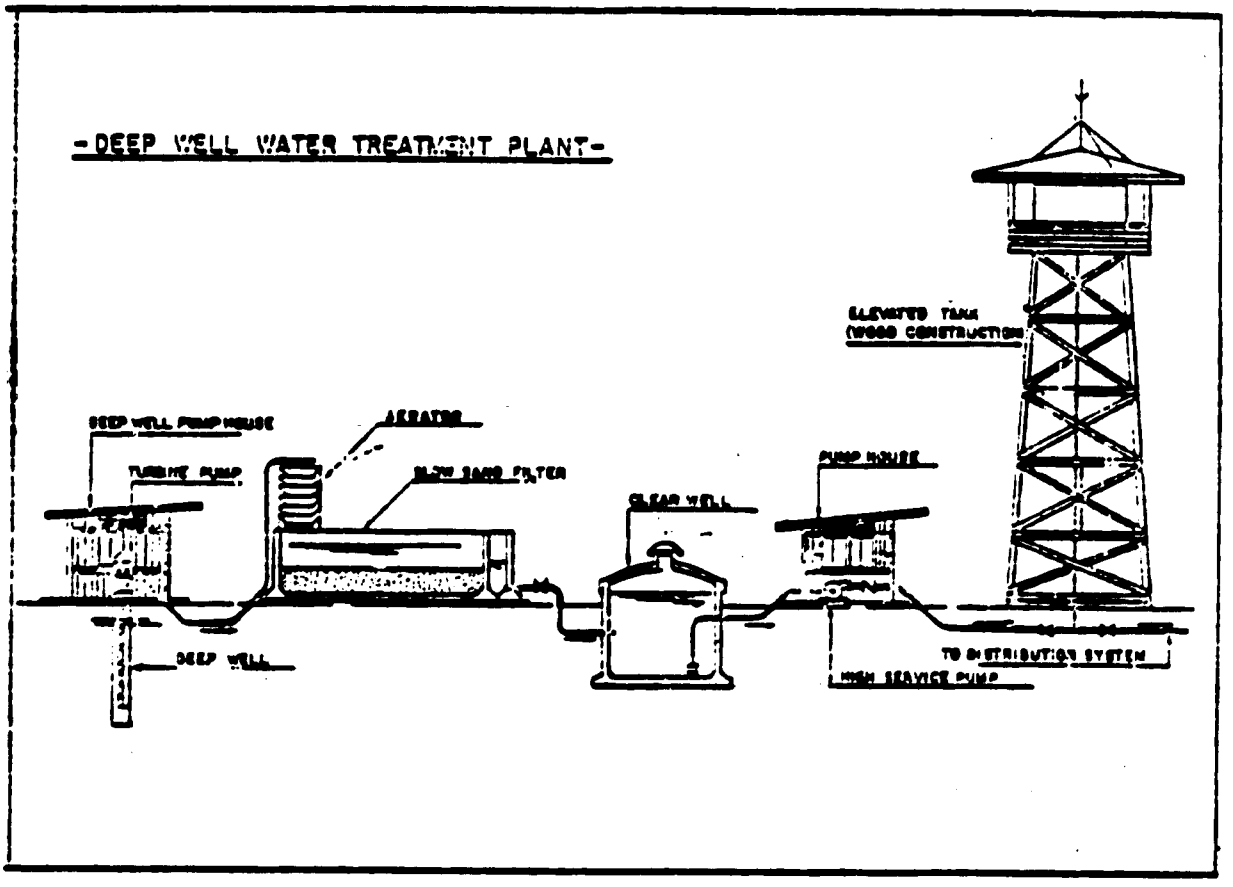
The field office supervised the investigation of proposed sites, prepared system designs and estimates, and addressed provincial authorities on the letting of contracts. The provincial team provided technical supervision and inspection during the construction phase and monitoring and technical assistance during operation.

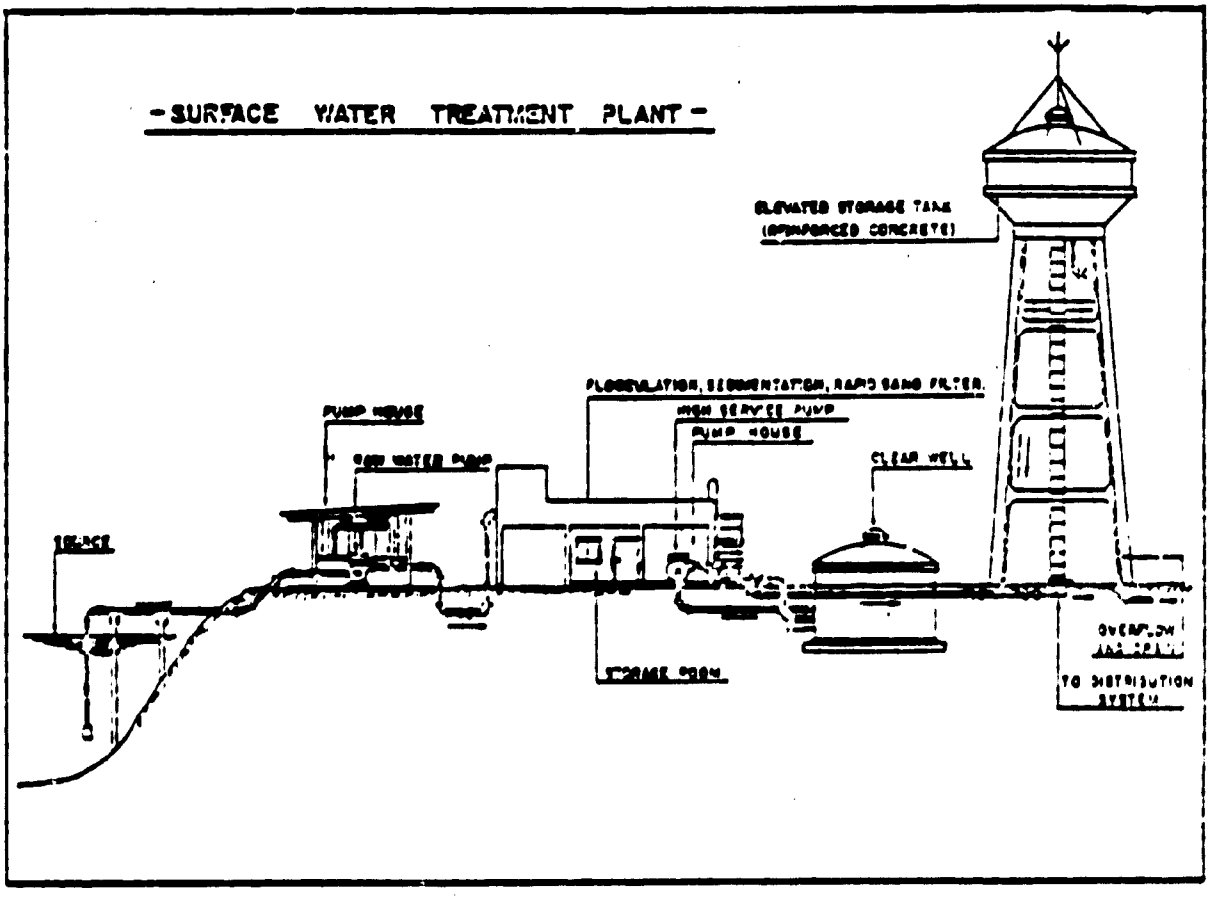
The entire process was simplified by the adoption of standardized designs for the water treatment plants with capacities of 10 to 50 cm/hr (cubic meters per hour) and suited to the various sources and conditions of raw water. All designs included chlorination. (Representative plants are pictured in Plate 1.)

Water systems were installed in two types of communities, villages and sanitary districts (rural market towns), at a ratio that was probably about two to one.[1] Project documents state that

[1] The evaluation team visited 52 systems of which 37 were located in villages and 15 in sanitary districts. Since this was a randomly selected sample it is believed that the 2:1 ratio probably characterized the entire project. The difficulty of establishing specific figures is described in section II below.

Plate 1 6A


-DEEP WELL WATER TREATMENT PLANT-
ELEVATED TANK
(WOOD CONSTRUCTION)
DEEP WELL PUMP HOUSE
AERATOR
TURBINE PUMP
SLOW SAND FILTER
CLEAR WELL
PUMP HOUSE
DEEP WELL
TO DISTRIBUTION SYSTEM
HIGH SERVICE PUMP


-SURFACE WATER TREATMENT PLANT-
ELEVATED STORAGE TANK
(REINFORCED CONCRETE)
FLOCCULATION, SEDIMENTATION, RAPID SAND FILTER
PUMP HOUSE
HIGH SERVICE PUMP
PUMP HOUSE
RAW WATER PUMP
CLEAR WELL
SURFACE
STORAGE POOL
OVERFLOW
AND DRAIN
TO DISTRIBUTION
SYSTEM

"initiative for obtaining a potable water system must start with the villagers themselves."[1] In fact, initiative appears to have come most often from district officials--the district officer, district health officer, or a local public health sanitarian. Villagers interviewed say that these officials held one or more meetings with the village chief and other villagers to discuss the proposed system. In the sanitary districts the district officials met with the sanitary district officials and apparently sometimes, but not always, held a meeting to inform the general public. To become selected to receive a system a village was supposed to:

a. have an existing but not potable source of water;

b. be readily accessible by road;

c. have high interest in obtaining a potable water system as indicated by villagers' willingness to assist in construction; and

d. be willing to develop a rate structure which would pay operation and maintenance costs and provide for future expansion.

The amount of financial contribution or self-help the villagers could provide toward construction

[1]John W. Neave, "In-Depth Report on the Potable Water Project," September 18, 1969, USOM/Thailand, pp. 12-13. (USOM = U.S' Operations Mission, the name used for AID's mission in Thailand.)

(e.g., laying the distribution mains) was a significant factor in the selection. In contrast, in the sanitary districts, which have taxing power, treasury funds were contributed but no public funds raised. Candidates for installation were reviewed by SED and USAID, the mission with the provincial governors' offices formally making the final selection and establishing priorities.[1]

In each selected village, villagers chose one among them to become the plant operator. Prior to completion of construction, these villagers received two weeks' training at one of the project's five potable water centers. Subsequently they were made responsible for proper operation of the system and in most cases for collecting water fees.

When plant construction was completed, the plant and water distribution system were turned over to the local government for operation and maintenance. The local government, in turn, usually delegated authority to the district officer or village chief or, where applicable, to the sanitary district.

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[1]See also Tippetts-Abbett-McCarthy-Stratton, "Community Potable Water Project Final Report, August 1969," pp.VIII-1-3 ("Development of Training Program") and IX-1-4 ("Program Planning and Implementation").

3. Relevant Historical Data

As noted above, the Potable Water Project was part of the Accelerated Rural Development Program. It has also been regarded as part of the mission's public health support program. Scattered efforts to improve sanitary conditions in Thai villages had been made during the 1950s. As the incidence of malaria declined in the late 50s, gastro-enteric and diarrheal diseases became identified as the greatest health problem in rural Thailand. It was estimated that over 90 percent of the rural population was infected by water-borne intestinal parasites. Approximately 60 to 80 percent of all illness and 40 percent of all deaths were believed attributable to water-borne diseases such as cholera, typhoid, and dysentaries.[1]

In 1960, therefore, AID launched a major initiative, the Village Health and Sanitation Project. Its objectives were to provide at least one source of safe water in each village, to provide a sanitary privy for each household, to improve premise sanitation, to promote health education, to provide training for a corps of

[1] See Neave, op. cit., p. 5, and John E. Kennedy, M.D., "A Brief History of USOM Support to Public Health Programs in Thailand," October, 1969, USOM/Thailand.

of environmental sanitation personnel, and to carry out research related to sanitation programming. Thai health and sanitation officials asked by the evaluation team about the significance of AID's support to Thailand's very successful village sanitation program say they could have implemented it alone, but much more slowly. "It was because of AID's help," they assert, "that village sanitation flared up rapidly all around the country."

USAID responsibility for the VHS project initially rested with the Public Health Division. In 1963, it was shifted to the newly created Office of Rural Affairs, the rationale being that mission efforts in rural sanitation would be better coordinated with support to other area development activities, particularly in the Northeast.

Shortly thereafter, emphasis in the VHS project shifted from "aided self-help" towards direct government execution of projects, and the mission began to focus more on public works engineering activities. The mission's health staff was curtailed as part of the general phase-down of U.S. technical assistance in Thailand. AID support to the VHS project ended in 1965.

By the end of that year, the VHS project had installed 5,000 sanitary wells and 220,000 sanitary privies, constructed 61 village water systems in the Northeast and the South, started village health committees and VHS self-help activities in 6,000 villages, conducted 48 provincial workshops of two weeks each for 1,187 rural sanitation personnel, given orientation in village sanitation to 542 other officials, and established two training centers capable of training 50 additional junior sanitarians per year.[1]

Numerous problems were nevertheless recognized. Health education lagged behind physical improvements and the fundamental outlook and understanding of the villagers reportedly remained unchanged. It became virtually impossible for the government to repair the numerous well pumps, and villagers were neither instructed in repair, nor did they have tools to carry it out. The VHS was not integrated with the provincial health organization and administration; logistics, and supervision were therefore autonomous, producing a schism within the rural health service system.

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[1] Kennedy, op. cit.

The need for safe water in Thailand had been dramatized by the cholera epidemic of 1958-59. AID assisted an Energency Water Supply Program in 1959, which increased the supply of piped water in Bangkok and Thonburi by one-third. In 1961, the Thai government requested the help of a U.S. consultant in drawing up a preliminary 15-year plan for developing piped water systems in 412 communities of rural Thailand. The Potable Water Project is an outgrowth of this initial request.

