PN-ABI-069
71167

PROJECT MANAGER'S REFERENCE GUIDE

POTABLE WATER

TABLE OF CONTENTS

MARCH 1986

INTRODUCTION

This Topical Reference Guide was prepared to provide useful reference material for people planning, designing, managing, analyzing, monitoring, and/or evaluating potable water projects.

The charts, graphs, and data were taken from published materials and supplemented by EASA statistics and learning experience extrapolated from potable water projects of AID and other development agencies. This information will be periodically updated.

This Topical Reference Guide recommends sources for technical assistance and project related literature. It is not meant to be a substitute for expert technical assistance. It is intended to provide a concise overview of relevant issues and information which must be adapted to fit specific project circumstances.

This is a pilot effort to be followed by others. We are in the process of making this information available in computerized form in addition to the original notebook format. We have consulted AID staff in Washington and are requesting reactions and suggestions from AID field staff and interested NGOs and PVOs. Suggestions on additional topics with sufficient specificity (for example, small farmer credit not agriculture) will be helpful and appreciated. This material will be periodically updated. Please contact Jim Cotter, PPC/CDIE, SA-14 room 524 (703) 235-8966.

BACKGROUND INFORMATION

Project Rationales:

This section explains the underlying assumptions which shape the rationales for potable water projects and whether that thinking tends to be verified or challenged by experience. IF the project is designed to accomplish specific objectives THEN the following benefits are anticipated.

Potable Water Issues:

This section acquaints people with useful observations which have proved helpful in anticipating problem areas and making impact expectations more realistic.

WHAT'S BEING LEARNED

What Tends To Work:

This is general advice about approaches which tend to be successful in dealing with operation and maintenance, financial, and administrative concerns. The advice tends to work well PROVIDED THAT most of the listed conditions are fulfilled EXCEPT WHEN any of the described constraints are present.

Site Selection:

This section lists key factors to consider when making a decision about project sites. Providing this information will assist technical assistance experts in tailoring their recommendations to the specifics of your area.

Fee Structures & Cost Recovery:

Prices vary widely and estimated averages tend to be unreliable. We have listed the key considerations affecting fee structures and cost recovery which were taken from lessons learned in project experience.

O&M Administration & Monitoring:

This section describes the advantages and disadvantages of alternative institutional approaches to managing and monitoring operation and maintenance responsibilities. Suggested forms to be used in monitoring and scheduling O&M tasks are included.

Procurement Planning:

This section contains a brief procurement planning checklist which can help project planners avoid delays and cost-overruns by anticipating constraints and obstacles.

TECHNOLOGY CHOICE

Choosing Appropriate Technology:

No single technology is appropriate for diverse project situations nor is cheaper hardware always better. This section describes the factors required to make an informed judgement.

Water Treatment Technologies:

This section describes five approaches to water purification, the advantages and disadvantages of each, and contains simple diagrams of the technology used.

Sanitation Technology Selection Criteria:

This section discusses the advantages and disadvantages of five types of on-site sanitation techniques. Information is presented on maintenance requirements, comparative construction costs and health aspects.

Selecting a Handpump:

This section describes six handpumps which are recommended as reliable and three others which are very cheap innovative pumps built with locally available materials. Sources are given for technical assistance and the results of comparative laboratory tests on others. A checklist is included suggesting the information you should give people supplying technical assistance so they will understand your needs, resources, and constraints.

Technical Assistance Resource:

This section provides the name and address of an organization which has supplied valuable technical assistance to many potable water and sanitation projects in LDCs.

Training Guidelines:

This section contains a systematic approach to training developed by the World Health Organization and fully explained in their recently published handbook. This section includes guidance on assessing skills, identifying training needs, formulating objectives and sample training modules on health and hygiene promotion, and construction of water and sanitation facilities.

INFORMATION & EVALUATION

Data Collection Guidelines:

This section provides general guidance on what types of baseline data tends to be useful to collect, and indicators for monitoring evaluations. This is a suggested framework which should be detailed and modified to meet the specific needs of individual projects in various stages of development.

AID Funding Criteria:

This explanation of AID's funding criteria for potable water projects was excerpted from the Agency's recent policy paper and explains the basis on which these decisions tend to be made. It provides an indication of what types of data are considered relevant for project designers and proposal writers.

Impact Evaluations:

This section lists AID potable water Impact Evaluations, Special Studies, and Working Papers which provide data on the performance and impacts of several projects under different conditions.

WHAT'S BEING DONE WHERE

Project Costs & Countries:

This section lists the amount of funding AID has obligated for potable water and sanitation projects in various regions and individual countries from 1973 through 1985 where data is available.

Access to Potable Water & Sanitation:

This section reports the percentage of rural and urban people with access to potable water and sanitation between 1970 and 1975 -- the most recent year for current, accurate data.

WHERE TO LEARN MORE

Bibliographic References:

This section lists bibliographic references from the World Bank, Overseas Development Administration, and WASH technical and field reports on potable water projects. Addresses are given where these publications can be obtained.

Commercial Databases:

The last section contains a list and description of commercial databases that deal primarily with water on both domestic and international levels. These databases can be accessed through CDIE/DI.

WHY FUND POTABLE WATER PROJECTS

POLICY AND PRIORITIES

The many competing uses for scarce resources demand that your project activities be cost-effective within the constraints of local circumstances.

Are potable water projects worth doing? The following factors should be considered:

o The general lack of empirically verifiable impact data means that AID probably won't be able to prove to constituencies or critics that these projects caused health benefits.

o In most cases