In 1966 the mission renewed its support in rural health as part of a generally increased concern for the well-being of villagers and the effectiveness of governmental presence in the Northeast where insurgency was spreading. Many elements of the village health and sanitation program were incorporated into a new Comprehensive Rural Health Project. In 1966, the Ministry of Public Health lost most of its budget for village wells when this allocation was transferred to the Ministry of Interior. It was at this time that the MOPH and AID began the Potable Water Project.

Responsibility for USAID assistance to the Potable Water Project was placed in the Capital

Projects Division, however, and later, in 1969, shifted to the Office of Field Operations. There was considerable controversy in 1966 regarding the project's suitability for the rural Northeast. The financial ability of smaller towns to support rather sophisticated water treatment plants with piped water systems was questioned. Because most northeast villages had less than 1,000 people, finding suitable sites promised to be difficult. The alternative of broadening AID support to include municipalities and district towns outside the politically dissident areas, however, was rejected as not compatible with U.S. assistance policy to Thailand. The final decision was that AID support would focus on sensitive areas but that the project scope would be reduced to include only sites where the population was sufficiently concentrated to make financial self-sufficiency in operating the systems a reasonable possibility.

Advocates of appropriate technology in water supply would still criticize this project on the grounds of its relative sophistication arguing that simpler technologies (e.g., hand pumps) should have been installed instead. At the time of project

development, however, hand pump installations had not been successful in Thailand. For example, from June, 1958, to September, 1964, 1155 wells were drilled in Northeast Thailand by the Mineral Resources Department (MRD) of the Ministry of National Development. Of these, 765 were provided with hand pumps. By 1966, it was estimated that 23 percent of the 1155 had been abandoned. The program had suffered greatly because there was no follow-up maintenance. Villagers had been left to repair the hand pumps when they broke down but many were unable or did not attempt to do so. No really reliable statistics are available, but 1966 estimates indicated that 50 percent of hand- and power-operated pumps installed were broken and not repaired.[1] The evaluation team found several wells where AID hand pumps had been installed but none where they remained. The cost of MRD wells, based on estimated numbers of users is extremely high--appraised as approximately US $100 per capita. Under the Potable Water Project, in contrast, development of surface water sources with complete treatment and

[1]Neave, op. cit., pp. 6-7.

including basic distribution piping is less than US $10 per capita.[1]

II. VERIFICATION OF EXISTENCE

The Potable Water Project was originally designed to (1) build 250 piped systems reaching 600 villages with a combined total population of 600,000 to 1,000,000 by 1971, and (2) help the MOPH's Sanitary Engineering Division develop the capacity to plan, design, construct, and maintain a network of potable water systems.

It is difficult to determine accurately the total number of systems built with AID funding. By 1972 when the project formally terminated, a total of 342 rural water systems had been installed. Of these, the 153 systems that were in operation, under construction, or approved for the 1969 construction program were all or partially AID-funded. These plants were designed to serve 363 communities with over 400,000 residents when completed. An additional 98 systems were completed during the following two-year period and many but not all of these were AID-funded. There were also a number of systems at least partially funded by AID still in various stages of design or construction at the time of project termination. In addition, over $600,000 of AID-financed project commodities had not yet been installed by the

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[1] Neave, loc. cit.

end of the project. These consisted of diesel engines, water pumps with electric motors, and water pumps with gasoline engines.[1] It may thus be roughly estimated that of the 342 systems, perhaps three quarters were built under the AID project. The remaining one quarter under the Thai National Potable Water Project nevertheless all benefitted from AID standard designs, commodities, or trained personnel.

The Sanitary Engineering Division did develop the capacity to plan, design and construct a network of potable water projects. From project termination to 1979 approximately 400 systems were completed. There are currently 572 piped water systems in rural areas (settlements of less than 5,000 population) and an additional 191 systems serving communities of over 5,000 population. Most of these were designed and constructed under the direction of the Rural Water Supply Division which was established within the MOPH's Sanitary Engineering Division.

These systems have been the subject of a number of evaluations. A 1969 survey by the U.S. Auditor General found 74 percent of the plants in operation.[2] The 1972 GAO terminal audit report indicated less than 25 percent

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[1]Twelve diesel engines are still unused. The Rural Water Supply Division is gradually using the balance of surplus commodities as needed.

[2]GAO Audit Report 69-12, June 9, 1969.

operating well, another 25 percent with limited operation, and 50 percent not operating.[1] Consulting engineer Richard Frankel, in a 1972-73 evaluation of 165 AID-funded systems in the Northeast, found that the average system was out of service approximately once every two months for an average period of nearly three weeks because of mechanical failure.[2] Thus at the end of the funding period previous evaluations had concluded that the capacity to maintain the systems was a major deficiency in the project. The present evaluation has reached a quite different conclusion as discussed in Section III.

Where systems have not been functioning, however, the reason appears in nearly all cases to have been due to management rather than technical problems per se. The project had not anticipated, or not adequately anticipated, management aspects of maintaining and financing systems operations. There was technical training for operators but not management trainin for village chiefs or any other village leaders. It is rather amusing that AID's engineering contractor (TAMS) detailed 25 specific steps leading to plant completion

[1]GAO Audit Report 8-493-73-3, July 19, 1972.

[2]Richard J. Frankel, "Systems Evaluation of Village Water Supply and Treatment in Thailand," Water Resources Research, Vol. 2, No. 3, June, 1975.

and then made a flying leap to a 26th step, "Villagers drinking the treated water?" (See Appendix G.)

Users of the operating systems regard them with esteem. This is especially indicated by their willingness in many communities to make high initial investment for private connections as well as the continuing monthly charges. All users praise the systems for the great convenience they provide. (See Table: Percent Systems with Metered Connections.)

III. PROJECT EFFECTIVENESS

Most piped water systems built under the Potable Water Project are continuing to function more than ten years after the first systems were installed. This is contrary to the expectations one would develop based on the earlier evaluations which indicated that as many as half the systems were not functioning at all or were of limited use because of inability to maintain the technology or unwillingness of villagers to pay for the water.[1] Of the total 52 systems visited, only 7 were not functioning.[2]

The provincial government agencies ("P.A.O.s"), sanitary districts, and village committees each manage their respective systems and generally provide necessary fiscal and operational management. Up until this year

[1] GAO Audit Report No. B-493-[illegible]-3 (July 19, 1972) and Frankel, op. cit.

[2] The seven non-functioning systems were all located in only three provinces--Nakom Phanom (three), Nong Kai (two), and Chiang Rai (two).

the Rural Water Supply Section of the MOPH's Sanitary Engineering Division has continued to train the community operators and to support and supervise them and their systems. With very few exceptions, the operators are qualified, competent, and motivated. Most were initially trained for two weeks and have received refresher training and important support and supervision, usually on a monthly basis from Rural Water Section personnel. Of all the operators of the 45 working systems visited nearly half are still serving as operators today. This is especially significant since many worked on a volunteer basis for about the first five years and today receive only the lowest level of civil service pay.

The fact that rural water programs have been administered by a multiplicity of Thai governmental agencies has been somewhat problematic.[1] The Thai government has, therefore, recently established a single coordinating body with wide powers--the Provincial Water Authority (PWA)--which over the next three years will gradually assume responsibility for all piped water systems outside municipal Bangkok.[2]

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[1] Active in water resources development have been at least three departments of the Ministry of National Development, four departments of the Ministry of Interior, the Ministry of Public Health and the Office of the Prime Minister (Neave, op. cit Appendix D).

[2] Of the 52 systems evaluated, 20 are now run by provincial governments (PAOs), 16 by sanitary districts, 15 by village committees, and a single large plant by the Provincial Water Authority.

This may be both advantageous and disadvantageous with regard to the effectiveness of the piped water systems. On the one hand, the fact that the central government has created such an authority, and is encouraging it to play an assertive role in providing safer water to all Thailand during the United Nations Drinking Water and Sanitation Decade, appears indicative of high level commitment that should assure even greater fiscal continuity than has prevailed until now. On the other hand, the effectiveness of the rural piped water systems has been in great part due to the continued high quality support and supervision provided by the MOPH's Rural Water Supply Section, especially through its monthly visits. The PWA, however, does not have the resources to provide the same level of support. Thus without continued supervision the effectiveness of the systems may, in fact, be comprimised.[1]

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[1]There is already evidence that operating standards have deteriorated since the Rural Water Supply Section began discontinuing monthly supervisory visits. In one system a small submersible pump has been installed to pump water into the distribution system prior to filtration. When asked why this was done the plant operator indicated that he needed additional capacity because the filters were too slow. (An alternative would be to backwash the filters.) When asked if the Rural Water Supply Section had approved this he stated that the practice had started only last month after the final visit of the Rural Water Supply Supervisor.

A. Financing

Most systems are completely self-sufficient financially with users paying full costs of maintenance and operation through fees collected for water delivered. Of the 45 operating systems evaluated it was possible to obtain fiscal data from 1978 on 35. Thirty-one of these were operating at a profit while 4 were operating at a loss and had to be subsidized by general revenues.[1] The situation in 1979 has changed. In the past year more meters have been added and at least one of the systems previously operating at a loss is now profitable. All systems, however--whether self-sufficient or not--are being supported by general revenues if not by specific fees for water used. Water costs vary from two to five baht per cubic meter, with most systems charging three baht. This is higher than is currently charged in Bangkok but it is acceptable to users of the systems.

B. Per Capita Costs

The 52 systems serve nearly 110,000 people.[2] Their cost when built was 19,240,000 baht. The cost

[1] "List of Rural Water Systems, 2509-2521 (1966-1978)," Rural Water Supply Section, Ministry of Public Health, Bangkok, 1978.

[2] Op. cit.

of service per person is approximately 175 baht. In addition to the original capital costs of the systems, some 9,600 metered private connections have been installed in the 52 systems. These are paid for by the individual users at an average cost of 30 baht per capita. Community contributions were 3,744,000 baht. This is an average of 34 baht per capita presently served. Each user has, therefore, an average investment of 64 baht while the capital cost is 141 baht for the plant and distribution network.

Other costs not included are the U.S. contractor's costs (approximately 10 baht per capita), Ministry of Public Health administrative costs (estimated at 20 baht per capita), and direct USAID advisory costs (4 baht per capita).[1] Total costs of supplying water for the sample of villages evaluated is thus 239 baht per capita for persons actually served by the 52 systems. (Table 1).

According to AID's U.S. contractors in 1969 the average overall cost of supplying potable water to villagers was $6.80 per capita served. Local

[1] Tippetts-Abbett-McCarthy-Stratton op.cit., p. XII-2.

Table 1: Costs of Service for Systems Evaluated*

		Baht Per Capita	Per Capita US
Total Cost:	19,240,000 baht	175	8.75
Community Contribution:	3,744,000 baht	34	1.70
Cost of Private Connections:	3,348,800 baht	30.4	1.52

*A total population of 110,000 were served; there were 9,568 private connections.

contributions were reported to have averaged $1.70 per capita and SED subsidies $5.10 per capita. This figure did not include the TAMS contract cost ($0.50 per capita), SED administrative costs (estimated at $1.00 per capita), or direct USAID advisory costs ($0.20 per capita). Adding these costs, the total overall cost of supplying potable water to villagers was calculated as $8.50 per capita as of 1969. In comparison, capital improvement costs for water works extensions in the U.S. during the project period were between $30 to $40 per capita.[1]

[1]Neave, op.cit., p. 21.

IV. DEVELOPMENT IMPACT

A. Health Impact--The Intended Consequence

> Drinking shallow well water is like using heroin. Once you do it as a young boy you become addicted for life.
>
> It is okay to drink chlorinated water, just as long as you boil it first.

These statements were the responses of villagers in the Northeast when asked about their preferrad source of water for drinking. These responses are significant because they illustrate the somewhat ironic fact that villagers do not automatically drink the water provided by the Potable Water Project. Project goals had focused on improving health status through provision of potable water which is chlorinated in 37 out of the 45 operating systems visited. The assumption was that villagers, once provided with potable water, would of course drink it.[1] This did not always happen.

In 3 of the 45 operating systems evaluated no one drinks the piped water. In 11 systems some of the population drink the piped water; in general, the younger community members drink the piped water all year while older people drink piped water only during the dry season. Most of the population in villages

[1] See Appendix G.

served by the remaining 31 operating systems do drink the water although some members of most communities use alternative traditional sources such as rain water or water from shallow wells. The evaluation team tried to gather health statistics that could demonstrate health impacts of the project. Such statistics do not exist. No baseline data was ever gathered either prior to or during implementation for the purpose of measuring impact. A report by the AID project director stated the following:

> The Potable Water Project has not included provision for measuring impact on the villages receiving potable water systems that might later be converted to a cost-benefit ratio, nor even any provision for measuring health benefits accruing to the villagers affected. This would require an economic analysis of the village and reasonable accurate health statistics prior to a village actually getting a potable water system. This has not been done nor contemplated. If it were, a follow-up study five to ten years after a potable water system has been provided would give an accurate analysis of benefits valuable to other Thai agencies and governments all over the world. There are some alternatives, however. Almost every village that has received a potable water system has a second or third class health center with general records of visits, frequency of visits, diagnosis and treatment. Records of births, deaths and infant mortality rates are also kept. With this information to start with, perhaps a trend towards better village health could be established, although it would not provide the accurate picture that statistics developed primarily for measuring potable water supply provision impact would give. [1]

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[1] Neave, op.cit.

Contrary to the above statement regarding village health records, however, health statistics do not exist on a village-by-village basis from which judgments about impact can be made. Neither village, district, nor provincial health personnel were able to provide the evaluation team with figures on disease incidence by year for even the recent years. Some rural facilities said they had begun keeping such records only in 1979. Others indicated that they have been keeping records but that the number of diarrhea cases noted is greater than before because their surveillance and reporting methods are improving. At the national level, health statistics were said to be poorer than those of other ministries. Nevertheless, villagers served by the piped systems--and especially those with private connections--now have access to an abundance of water piped directly to the home. This increased quantity of water has resulted in sanitary practices that villagers report have had beneficial health impacts, including decreased skin disease and diarrhea. Sanitary practices facilitated by the greater availability of water

include bathing, washing of clothes, washing of utensils, washing of food before consumption, and improved infant and child care.

The availability of piped water also seems to encourage the use of water-sealed privies. In villages served by 10 of the 45 operating systems all villagers have or use neighbors' water-sealed privies. Eighty to 95 percent of the population in villages served by another 2 of the 45 systems use water-sealed privies. In the case of only 4 of the 45 systems do less than half the population of the villages served use this method of excreta disposal.

B. Economic Impact

Of the 45 operating systems visited, 15 serve primarily the business community of small market towns. The majority of systems, however, serve either all or a portion of village households. Both the business communities and the villagers have benefitted from the project but because of AID's present policies it is this latter group that was the focus on the evaluation concerning impact.

What is significant with regard to economic change for these villagers is the quantity of water that is delivered, directly and reliably to the home.

This convenience results in considerable time-saving and increase in water use per household. Villagers were asked what the effects of this has been. Most respondents gave as their first answer more gardening and farming. The second most common first answer was crafts activities. "Convenience" and better health were the third and fourth most frequent first answers. Villagers responses to this question are given in Table 2.

Table 2: Effects of the Piped Water System on the Community

Effect	Number of Times Mentioned		
	First	Second	Third
More Gardening and Farming	21	3	
More Crafts	4	2	
Increased Convenience	4	1	1
Better Health	3		
Increased Income	3		
Raise More Animals	2	6	3
More Outside Jobs	1	1	
More Fishing	1	1	

It is noteworthy that respondents in three communities saw the piped water supply as an insurance against loss of income during drought. In times of crop failure in the non-irrigated areas of the north-east, many male heads of the household migrate to Bangkok for wage labor until the next planting season.

According to villagers interviewed, the minor irrigation of high value crops, such as garlic and onions, as well as the increased amounts of animals raised has provided greater protection and enabled more men to remain home rather than migrate temporarily.

Originally most of the systems provided community-wide access to the water through public taps. Under this condition virtually socio-economic groups benefitted more or less equally. The schedule for collecting revenue from the public taps was in most communities, a flat fee per household or person. Most communities failed, however, to pay the full fees. As a result, systems almost universally changed to metered private connections and most systems closed all public taps. Each private metered connection costs between 300 and 450 baht for installation and an average of 3 baht for each cubic meter of water used, a rate higher than is currently paid in Bangkok. Conversion from public to private taps meant that some villagers originally served by the potable water project are no longer served; these are generally the poorer villagers.

Some systems, however, still retain some public taps and formal or informal meter sharing does take

place. Evaluation findings indicated that approximately half the systems are serving between 90 and 100 percent of all residents. (See Table 3.)

Table 3: Percentage of Community Served by Piped Water System

Percentage of Systems	Percentage of Community Served
50	90-100
30	50-89
20	less than 50

C. Social Impact

The piped water system itself is one of the social services that AID has assisted in providing to Thai people. It is virtually impossible to disaggregate the effects of this project from the whole of the Accelerated Rural Development Program of which it was part. Insurgency has apparently declined in the Northern regions where the program concentrated and it appears that people of these regions consider themselves more a part of Thai society than before. The Potable Water Project reinforced participation in village-level organization--specifically, in the village committees that were initiated under the earlier Village Health and Sanitation Project.

The piped water systems were originally built to provide piped water to entire communities through the use of public taps. As noted above, there has been an almost universal change from predominantly public taps to metered private connections. In view of AID's present mandate to serve the "poorest of the poor," many of the systems would not now be considered socially sound according to criteria of equity. Nevertheless, in over half of the communities with piped water visited, approximately 90 percent of households are served through a combination of meter sharing and a few public standpipes.

For the reasons stated in the above section on economic impact, all socioeconomic groups were originally affected. Recent measures to establish greater financial viability have, however, excluded villagers unable to pay for the services. Communities served by the project are almost 100 percent Thai and thus no significant changes have taken place with regard to minorities.

Women and children are the main bearers of water in Thailand. In those households now served by piped water women and children now have extra time which is generally used for activities--such as weaving and gardening--that either generate income or raise the household subsistence level. These activities are regarded as less menial than water-bearing--"Women prefer raising vegetables and weaving", it was said, "because it is not so boring and it lets them use their brains".

D. Environmental Impact

The provision of domestic water supply has facilitated a more hygienic household environment, encouraged the use of water-sealed privies, and provided the opportunity for more household gardens. No negative impacts were apparent.

V. SPREAD AND REPLICABILITY

The concept of piped water systems in rural villages has been adopted by the Thai government and used throughout the country. Under the AID-supported Potable Water Project about 250 systems were installed. Since then, Thailand's National Potable Water Program, which was spurred by the AID project, has brought this number to nearly 800, a large proportion of which have been built according to the AID contractor's basic designs.

Originally the piped water systems were designed to serve the entire community through provision of public taps. In an effort to make the systems financially sound the managers of most systems eliminated public taps and shifted to supplying water via metered private connections. This reduced the number of persons in the community who were served. Since the public taps were closed the number of metered connections has continued to increase, however. Almost all systems evaluated report annual increases in the number of meters and in the amount of water delivered. In addition many systems are extending distribution networks to areas previously unserved.

It is estimated that 17 percent of the rural population of Thailand is served by piped water systems providing for the most part treated chlorinated water.

VI. FACTORS RESPONSIBLE FOR RESULTS

A. Positive Factors

AID's previous project acitvity in rural Thailand in general and in particular its support to village health water and sanitation has been a major contributor to this project's achievements. (See Section I above.) The participant training in U.S. institutions given to Thais under this and the earlier projects provided an important cadre of highly motivated well-trained professionals eager to work with AID and committed to improving health and the quality of life in rural Thailand. The present evaluation was assisted throughout by Thai graduates of U.S. degree programs. Conversation over tea one morning in a provincial outpost north of Bangkok found eight U.S. universities represented by Thais present. They noted that of Thais sent to the U.S. for training in the various fields of sanitation 100 percent have returned.

A factor of equal magnitude and consequence has been community participation and commitment. Individual systems for which communities contributed substantial amounts of money and labor generally succeeded whereas those for which contributions were only

minimal, or were made on their behalf by government bodies, tended to fail or to meet needs of only the community elite--even while part of the same project.

Other positive factors have, for most systems, included:

*the continuity of operators over time;

*the quality and regularity of supervision and support;

*the existence of a hierarch of district, provincial, and regional health, sanitation, and local government offices with good communication networks from whom rural operators can secure advice, assistance, and equipment;

*the existence of regional field headquarters established for systems design, personnel training, water testing, and warehousing of commodities; and

*the fact that systems were installed only in communities that committed themselves to a substantial financial contribution.

B. Negative Factors

1. The U.S.-furnished Onan engines proved to be a disaster. They broke down and spare parts were difficult to obtain. Many have since been replaced by Japanese or British engines.

2. Failure to design a maintenance component until too late in project implementation resulted in non-functioning and inferior performance of systems

that were essentially technically sound. This need should have been anticipated.

3. In the more urban communities systems were frequently superimposed by external authorities as a result of which community elites captured the benefits of the system to the virtual exclusion of the larger community.

VII. LESSONS LEARNED

A. General Lessons

1. Participation. In the communities where this project succeeded in serving a large portion of the public, there was genuine community commitment and participation. Those who participate benefit. Where participation is restricted to elites, only elites benefit.

2. Incremental Steps. Few would argue that the most desirable water system is one that can deliver water continuously to each household in a community. An AID workshop held prior to this evaluation concluded that rural water supply projects are more likely to succeed when the technology chosen represents an incremental improvement over the existing level and can offer the prospect of further step-by-step progress.[1]

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[1] Report of AID Workshop on Rural Potable Water Supply, November 16-17, 1978 (See Appendix I).

Traditional water resources in rural Thailand are: rain water collected from roofs; water from open shallow wells; surface water from rivers, ponds, and reservoirs; and water from deep wells with pumps. Rain water is collected and available domestically and other water sources are usually not distant. Any system which would offer an incremental improvement would need to displace a present source and be perceived as offering better quality, greater quantity, or more convenience. Hand pumps for shallow wells do not seem to be perceived as enough improvement to warrant the effort to keep them functioning.

3. Training. Those responsible for the operation of the project must be adequately trained. Training cannot be a one-time event. Levels of performance after training must be monitored.

4. Supervision and Institutional Support. The functioning of all systems must be supervised at all levels. Supervisors should be equally prepared to praise good performance as to correct inadequate performance. Supervision must be regular and frequent. Supervisory

institutions must be able to provide advice on all necessary matters.

The Rural Water Supply Section of the Ministry of Public Health has been an extremely effective organization and is, in the team's opinion, responsible for the improvement of the systems that has occurred since previous evaluations. The Rural Water Supply Section no longer has this responsibility. Those interested in the continued functioning of these systems should monitor the effectiveness of the systems closely during the transition to management by the Provincial Water Authority.

5. Commodities. U.S. commodities furnished should be equal to or better than their equivalents manufactured in other countries; otherwise AID should allow purchase of foreign commodities.

B. Specific Lessons Regarding Water Projects

1. Convenience. Water systems provided by AID should always be more convenient than those already in use. Likelihood of acceptability is otherwise low.

2. Quantity. Abundance of water should be recognized as a major factor contributing to improved health.

3. Health Impact. While it is difficult to prove health impact, it will be impossible to do so unless data for local communities are systematically gathered on a village-specific basis.

4. Financing and Equity. If AID desires to install piped water supplies in rural communities with the intent of serving the poor, it must ensure that the systems are financially viable. Evidence from the Potable Water Project clearly shows that it was not possible to meet operating costs by collecting revenues from public facilities. Metered individual connections do provide the necessary fiscal stability, but they generally exclude the poorest community members. Provision of service to the entire community by means of universal metering should be encouraged. To make water affordable by the poor, this should be coupled with an increasing block

rate tarriff schedule. Such a schedule provides the first units of water at low prices and increasing costs per unit for increased volume delivered. The poor of the community would thus receive service at low prices while those who wanted and used larger amounts would pay the major part of the costs.

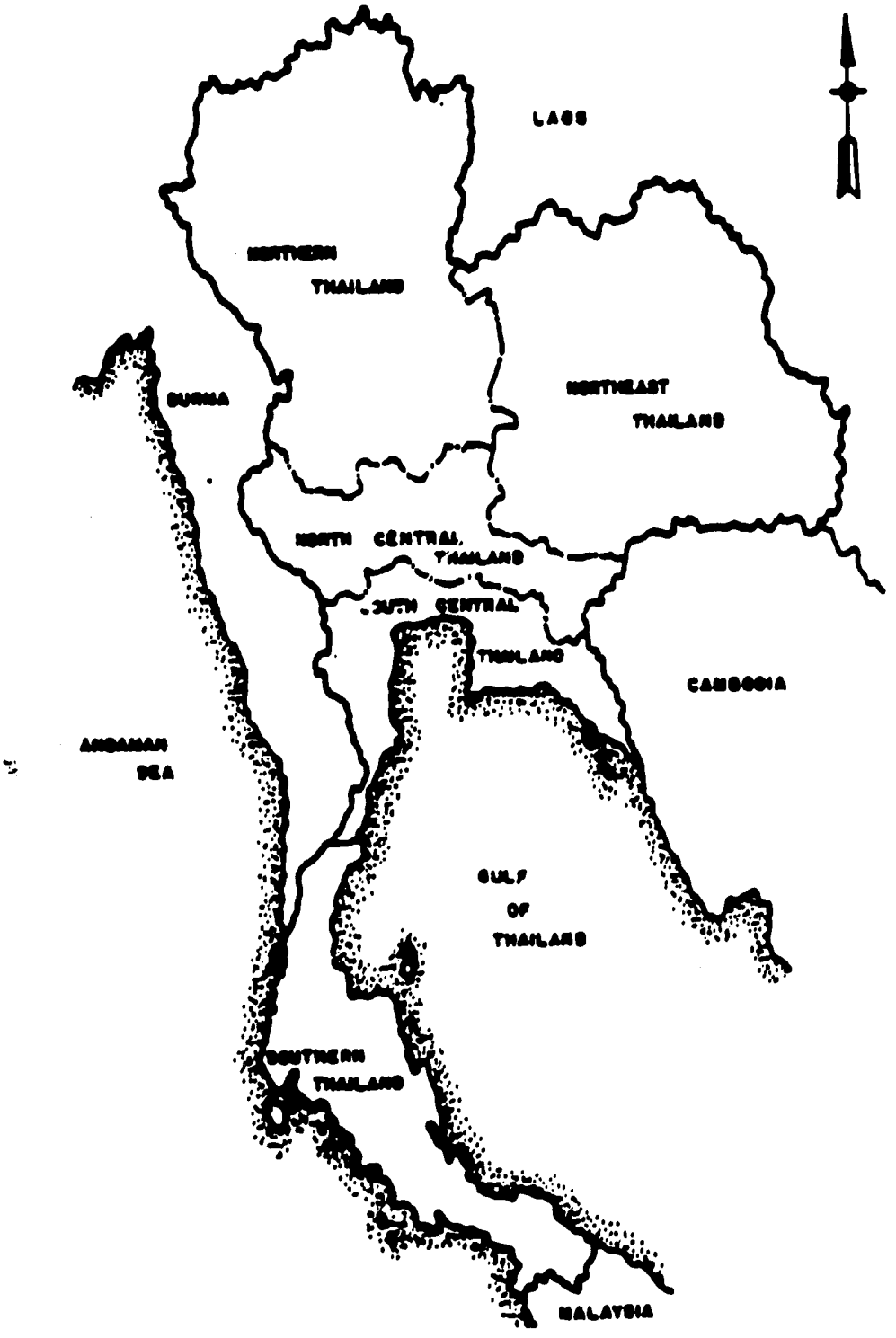
Credit programs permitting poorer community members to partially defer payment for meter installation should also be considered as should metered water sharing schemes.

7. Regional Variation. Diversity of culture and administrative capabilities must be taken into account in project design and evaluation of impact.

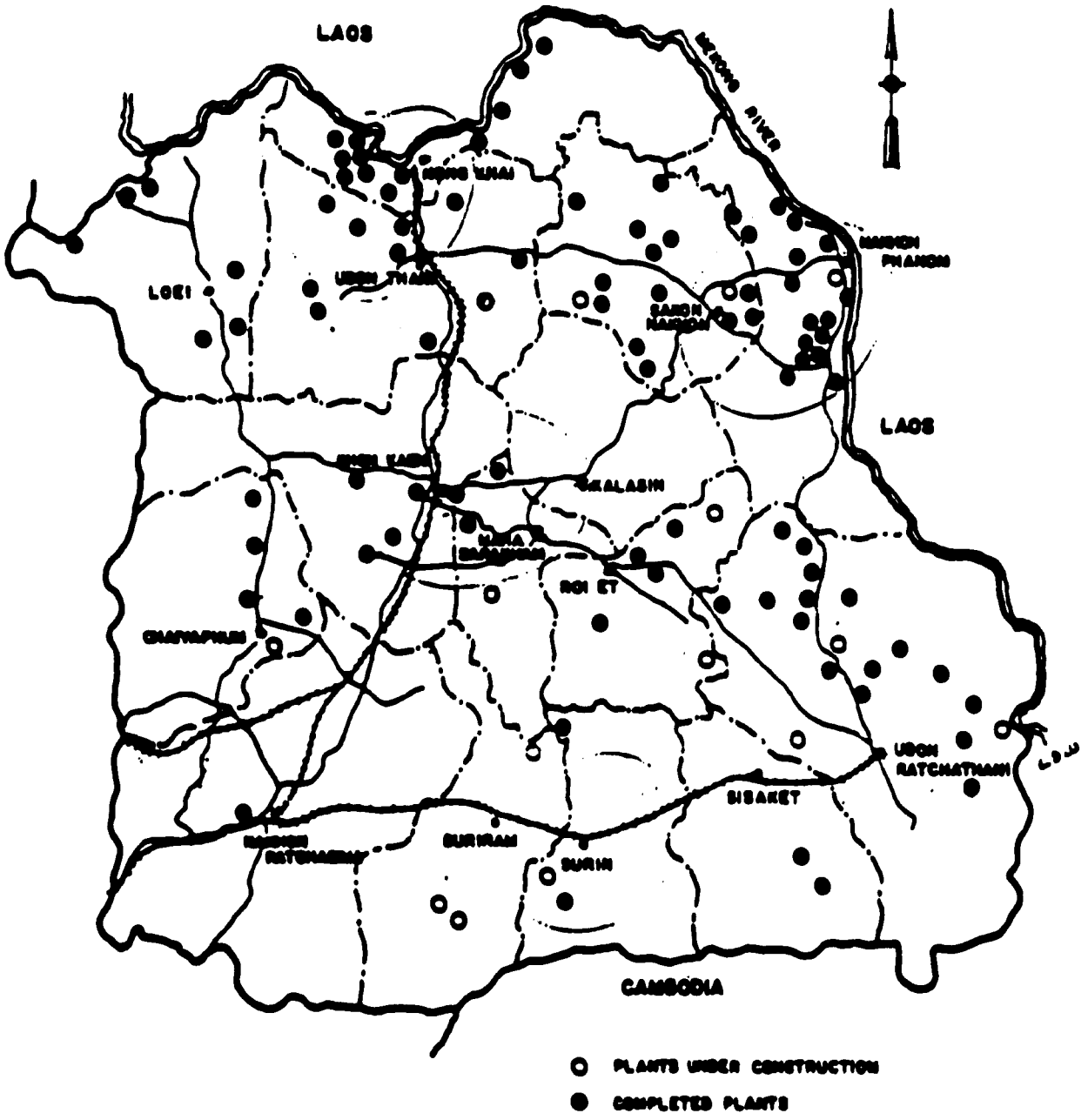
8. Institutional Memory. The Thailand mission has not followed standard AID procedures of retiring documents after five years. Instead many useful documents have been selectively placed in the mission's library. This is of great benefit for evaluations such as the present.

Appendix A

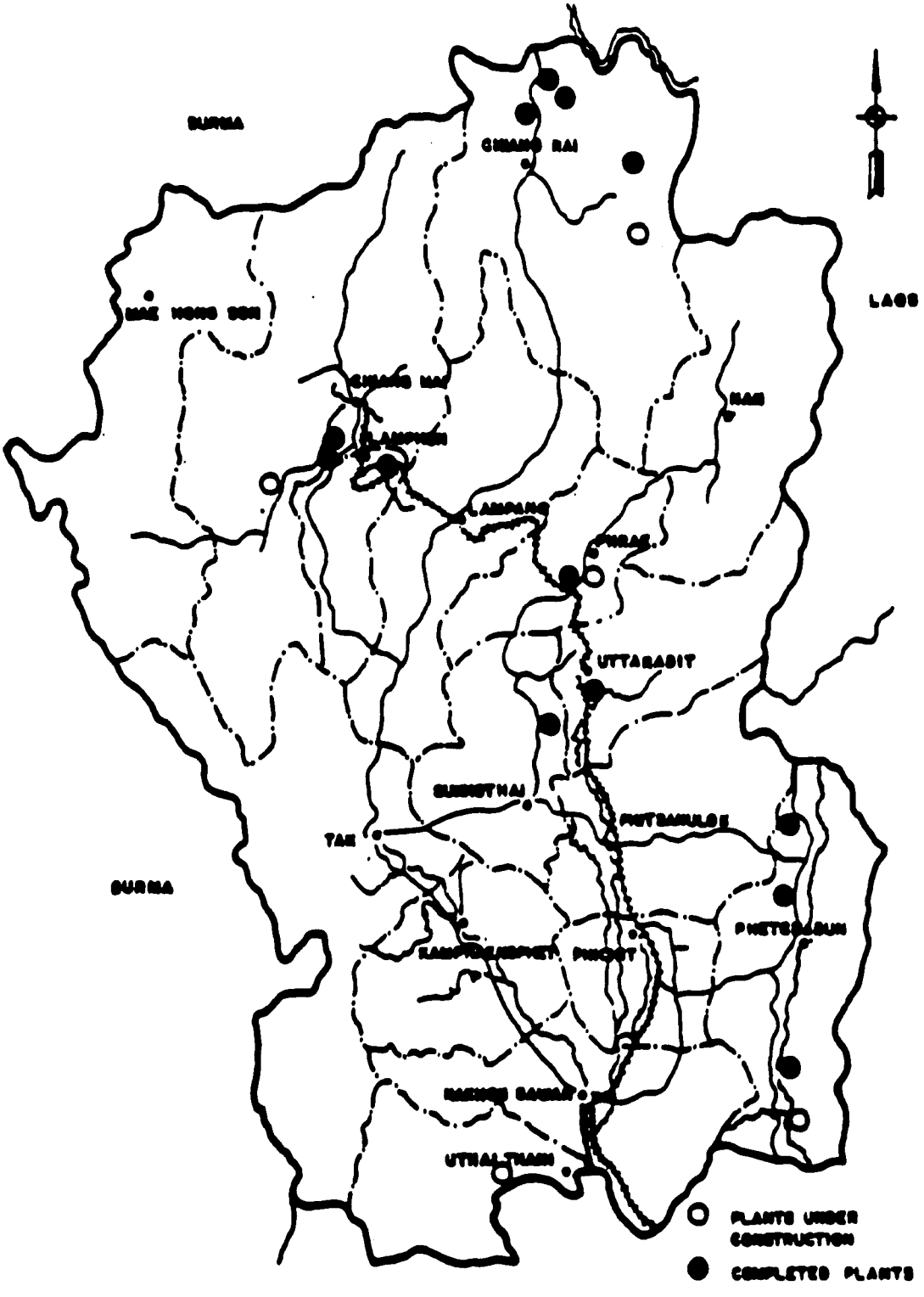
MAPS



MAP OF THAILAND



MAP OF NORTHEAST THAILAND



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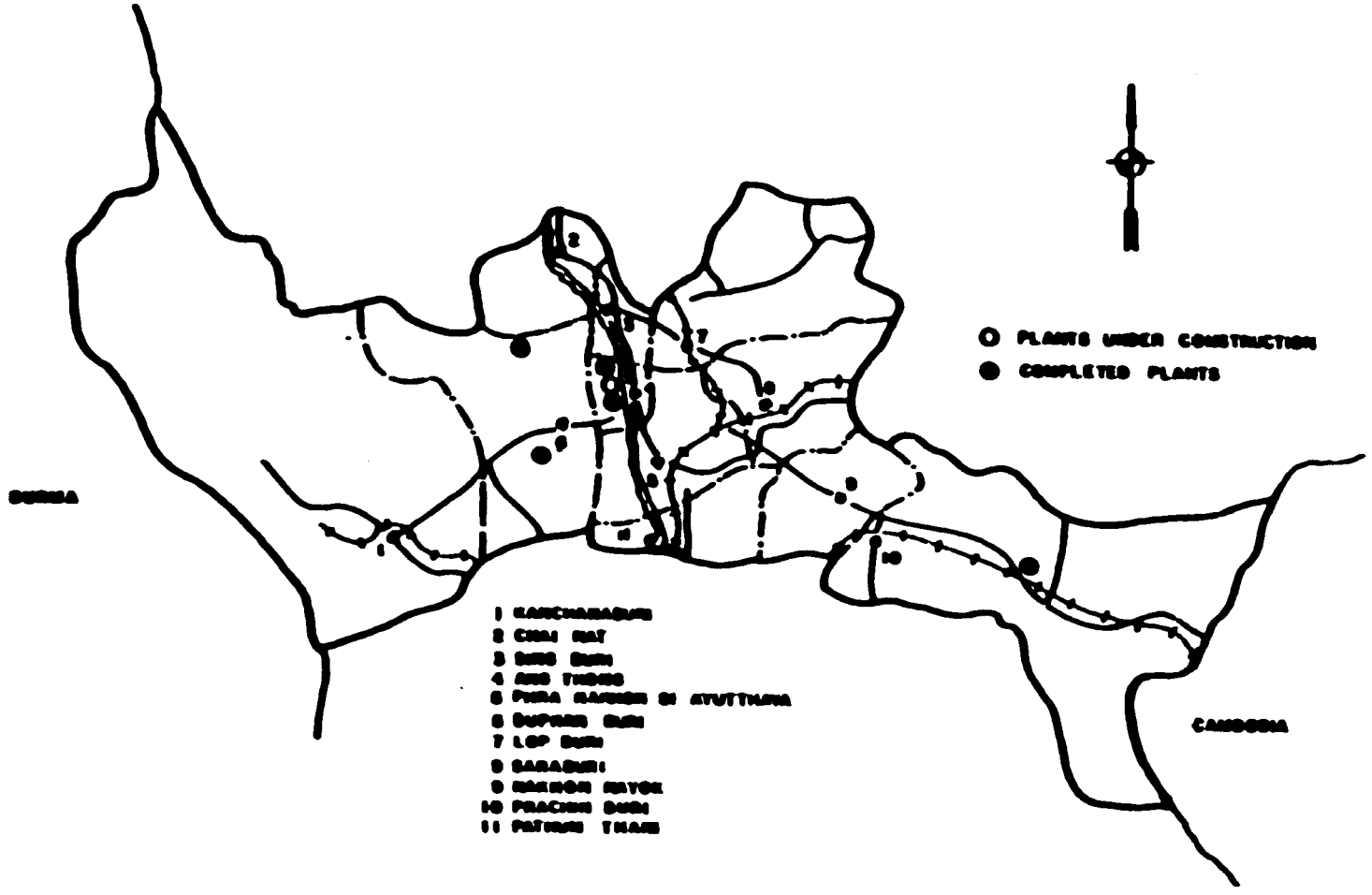

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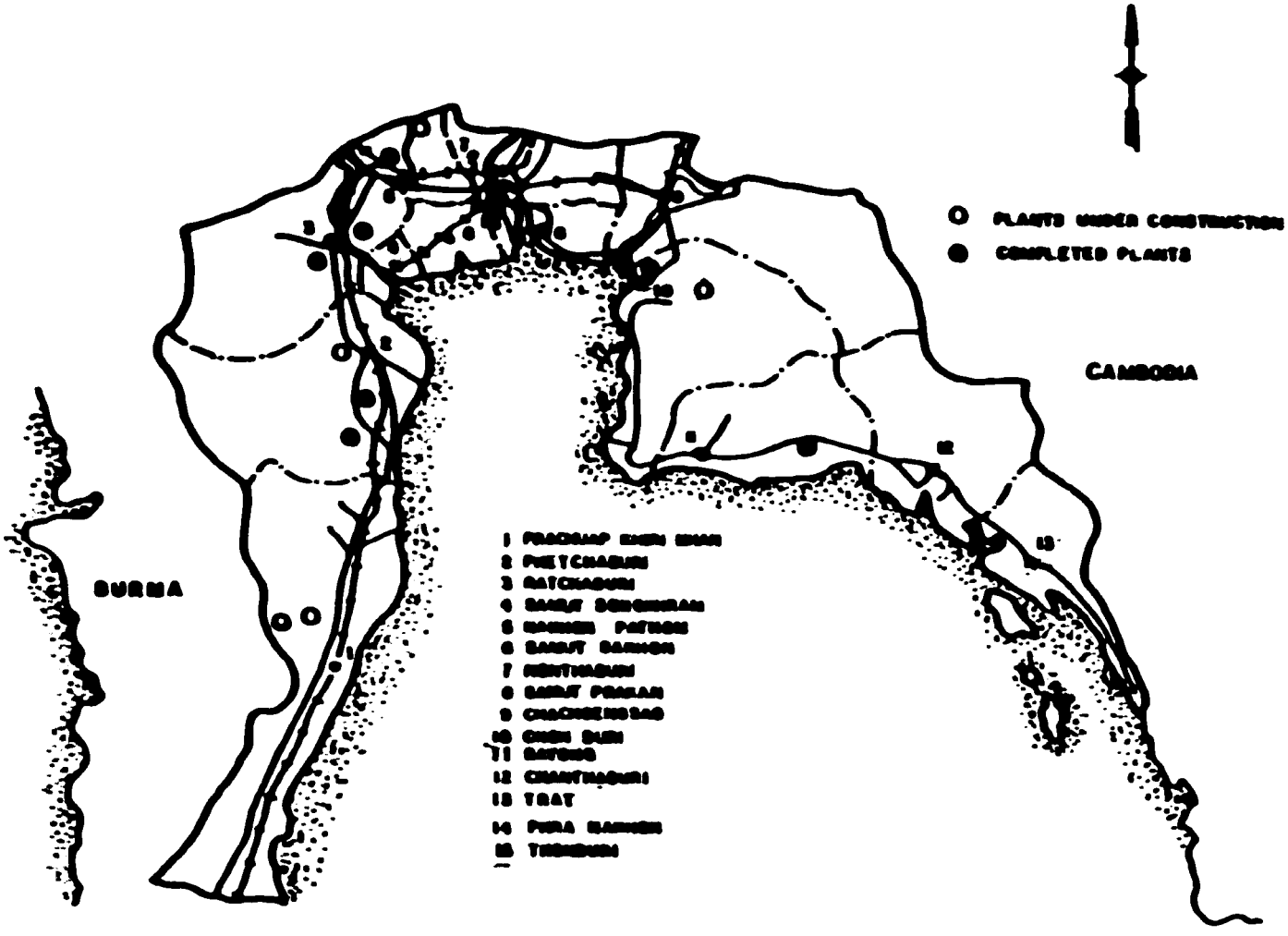
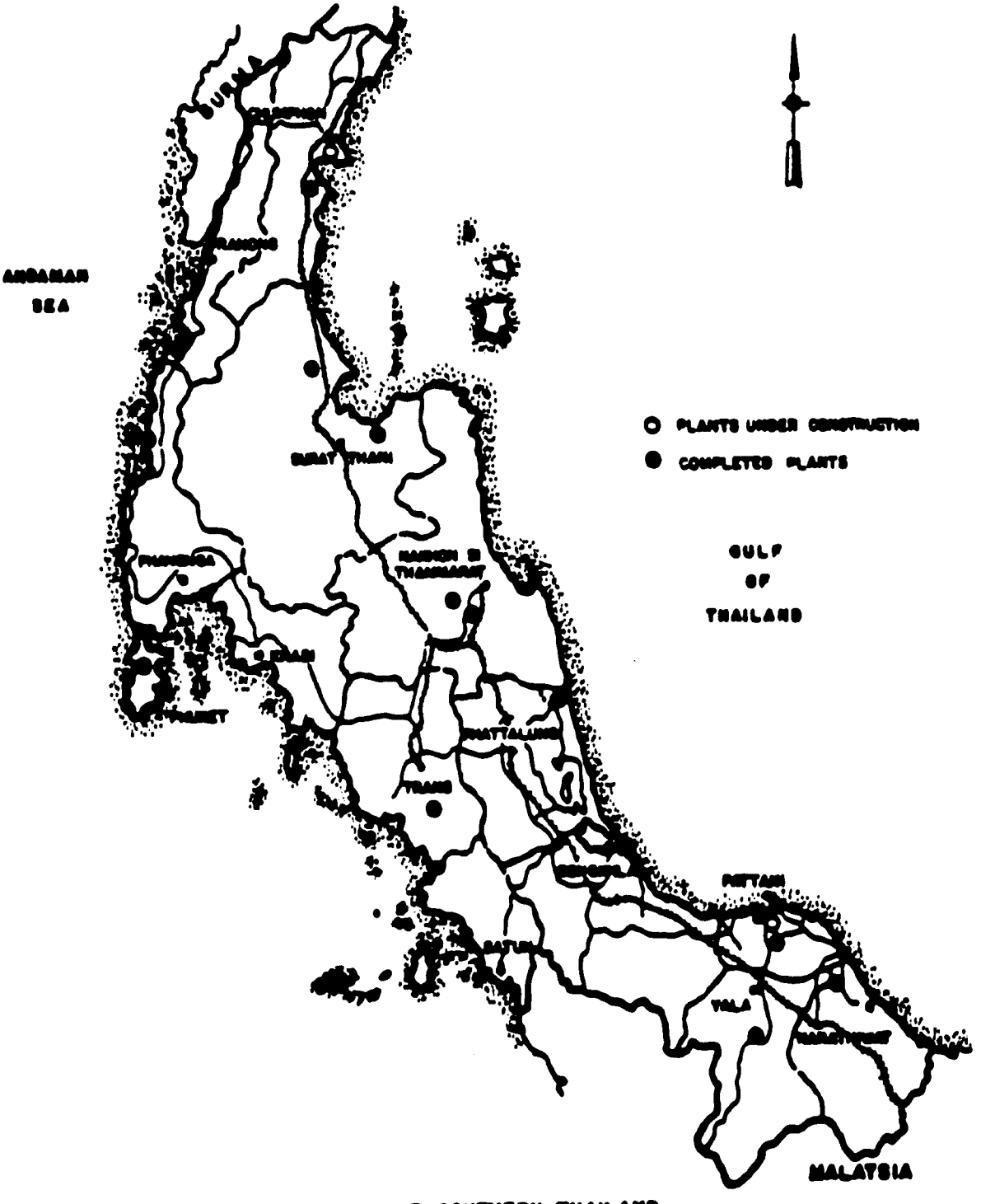


- MAP OF SOUTH CENTRAL THAILAND -



MAP OF SOUTHERN THAILAND

Appendix B

SYSTEMS VISITED

Province	Date of Visit
Khon Kaen Province	
Ban Tha Phra	November 3
Ban Kut Kwang	November 3
Ban Phra Ku	November 4
Ban Pang	November 5
Ban Nong Ta Kai	November 5
Ban Nong Rua	November 5
Ban Lawa	November 5
Ampur Mancha Kiri	November 6
Ban Phong Sawang	November 6
Sakon Nakon Province	
Ban Tha Rae	November 7
Ban Ba Hi	November 8
Ban Kok	November 8
Ban Phang Khon	November 8
Ban Rai	November 8
Nakom Phanom Province	
Ban Na Khok Kwai	November 9
Ban Atsamarat	November 9
Ban Tha Champa	November 10
Ban Tai	November 10
Ban Phon Swan	November 10
Ban Tha Kho	November 11
Ban Saen Phan	November 11
Ban Nam Kham	November 11
Ubon Province	
Ban Yang Cha	November 12
Ban Amnat	November 12
Ban Khamin	November 13
Ban Don Wai	November 14
Ban Nam Plick	November 14
Ban Dong Bang	November 14
Ban Non Pho	November 14
Ban Koeng Nai	November 15
Ban Tha Hi	November 15

Province	Date of Visit
Chiang Mai Province	
Ban Khun Kong	November 18
Ban Hat Sai Thong	November 18
Lamphun Province	
Ampur Mae Tha	November 19
Ampur Uwar	November 19
Chiang Rai Province	
Tambon Mae Chan	November 20
Ban Mae Suai	November 20
Ban San Sai	November 21
Ban Mae Kham	November 21
Ban Tha	November 21
Prayao Province	
Ampur Chaing Kum	November 21
Rayong Province	
Ban Tang Kuien	November 26
Udon Thani Province	
Ban Non Sa-at	November 28
Ban Muang Phruk	November 28
Ban Na Kha	November 28
Nong Kai Province	
Ban Wiang Khuk	November 29
Ban Thon	November 29
Ban Kong Nang	November 29
Ban Mo	November 29
Ban Nong Sawang	November 29
Pratchup Kiri Kan Province	
Ban Rai Bon	November 30
Ban Phrong Kasang	November 30

Appendix C

METHODOLOGY

The evaluation team consisted of a geographer and a social anthropologist from AID, Washington, and a sanitarian from the Thai Ministry of Public Health. It was assisted throughout and accompanied for part of the field visits by a Thai national, assistant project officer of USAID/Thailand. In each region the team was joined by a chief regional sanitation officer, who provided local transportation and spoke the local dialects.[1] The field portion of the evaluation lasted six weeks.

The selection of systems visited by the evaluation team was made from the final report of the U.S. consultants to the Potable Water Project.[2] This report listed 212 systems completed, under construction, approved, or with the design completed as of 1969. A random sample was drawn from these 212 systems and stratified by province. Whether or not the system had actually been constructed was determined by consulting a listing compiled by the Ministry of Public Health of all rural water systems built in Thailand.[3] Sample selection

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[1] Vehicle fuel costs were paid by AID.

[2] "Community Potable Water Project Final Report," Tippetts-Abbett-McCarthy-Stratton Engineers and Architects, August 1969, New York and Khon Kaen.

[3] "List of Rural Water Systems, B.E. 2509-2521 (1966-1978)," Rural Water Division, Ministry of Public Health, Bangkok.

was modified to eliminate those systems that did not cluster geographically for daily visits. Fifty-two systems serving 133 communities with a total population of approximately 170,000 persons were evaluated. Of these, 15 were located in sanitary districts (rural market towns) and 37 in villages.

A standardized interview schedule (Appendix D) was administered at each of the sites. Respondents usually included the system operator, the village chief, village leaders, and other villagers.

Appendix D

AID RURAL DOMESTIC WATER EVALUATION: VILLAGE LEVEL DATA SCHEDULE*

Date of field visit: Country:
Team:
Project name:

Village Data:
Name
Region
District
Other designation
Population: Families Persons:

Physical Characteristics:
Elevation
Terrain
Rainfall amount (specify units)
Rainy months (circle) J F M A M J J A S O N D
Dry months (circle) J F M A M J J A S O N D

Settlement Patterns:
Discrete village
Discrete village and dispersed population
Dispersed population and rudimentary village
Dispersed population
Other (specify)
Segment served by improved supply

1. Describe each improved source of supply (include source, distribution, number of taps, accessibility, water quality, and present use).

2. Describe the traditional water sources (include accessibility, reliability, water quality, and present use).

3. For each improve source:
   a. Source of idea:
      1. villagers
      2. local leaders
      3. government officials
      4. foreign project personnel
      5. other (specify)
   b. Who did planning?
   c. Was community involved and how?

*Actual schedule was 15 pages in length thus allowing space for answers.

d. Major issues?
e. Did the community understand what was going to happen?
f. How long after planning did project start?
g. When completed?
h. Did beneficiaries make any commitment?
i. Is water quality good, acceptable, poor?
j. Are water outlets convenient?

4. What is the planned availability of water at individual taps?

5. How does this differ from original project plans?

6. What is the percentage of time water was not available (during scheduled periods of availability) last year?

7. What percentage of the time (on the average) is water not available (during scheduled periods of availability) on a daily basis?

8. What percentage of the taps are presently working as scheduled?

9. Functioning of taps:
   a. Percentage of taps that are always working
   b. Percentage of taps that are never working
   c. Percentage of taps that are operating some of the time
   d. Percentage of taps that are functioning on a regular basis for only some part of the day.

10. Reasons for non-functioning taps (as percent of time not functioning):
   a. Lack of pressure
   b. Broken distribution pipe
   c. Broken tap
   d. Other

11. Describe the maintenance procedure and problem history of each improved source.

12. Who has the primary responsibility for maintenance of system?
   a. Local person_____
   b. Water committee_____
   c. Government_____

13. Is there a local maintenance person?

14. How is the person paid?
   a. Paid for each job?_____
   b. Paid salary_____
   c. Not paid_____
   d. If "c", what was the incentive offered?

15. Is there a local supply of spare parts?

16. If maintenance of system requires outside help, how is this paid?
    a. Not paid_____
    b. Paid for by job_____
    c. Part of government service_____

17. If maintenance requires spare parts, how are these paid for?
    a. Not paid_____
    b. Paid by item_____
    c. Part of government service_____

18. How often is maintenance done?
    a. Routinely_____
    b. When there is a breakdown_____

19. If a problem occurs, how is the person or agency responsible for maintenance informed?

20. If spare parts are required, where are these obtained?

21. How long does this take?
    a. On the average_____
    b. As a maximum_____

22. Is there a charge for water?

23. What is the charge (or tax) for water by household and per year?
    a. In the case of a public source_____
    b. For private connection_____
    c. There are no charges_____

24. How are the charges calculated?
    a. By the cost of the installations_____
    b. By the ability of the villagers to pay_____
    c. By the quantity of water used_____
    d. By predetermined standards_____
    e. By the type of service obtained_____

25. Last year, what percentage of the charges was collected?

26. Source of water

	Wet Season		Dry Season	
Use	Actual	Preferred	Actual	Preferred
Drinking				
Cooking				
Bathing				
Laundry				
Water for Animals				
Minor Irrigation				

27. Explain difference between actual and preferred.

28. How has improved water source(s) affected community water use? (Include time saving and increased use.)

29. If there is time saving, how is it used?

30. How is waste water used or disposed of?

31. Have the villagers been instructed on the health benefits of clean water? If so, by whom?

32. Has the health of the community changed since the improved water source was provided? (Note particularly skin and intestinal problems.)

33. Are there other project benefits or disbenefits?

34. How is excreta disposed of?
    a. Are there latrines?
    b. Are they used?

35. How important do villagers regard organization activities?
    a. Very important
    b. Somewhat important
    c. Not important

36. Was a distinct formal organization developed for the project?
    a. Name of organization
    b. Starting date

37. Is this organization still active? If not active, ask for:
    a. Past function
    b. Past membership structure
    c. Reason for not being active

38. List active organizations (include formal water organization)

Organization	Function	Leadership	Structure	No. Members	
				M	F

39. Which were most valuable in initiating or supporting the project? (Probe if there were other organizations not active today but important formerly; get function and reasons for not being active.)

40. When did the organization(s) get involved in the project? Specify which organization(s) and which project, if more than one.
    a. At planning stage
    b. At start-up stage
    c. At implementation stage (specify construction, maintenance, etc.)
    d. Other:

41. What is the composition of the organization? (Probe to get characteristics of participants and leader(s) in terms of economic status, ethnicity, political power, education, and age.)

42. What is the organization(s) specific function? (Maintenance, supply, etc.)

43. Does the organization(s) keep records?

44. How often has the organization met in the last six months?

45. How does the organization relate to other sources of authority in the village?

46. What ethnic, religious or other similar distinctions exist in the village?

Note: the objective of 47 and 46 is to determine distribution of economic resources. Obtain data for total landholding, agriculture machinery, and livestock from regional authorities.

47. Landholding (specify units)
    Largest_____
    Smallest_____

48. Livestock (specify types and units)
    Most_____
    Least_____
    Most_____
    Least_____
    Most_____
    Least_____
    Most_____
    Least_____

49. Does largest landholder(s) or livestock owner(s) have particularly desirable location vis-a-vis the improved water source?

50. Does above person(s) have ability to control distribution of water?

51. How important is this project for the villagers?

Appendix E

PERSONS CONSULTED

Term Taucodtr
Chief of Sanitation Section
Nakon Phanom

Dr. Banyat Atiburanakul
Provincial Chief Medical Officer
Nakon Phanom
Nakon Srisuwan
Deputy District Health Officer
Amnatjairon District
Ubon Ratchathani

Sampon Thonesan
District Health Officer
Ubon Ratchathani

Dao Keokraisorn
Sawitarian Region 3
Nakon Ratchasima

Dr. Bonkit Prapaprasurt
Deputy Provincial Chief Medical Officer
Ubon Ratchathani

Dr. Yanyoong Pootrakul
Paovincial Chief Medical Officer
Ubon Ratchathani

Pateep Siribodhi
Director of Sanitation Center Region 5
Health Department
Ministry of Public Health
Lampang

Dr. Anan Rabsompop
Deputy Provincial Medical Officer
Chaing Mai

Chetpan Karnkaew
Director
Rural Water Supply Division
Department of Public Health
Bangkok

Mrs. Catherine Deaks
UNICEF
Bangkok

Causakdi Wongsuwan
Chief of Operations and
Promotion
Sanitation Division Region 4
Department of Public Health
Khon Kaen

Sanguan Phrathani
Chief of Sanitary Operations
Sanitation Division Region 4
Department of Public Health
Khon Kaen

Suchin Yoosawatdi
Director of Sanitation Center
Region 4
Health Department
Ministry of Public Health
Khon Kaen

Sarasin Adyyanondha
Chief of Water Supply Section I
Sanitation Center Region 4
Khon Kaen

Uathana Kammuang
Chief of Administration Section
Sakon Nakon

Dr. Chana Kumboonrat
Deputy Director General
Department of Health
Ministry of Public Health
Bangkok

Chit Chaiwong
Director Sanitation Division
Ministry of Public Health
Bangkok

Pricha Chulasuchana
National Officer
UNICEF

Dr. Swish Rasdjarmrearnsook
Provincial Health Officer
Rayong

Dr. Kujchai Yingsery
Provinsional Health Officer
Ching Rai

Charles S. Pineo
Consultant
Bethesda, Maryland

Rifat Barokas
New World Planning Corporation
Newton-Upper Falls, Massachusetts

Suang Liamrangsi
Sanitation Scientist
Sanitation Division
Ministry of Public Health
Bangkok

Arthur Bruestle
World Bank
Washington, DC

J. K. Robert England
Assistant Regional Representative
UNDP Bangkok

Chatchai Ppongprayoon
Chairman Department of Geography
Chulalongkorn University
Bangkok

Maximiliano Cox
World Bank
Washington, DC

Boleslaw Jan Kukielka
WHO Team Leader
Environmental Health Project
Bangkok

Lert Chainarong
Deputy Governor
Provincial Waterworks Authority
Bangkok

Henry D. Merrill, O/HPN
USAID/T

Vernon R. Scott, Chief, O/HPN
USAID/T

David Oot, O/PHPN
USAID/T

Somchit Yatarohit
District Health Officer
Maesuai
Ching Rai

Charus Tebboon
Deputy District Health Officer
Maesuai
Ching Rai

Swai Sungsiri Pong
District Health Officer
Terng
Ching Rai

Dr. Anam Pongsri
Provincial Chief Medical
Officer
Pra Yao

Thongyoad Promsen
District Health Officer
Dok Tum Tai District
Pra Yao

Kumjohn Yongyut
District Health Officer
Klang District
Rayong

Surachard Suriyachot
Director of Sanitation Center
Region 2
Chon Buri

Dedduong Intaro
Sanitarian Region 2
Chon Buri

Dr. Tatan Phunpoo
Provincial Chief Medical Officer
Udon Thani

Miponth Sriboonroung
Chief of Sanitation Section
Nong Kai

Suwan Ngamsutdi
Acting Director of Sanitation Center
Region 7
Rat Buri

Saman Koolat
Sanitarian
Region 7
Rat Buri

Bonson Pondi
Provincial Chief Medical
Officer
Nong Kai

Charon Benchawisanu
Acting Director
Provincial Water Authority
Khon Kaen

Richard J. Frankel
SEATEC International
Consulting Engineers
Bangkok

Khun Palibool
Director of Rural Water
Supply Region 4
Khon Kaen

Uinai Manakics
Deputy District Health
Officer
Phang Khon
Sakon Nakon

Appendix F

GAO AUDIT REPORT AND COMMENTS

One of the documents reviewed prior to field work was the 1972 Terminal Audit Report by the Office of the Auditor General for East Asia.[1] The auditors visited 22 systems and found 11 inoperative. The present evaluation team visited seven of those 22 systems. Of the 11 systems identified in the 1972 audit as out of order or abandoned, 4 visited by this evaluation team are currently functioning. For example, Ban Amnat in Ubon Union Province was listed as abandoned in 1971, but is currently providing water on a regular basis to residents in five villages. According to the Ban Amnat operator and villagers the longest the system was ever out of operation since its inception was one month. The others, (Ban Phra Kue, Ban Kud Kwang, and Ban Na Kok Kwai) are also now operating. Three systems listed in the 1972 audit as being in only limited operation (Ban Rai, Ban An Yor, and Ban Pang Kone) are now in full operation.

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[1]Office of the Auditor General, Area Auditor General-East Asia "Audit Report, USOM/Thailand Water Resources Projects," Audit Report Number 8-493-73-3 July 19, 1972. Relevant pages are attached.

AGENCY FOR INTERNATIONAL DEVELOPMENT
Washington, D. C. 20523

OFFICE OF THE AUDITOR GENERAL
AREA AUDITOR GENERAL - EAST ASIA

AUDIT REPORT

USOM/THAILAND

WATER RESOURCES PROJECTS

POTABLE WATER PROJECT
NO 493-11-521-186

LABOR INTENSIVE WATER RESOURCES PROJECT
NO. 493-11-120-206

Period Covered by Audit: Terminal
As of March 31, 1972

Audit Report No. 8-493-73-3

Date Report Issued: JUL 19 1972

AUDIT REPORT

USOM/THAILAND

WATER RESOURCES PROJECTS

POTABLE WATER PROJECT
NO. 493-11-521-186

LABOR INTENSIVE WATER RESOURCES PROJECT
NO. 493-11-120-206

I. SCOPE OF EXAMINATION

We have performed a terminal audit of two water resources projects, Potable Water Project No. 493-11-521-186 and Labor Intensive Water Resources Project No. 493-11-120-206, both administered by the USOM Office of Field Operations (O/FO). The audit was performed in accordance with the provisions of AID Manual Order No. 793.1, "Audit of Technical Assistance", for the purpose of reviewing project implementation, verifying compliance with agreement terms and applicable AID regulations. The audit included a review of records maintained by USOM and Government of Thailand (RTG), discussions with USOM and RTG officials, visits to various project sites and other audit procedures deemed necessary. We visited a total of 30 RTG offices and establishments located in three major cities (Bangkok, Khon Kaen, Nakhon Ratchasima) and throughout nine changwats (provinces): Nakhon Ratchasima, Khon Kaen, Udon, Sakon Nakhon, Nakhon Phanom, Ubon, Yasothron, Roi Et, and Maha Sarakham. The audit covered the periods January 1, 1969, to March 31, 1972 (Potable Water Project) and June 30, 1968, to March 31, 1972 (Labor Intensive Water Project).

Significant matters disclosed by the audit are presented in Section V, Findings and Recommendations. Major findings are summarized in Section III.

II. BACKGROUND INFORMATION

Potable Water Project No. 493-11-521-186

This project was initiated April 27, 1966, for the purpose of assisting the Sanitary Engineering Division (SED), Ministry of Public Health, to develop the capacity to plan, design, construct and maintain a network of potable water systems in the Accelerated Rural Development (ARD) changwats. The project aimed to construct, by 1971, approximately 250 water systems reaching 600 villages and a population to 600,000 to 1,000,000.

Since inception, the project has been administered by three USOM offices: Office of Health and Population Planning (O/HPP), April 1966 through CY 1967; Office of Economic Development and Investment (O/EDI), CY 1968 through the first quarter of 1970; and Office of Field Operations (O/FO), since the 2nd quarter of 1970. U.S. dollar assistance to the project ended with the FY 1970 Project Agreement (ProAg). AID assistance to the project consisted of U.S. advisory services, participant training, commodities, and an AID-financed contract (No. AID-493-14) with Tippets, Abbett, McCarthy, Stratton (TAMS). The AID-financed, cost-plus-fee contract ($617,626) was executed August 17, 1966, between the RTG and TAMS for the purpose of TAMS providing engineering advisory training to SED personnel, and was completed on August 16, 1969.

The financial status of the project as of March 31, 1972, was:

	Obligated	Accrued Expenditures	Balance
U.S. Contribution	$ 2,992,253	$ 2,976,185	$ 16,068

	ProAg Budget	Withdrawn	Expenditures
RTG Contribution - Counterpart Funds (฿20 equals $1.00)	฿42,915,274	฿42,646,596	฿38,013,025

Exhibit I contains additional financial information on the project.

Labor Intensive Water Resources Project No. 493-11-120-206

This project was initiated on June 30, 1968, for the purpose of assisting the RTG in stimulating the economy of Northeast Thailand by providing irrigation water to farmers and employment to local laborers by constructing and rehabilitating reservoirs and distribution systems. The project objectives provide for the Royal Irrigation Department (RID), Ministry of National Development to construct 12 reservoirs and to rehabilitate 18 reservoirs including distribution systems by December 31, 1972. RID would stimulate employment in these areas by employing approximately 8,300 local laborers.

The project was initially administered by O/EDI through February 1970, at which time O/FO assumed the administrative responsibility. U.S. dollar assistance to this project ended with the FY 1971 ProAg. AID assistance to this project consisted of U.S. advisory services, participant training, and commodities.

The financial status of this project as of March 31, 1972, was:

	Obligated	Accrued Expenditures	Balance
U.S. Contribution	$1,191,656	$1,160,340	$31,316

No counterpart funds were provided to the project. We were informed by RID, however, that $56 million (U.S. equivalent $2.8 million) was contributed to the project from its regular budget. Exhibit II contains additional financial information on the project.

III. SUMMARY OF MAJOR FINDINGS

Audit findings are discussed in detail in Section V. We summarize below those findings which we consider most significant.

Potable Water Project:

The SED has fallen behind in its effort to sustain the potable water systems after the phase out of U.S. dollar assistance (Para. V, A); and legal problems, RTG funding limitations, and SED operating conditions and practices have hampered the usage of AID-financed commodities (Para. V, B).

Labor Intensive Water Resources Project:

Project objectives for constructing and rehabilitating water reservoirs were not met because of RTG budgetary limitations (Para. V, C); and project commodities were not effectively used because of lack of coordination and monitorship (Para. V, D).

IV. FOLLOW-UP ON PRIOR AUDITS

There are no recommendations outstanding from the last prior Audit Report No. 69-12 of the Potable Water Project issued on June 9, 1969, which covered the period April 7, 1966, to December 31, 1968.

There has been no prior audit of the Labor Intensive Water Resources Project.

V. FINDINGS AND RECOMMENDATIONS

A. Continued Operations of Potable Water Systems

SED efforts to sustain the potable water program since the phase out of U.S. dollar assistance have been unsatisfactory. Maintenance and repair problems stemming from a shortage of mechanics, insufficient operating funds, and inadequate support by villagers have contributed to this condition. As a result, numerous water treatment plants were inoperative, minimizing accomplishment of the project objective to provide villagers with potable water for betterment of their health.

We visited 22 water treatment plants and found 11 inoperative, and six operating on a limited basis, see Exhibit III. SED officials in Khon Kaen told us that there were at least another 31 inoperative water plants of the 116 under their jurisdiction. As was the case at water plants visited, mechanical breakdowns and problems in collecting water fees were the prime causes for systems not operating.

The acute shortage of plant maintenance technicians is a factor contributing to the inoperative water systems. In Khon Kaen, SED officials stated that as a minimum, a maintenance team consisting of one technician and one mechanic helper was required for each of the nine changwats under their jurisdiction. Currently, staffing is 55% below the desired level, consisting of only four teams for the nine changwats. Our review at SED Headquarters in Bangkok revealed that SED lost many field personnel when counterpart funding was discontinued after U.S. assistance was ended. Although 17 additional field operations personnel were hired by SED to be funded from its regular RTG budget, 36 field operations personnel previously funded out of counterpart funds were dismissed. Dismissal of engineers, construction technicians, mechanics, mechanic helpers and laborers that are needed in plant operations undoubtedly contributed to the problems of plant maintenance. In this connection, we noted that USOM issued a Staff Notice (No. 71-261 dated April 9, 1971), listing criteria that should be kept in mind by drafters of ProAgs to ensure that a continuance of project activities are accomplished by the RTG after U.S. assistance ends.

Another factor hampering the potable water program is the lack of villager support of the water systems. Failure to adequately pay plant operators and maintain plants continues to plague the program. A limited number of water users and difficulties in collecting water charges, due to poor village economic conditions, have precluded the generation of sufficient revenue to operate and maintain the water plants. In one instance, an operator received no monetary compensation over a two-year period. In another instance, the

amount of an operator's salary payment was dependent upon availability of funds. Villagers also told us that operators have left after breakdowns at water plants because of dissatisfaction with their meager salaries. Maintenance teams told us that their pleas to villagers to purchase lubricating oil, oil filters and other necessary items for preventative maintenance were frequently ignored. As a result, preventive maintenance was unsatisfactory, as evidenced by the excessive amount of inoperative equipment.

There is no easy solution to these maintenance and operation problems of water plants, especially when causes are varied. Nonetheless, there is a need to provide guidance to SED in the area of operation and maintenance of water plants.

Recommendation No. 1

We recommend that USOM/Thailand review, with SED, problems relating to operation and maintenance of water plants for the purpose of advising SED on possible solutions to these problems.

Commodities - Potable Water Project

Legal problems connected with payment of sales commission, RTG funding limitations, and SED operating conditions and practices have hampered the effective usage of AID financed commodities totalling $629,894. Details of problems related to commodity utilization are as follows:

1. ONAN Engines

There were $348,782 of commodities consisting of 360 ONAN engines, 28 ONAN generating plants, and related parts in storage at a local distributor's warehouse (United Machinery) since March 16, 1970, over a dispute regarding sales commission to the distributor. This situation was reported in our last prior audit of Port Clearance Operations, Audit Report No. 8-493-72-42

issued on September 14, 1971. Our review disclosed that the RTG was preparing the necessary documents for initiating legal action against the distributor to have the commodities released to the project. Meanwhile, SED officials informed us that, the overhauling of over 300 engines has been unduly delayed, since the above distressed engines were intended to be used while old engines were being overhauled, and diesel engines in many cases were to replace gasoline engines for heavy duty service.

Although USOM has been working vigorously on this problem, there has been no significant progress to get the engines released to the project. We were told that the Department of Technical and Economic Cooperation turned the matter over to the Public Prosecutor's Office over a year ago to initiate legal action against United Machinery Co. for possession of the engines. We understand a good portion of the delay is caused by the necessity for translating the bid documents and relevant correspondence, including portions of Regulation 1, into Thai, as this is the official court language.

We further understand that the action, proposed to be taken by the Public Prosecutor's Office in its case against United Machinery, includes the filing of an urgent motion for possession of the engines on grounds of public interest pending resolution of the issues in the main case relating to the wrongful withholding of the engines by United Machinery. This action, if successful, will enable the Thai Government to get the engines immediately upon filing of its suit, rather than await the results of what might be a long and protracted period of litigation. Accordingly, no recommendation is deemed necessary at this time.

2. Water Pumps with Electric Motors

When we visited Khon Kaen in March 1972, 132 water pumps with electric motors, cost $74,686, had been in storage in Khon Kaen for 15 months or more because of a lack of RTG funds necessary to make them

operational. There were 68 Westinghouse Centrifugal pumps and 48 Westinghouse Submersible pumps in storage since November 1970; and 16 Peerless Centrifugal pumps in storage since December 1968.

This equipment, intended for converting certain deep well pumps from diesel drive to electric drive, had never been used, because local currency funds to purchase necessary transformers to operate the equipment have not been made available. A SED official told us that, approximately ฿30,000 to ฿50,000 ($1,500 to $2,500) was required to purchase and set up a transformer, and until such time as RTG provides such funds, this equipment cannot be used.

3. Water Pumps with Engines

Warehouse records showed that there were 175 Peerless pumps with Wisconsin gasoline engines and 77 ONAN pumps with diesel engines, cost $206,426, stored in Khon Kaen. At the time of our visit, the warehouse was in an untidy condition and we were unable to verify the exact number of pumps stored.

Only 87 of the 262 Peerless deep well pumps that arrived in country on June 30, 1969, have been issued because of the limited use of deep wells as a source of water. SED officials told us that usage of deep well pumps in the future would be limited, since few of the newly constructed water plants use deep wells

We were told by a SED official at the warehouse that 44 of the 77 ONAN pumps that arrived in country during November 1970, have been set aside for newly constructed water plants and will be used in the near future. SED Bangkok told us that of the remaining 33 pumps, an undisclosed number were not usable as units, because the engine components had been removed to replace broken engines in the field. During the audit we informed O/FO of this condition and O/FO is now investigating the matter in detail to determine the basic cause leading to the condition.

Recommendation No. 2

We recommend that USOM/Thailand review with SED, plans for utilizing pumps in storage identified above and initiate action to have pumps that are not to be used in the near future transferred to another area where they can be effectively used.

C. Labor Intensive Water - Project Objectives

It is unlikely that the Labor Intensive Water Project will meet its goal of constructing 12 water reservoirs, rehabilitating 18 reservoirs, and employing 8,300 laborers by December 31, 1972. Lack of RTG budgetary support has contributed to this condition. The status of the project as of March 31, 1972, was as follows:

New Construction -- Four water reservoirs have been constructed, and are complete except one for which the water distribution system was incomplete. Four water reservoirs were under construction. (Work was discontinued at one site due to communist insurgency.) Work has not started on the remaining four reservoirs.

Rehabilitation -- The rehabilitation of nine reservoirs was considered completed, and work on the remaining nine has not started.

Employment of Laborers -- The objective of employing 8,300 laborers on the project had not been achieved. RID informed us that total laborers hired on the project was about 4,660.

The RTG cost for constructing 12 water reservoirs was estimated at ฿75.7 million (U.S. equivalent $3.8 million), but funds provided for constructing reservoirs totalled only ฿48 million (U.S. equivalent $2.4 million). Furthermore, while ฿8.1 million (U.S. equivalent $400,000) was provided for rehabilitating the first group of nine reservoirs, the ฿10.4 million (U.S. equivalent $500,000) estimated cost for rehabilitating the remaining nine reservoirs was never budgeted.

POTABLE WATER PROJECT
NO. 493-11-521-186

EXHIBIT I

FINANCIAL STATUS AS OF MARCH 31, 1972

U.S. Contribution

	Obligated	Accrued Expenditures	Balance
Personal Services:			
Direct Hire	$ 88,033	$ 88,033	$ -
PASA	59,506	59,506	-
Contract:			
Tippets, Abbett, McCarthy, Stratton	617,626	617,626	-
Other	6,796	6,796	-
Participants	152,096	136,028	16,068
Commodities	2,068,196	2,068,196	-
Total	$ 2,992,253	$ 2,976,185	$ 16,068

RTG Contribution (฿20 equal $1.00)

	ProAg Budget	Withdrawn	Expenditures
Trust Funds 1/	฿ 3,222,108	฿ 2,953,430	฿ 2,953,430
Project Account Fund 2/	39,693,166	39,693,166	35,059,595
Total	฿42,915,274	฿42,646,596	฿38,013,025

1/ To pay local currency support cost of U.S. employed technicians

2/ To pay all approved local currency costs (other than Trust Funds) for the project.

SOURCE: USOM/Thailand financial records.

VISITS TO WATER TREATMENT PLANTS
During March 1972

Location	Operating	Limited Operation	Not Operating	Comments
Khon Kaen:				
Ban Phra Kua			X	Engine (OHAM) breakdown - March 1972.
Ban Kud Kwang			X	No water - canal embankment damaged - March 1972.
Udon:				
Ban Nakha			X	Cylinder ring broken (OHAM) - February 1972.
Ban Tong		X		Limited water distribution. Main distribution pipes broken.
Ban Nong Suan			X	Crank shafts broken (2 OHAM) - October 1971 and February 1972.
Nakhon Phanom:				
Ban Taker	X			
Ban Na Kok Kuai			X	Pump (Farriman) broken - 1970.
Ban Nong Yang Chia			X	Pump piston ring (Farriman) broken - January 1972.
Ban Kok Suang			X	Engine (OHAM) and pump (Ruston) broken - April 1971. Also, water distribution pipes broken extensively.
Ban Tong			X	Abandoned - 1971.
Ubon:				
Nai Srisook	X			
Muong Samsib	X			
Ban Amnat			X	Abandoned - February 1971.
Ban Kueng Nai		X		Only 45 out of 697 families use this water system. Water salty and yellowish. Needs filtering unit. Village encountering financial difficulty in supporting this system.

VISITS TO WATER TREATMENT PLANTS
During March 1972

Location	Operating	Limited Operation	Not Operating	Comments
Mahasarakham:				
Ban Hua Kuang			X	Engine breakdown - March 1972.
Ban Pong			X	No water distribution pipes.
Sakon Nakhon:				
Ban Bai		X		Operating only 1 hour a day. Broken deep well pipe is too short to pump sufficient water.
Ban Tarree		X		Only 170 out of 1,300 families use this water system. Villagers cannot afford pipe installation costs. 13 public faucets closed since May 1971 due to difficulty in collecting water fee.
Ban Pong Kone		X		Newly opened water system in March 1972. Only 15 out of 250 families were able to afford water distribution pipes. No public faucets.
Ban Yor		X		Only 140 out of 400 families use this water system. Water salty and yellowish. Filtering unit now under construction. Plant operator, a school janitor receives no pay for plant operation.
Nakhon Rajsima:				
Ban Gudjig	X			
Roi Et:				
Ban Klang	X			
Total	5	6	11	

Appendix G

CHECK LIST—OPERATING PLANT INSPECTION

(Taken from contractor's report, "Community Potable Water Project Final Report, August 1969,")

1.	Operator on duty at plant?					Yes ____	No ____		
2.	Operator interviewed if not at plant?					Yes ____	No ____		
3.	Intake pump in operating order?			Yes ____		No ____	N/A ____		
4.	Treated water pump in operating order?			Yes ____		No ____	N/A ____		
5.	Chlorinator in operating order?					Yes ____	No ____		
6.	Chlorination being practiced?					Yes ____	No ____		
7.	Lime solution being batched correctly?					Yes ____	No ____		
8.	Lime solution being fed properly?					Yes ____	No ____		
9.	Alum solution being batched correctly?					Yes ____	No ____		
10.	Alum solution being fed properly?			Yes ____		No ____	N/A ____		
11.	Floc formation:		Good ____	Fair ____		Poor ____	N/A ____		
12.	R.S. filter being backwashed regularly?			Yes ____		No ____	N/A ____		
13.	S.S. filter being cleaned as needed?			Yes ____		No ____	N/A ____		
14.	Fuel supply adequate?			Yes ____		No ____	N/A ____		
15.	Chemical supply adequate?					Yes ____	No ____		
16.	General appearance of plant:			Good ____		Fair ____	Poor ____		
17.	Chlorine residual in dis. sys.	None ____	0.1 ____	0.2 ____		0.3 ____	>0.3 ____		
18.	Samples of influent & effluent sent monthly to Khon Kaen					Yes ____	No ____		
19.	Operator trained?					Yes ____	No ____		
20.	Operator being paid regularly?					Yes ____	No ____		
21.	Operator maintaining daily log?					Yes ____	No ____		
22.	Valves operating properly?					Yes ____	No ____		
23.	Flocculator being cleaned as needed?			Yes ____		No ____	N/A ____		
24.	Sedimentation tank being cleaned as needed?			Yes ____		No ____	N/A ____		
25.	Appearance of water in clearwell:			Good ____		Poor ____	N/A ____		
26.	Villagers drinking the treated water?					Yes ____	No ____		

Where answer no, none or poor is checked, explain below

Other remarks:

(Sign) Engineer ____

Date ____

Appendix H

SANITATION DIVISION: NOW AND THEN*

SANITATION DIVISION: YESTERDAY, TODAY, AND TOMORROW

Since the pilot program for Rural Health Development (RHD) had been terminated in 1960, and due to its remarkable success, the Health Department in cooperation with USAID launched the continual project called "Village Health and Sanitation Project" (VHS) which utilized the RHD as a model.

The VHS project had two major objectives. The first objective was to reduce the mortality and morbidity due to gastro-intestinal diseases. The second objective was to improve and promote the basic sanitation condition of all rural villages, which would cover 80% of the total population of Thailand.

This project had been in action for six years, 1960 - 1965, then it was transferred to the Comprehensive Rural Health Project (CRH). The CRH project had the same objectives as the VHS project, but the sites of implementation were concentrated in the northeastern provinces of Thailand. The financial assistance from USAID for CRH ended in 1974, but the project was carried on until 1976.

The Public Health goals which have been set forth in the Fourth Plan of the National Economic and

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*Ministry of Public Health, Bangkok.

Social Development Plan, have strong influence on the CRH project to develop to be the Sanitation Division in 1976, with its main function that of providing good health and life in a decent environment through better sanitation. As an organization, this dividion is under the Department of Health, Ministry of Health. The Sanitation Division is responsible for all activities concerned with environmental sanitation, which is part of the Environmental Health Protection Project (EHP). This project has two objectives. The first one is to reduce the mortality caused by water and food borne disease by 50 percent. The second objective is to reduce morbidity due to water and food borne disease by 30 percent. (These two figures are based on the vital statistical data of 1976.)

Right after the Environmental Health Protection Project is completed in 1981, the Sanitation Division intends to divide into two subdivisions, namely, the Urban Sanitation subdivision and the Rural Sanitation subdivision.

The Urban Sanitation subdivision will be concerned with the problems of urban communities, such as food sanitation and solid waste disposal and management. To prepare for such a situation, the Food Sanitation Project is now being undertaken as a pilot project in the Sanitation Division.

The Rural Sanitation subdivision will be more or less interested in the appropriate health development system that will be suitable and practicable for the socio-economic situation

as well as the culture of each village. In order to fulfill this goal, many programs of sanitation establishment are now be studied, including the school sanitation program, the Sanitation Acceleration Village program, and the Follow-up or Monitoring Network program.

THE SUMMARY OF VHS, CRH, AND ENP PROJECTS

PROJECTS	OBJECTIVES	TARGETS	METHODS OF OPERATION	SOURCES OF FINANCE	ACHIEVEMENTS
1. Village Health and Sanitation (VHS) Project 1960-1965	1. To reduce the mortality and morbidity rate of gastro-intestinal diseases. 2. To improve and promote sanitation of the rural area.	1. Privy installation and use by each household. 2. Village water supply will be constructed in every village. 3. Improvement of premise sanitation.	1. Conduct in-service training to sanitarian and health workers. 2. Create "Health Development Village" 3. Health educate and encourage people to install and use water-sealed latrines. 4. Assist in the construction activities in terms of technical and financial assistance.	1. Royal Thai Government (8,981,060 ฿) 2. USAID (28,411,616.76 Baht)	1. Health Development Village 7,118 villages. 2. Construction activities: Water-sealed latrines-- 249,019 units Small scale rural water supplies-- 287 units
2. Comprehensive Rural Health (CRH) Project 1966-1976	The objectives are still the same as the VHS project but the implementation are concentrated in the northeastern provinces of Thailand.	Same as VHS Project	The methods of operation follow the pattern of VHS Project.	1. Royal Thai Government (214,598,500 ฿) 2. USAID (1966-1974) (65,311,430 ฿)	1. HDV 31,073 villages 2. Construction activities: Water-sealed latrine-- 1,741,327 units Small scale rural water supplies-- 10,770 units

PROJECTS	OBJECTIVES	TARGETS	METHODS OF OPERATION	SOURCES OF FINANCE	ACHIEVEMENTS
1. Environmental Health Protection (EHP) Project 1977-1981	1. To reduce the mortality due to water and food borne disease by 50% 2. To reduce the morbidity due to water and food borne disease by 30% (based on the rate of 1976)	1. Construction activities: Small scale rural water-supplies 10,000 units Water-sealed latrine--2,360,000 units Cestern 50,000 units Refuse container 50,000 units Incinerator 500 units 2. Population coverage: Water supply progrm must cover 25% of the rural population Excrete disposal program must cover 50% of rural population Refuse disposal program must cover 50% of rural population	1. To conduct conferences, in-service training to local personnel, volunteers, and local leaders. 2. Give financial assistance on the basis of community participation. 3. To provide equipment and technical assistance for construction activities 4. Health educate school children as well as public 5. Demonstrate all responsibility activities in the demonstrating villages	1. Royal Thai Government 2. USAID in 1977 granted 4 scholarships for Food Sanitation program and 10 study tours for Rural Sanitation program	Achievement in 1977 1. Construction activities: Water-sealed latrine 172,113 units Small scale rural water supplies 1,500 units Cestern 3,162 units Sanitary wells 295 units Incinerator 120 units 2. Training Health personnel 700 persons Local leader 1,756 persons Food handler 8,968 persons

THE SUMMARY OF URBAN SANITATION AND RURAL SANITATION PROJECT

PROJECT	SUBPROJECT	ACTIVITY
Urban Sanitation	1. Food Sanitation 2. Solid Waste Management 3. Vector Control	1. Training of food handler 2. Demonstrate the Solid Waste and Vector Control system
Rural Sanitation	1. School Sanitation 2. Sanitation Acceleration Village 3. Follow up or Monitoring Network	1. Health Educate school children and public 2. Demonstrate the construction activities in the selected villages 3. Set up follow up or Monitoring system 4. Training of local personnel to continue the progress

Appendix I

SUGGESTIONS TO AID FOR FUTURE WATER ACTIVITY IN THAILAND*

The following is a brief outline of findings presented December 4, 1979, to USAID mission director, Mr. Donald Cohen. Several qualifications should be considered when reading this outline.

- *First, it has been prepared by one of the team members and, while it is believed to represent collective conclusions, it should not be considered as such until reveiw by both of the AID/Washington team members.
- *The statistics have been drawn from 60 separate interview forms; a more careful review may alter some of the figures. (Eight projects were eliminated as not being funded by AID.)
- *The evaluation team's assignment was to evaluate only one specific AID project. The team therefore defers to the judgments of others specifically charged with project design.

There are at present over 600 piped water systems serving communities in Thailand that are classified as rural. Of these, AID funded the construction of approximately 250. The evaluation visited 60 systems serving 125 communities. The smallest was less than 500 and the largest had over 7,000 persons. The medium size was 850.

The systems were sophisticated piped water systems using both surface and ground water. All systems included chlorination of water prior to distribution although a few of the communities

*To be integrated into body of final report.

have discontinued this practice. The systems are built to U.S. design criteria established by the American Water Workers Association. The following outlines a debriefing by one of the team members with the USAID/Thailand mission director, the chief of Health, Population, and Nutrition Office, and the officer who coordinated the team's activities in Thailand. Three questions were addressed: (1) What is going on? (2) Why? and (3) What does this mean for USAID/Thailand?

1. What is Going On?

Of the 60 systems visited, 53 were currently working, 2 were recently rehabilitation and are in working order but are awaiting a trained operator and 5 are failures.[1] The working systems are in most cases delivering water to individual users through metered connections. In almost all cases they are self-sufficient not only in ordinary operating costs but have also paid for replacement of major components that have failed.

The average cost of water is three baht per cubic meter. Users all pay although about 10 percent are one or more months delinquent. A few systems are not metered and a variety of methods are used to assess charges. A minority of systems use public taps, some of which provide free water. Approximately 40 percent of the systems provide water for nearly the entire

[1] Of the four failures one is under review by the Ministry of Public Health for rehabilitation.

community. The rest exclude some portion either because the distribution line does not reach the entire community or because the poor do not have money for a private connection which usually costs about 300 to 400 baht.

In addition to the piped water system, the evaluation team was interested in two aspects of another USAID project: water-seal privies and shallow wells with handpumps. The communities visited had a high percentage (nearly 80 percent) of use of water seal privies. This indicates wide acceptance and spread of this technology.

On the other hand, the team failed to find any AID-funded handpumps in operation with the exception of one demonstration pump in the Rural Water Supply Section compound at Khon Kaen.[1]

2. Why?

One simple program--provision of handpumps--was a complete failure and yet a much more sophisticated water supply program was successful. In addition, residents in 11 communities with piped water systems had an over 80 percent rate of use of water-seal privies. The reasons why a simple technology has failed and a complex one succeeded, and also why there is widespread use of water-seal privies, are not completely clear. Three reasons seem relevent, however: community acceptance, financial support, and institutional support.

[1] The Rural Water Supply Section has a program designed to support handpump maintenance which is under test in the Khon Kaen area, but the team did not visit the site.

a. Community Acceptance

Communities have accepted the piped water systems because they view piped water delivered to the house as an incremental improvement over more remote sources. In response to the question, "Does the system save time or provide more water?" the answer is nearly uniformly that there is both time-saving and more water use. When asked what is done with the time saved and the extra water used the responses are predominately economic. Villagers cite in particular the use of extra water for raising additional animals, for raising more market crops, and for providing more time for home crafts. The estimate of increased income provided because of the water system ranged from 5 to 200 percent.

In addition to the obvious advantages of increased income, the water systems are seen by some to provide economic protection in times of drought and rice crop failure. The income from the animals and cash crops, it was pointed out, means that heads of households can remain in the village rather than going to Bangkok for jobs to tide them over.

There is no evidence that handpumps on shallow wells represent an improvement over the commonly used rope and bucket. Indeed, there are supplies of both handpumps and

water-seal privies available in all market centers. Villagers buy the privies but not the handpumps. Faced with the economic choice, the consumers opt for privies. The lesson seems clear, that privies are more highly valued.

b. Institutional Support

However great the desire for piped water, the systems would not operate unless operators and maintenance people were trained and there was an adequate supply of spare parts and a system to deliver them when and where needed. Indeed, in an evaluation by the General Accounting Office in 1971 only half the systems were operating. The others were abandoned, out of repair, or operating on a limited basis.

The story of how the systems have improved over time is really a story of the growth of one of the most effective institutions in the rural water supply field, the Rural Water Supply Division of the Ministry of Public Health. This organization has over the past years trained and retrained every rural water supply operator, has visited each system (usually on a monthly basis) to take water samples and to inspect the operation of the system, and has provided maintenance support for problems beyond the capability of the local operator. The Rural Water Supply Division is now being relieved of responsibility for piped water systems; this now is under the control of the newly formed Provincial Water Authority.

c. Financial Support

The systems visited are for the most part economically self-sufficient. In the past the systems were run by either the village committee or a tambon (district) committee. In the sanitary districts, the sanitary district committee was in charge of the systems. Funds collected were used to pay for fuel, chemicals, and spare parts or component replacements. A single operator ran the system and in the rural communities often was a volunteer when collected revenues failed to provide an excess over costs.

Providing funds for fuel and the need for replacement of major components led to a change from public taps to private metered connections. Revenues are now usually more than adequate to run the systems. The financial support is, of course, additional evidence of community acceptance.

3. What Does This Mean for USAID/Thailand?

There is ample evidence that a previous handpump program in Thailand was a failure. Furthermore, were the mission to consider such a program, it would be in conflict with WHO which is planning to serve the entire country by 1991. On the basis of past performance the team would strongly recommend for communities of approximately 400 to 500 persons systems using

ground water and chlorination. Power for the system should be electric motors, windmills, or handpumps. Diesel power should not be used. Each residence should have a private metered connection. Rates should be based on increasing block rate pricing, set to provide adequate basic water for washing and sanitation at low rates to everyone with increasing unit costs for additional water. The rate structure should cover all operating, maintenance, and depreciation costs.

Such a system would provide economic and health and nutrition benefits--and the experience has shown will be supported by the users. The community should be involved in the system and commitments of labor or cash should be a prerequisite. Advantages are:

a. Increased economic potential for the community.

b. Increased health through:

   i. an improved source of water,

   ii. better nutrition,

   iii. increased use of water-seal privies as a result of easier availability of water, and

   iv. more water for sanitary practices.

c. The maintenance of the Rural Water Supply Division as a functioning organization.

In addition to a simple transfer of resources USAID/Thailand can provide:

a. engineering expertise in the design of simple "packaged" water plants;

b. advise on the gathering of small area health statistics that will enable evaluation of the effectiveness of this and other health programs;

c. participants training in the United States for degree candidates (the record of return of Thai Sanitation students is claimed to be 100 percent); and

d. work study training in other Asian countries.

Addendum Regarding Financial Sustainability

The Thai government has decided to incorporate the responsibility for all piped water systems (except that serving municipal Bangkok) into a new para-statal organization the Provincial Water Authority (PWA). While the desire to nationalize the supervision of piped water is understandable, the immediate effect is detrimental and in the long run promises to prove disasterous for the systems serving the smallest communities.

Piped systems that effectively serve small rural communities of as few as 500 persons are not usual in the developing world and their technical and financial success in Thailand is in great part due to the training, management and supervision provided by the Rural Water Supply (RWS) Section of the Ministry of Public Health's Sanitation Division. This section was set up to manage a joint Thai-USAID project. The project had as an objective the provision of piped water supplies to

600 rural communities in the areas designated as targets for an Accelerated Rural Development Program. While the project failed to serve the number of communities projected and fell behind in the schedule, the achievements in terms of lasting impact, growth, and spread have been impressive.

The main report outlines the results of the evaluation in detail and it is sufficient to indicate that there are now nearly 600 systems serving over 1500 rural communities with piped water supplies. The systems are reliable, and in most cases provide water that meets all WHO standards. Most operators have been trained, some as many as three times, in the operation of the systems which provide full treatment for surface supplies and in most cases chlorination of water from deep wells.

The Rural Water Supply Section has in the past visited the systems on a monthly basis checking the operation and maintenance of the system, providing on the job training of the operator and drawing samples of water for physical and chemical testing. In addition it provided parts and emergency maintenance in the case of breakdowns. For small systems it also delivered chlorine. The RWS no longer has official responsibility for the systems. In some cases it is responding to emergency needs, but no longer provides the regular monthly or bi-monthly supervision. In some cases deterioration is already taking place. One system is using some of the filtered

water for irrigation of the operator's gardens while unfiltered water is being distributed to the public. The use of excess filtered water for irrigation is not new, but by-passing the filter for the potable water has only been done after the RWS supervisor stopped his regular visits.

There are three levels of piped supplies in Thailand which can be distinguished by the population served. These are: (1) urban systems, (2) systems serving sanitary districts, and (3) systems serving villages. It is the intention of the PWA to make all the systems economically viable. Most now are, but in some villages the operators are volunteers who run the systems as a community service. In others the operators are paid considerably less than the minimum civil service pay scale. If pay scales are raised to the level of PWA operators interviewed (3000+ baht) fewer systems will be able to be self supporting at present water rates--which are for the most part already higher than rates in Bangkok.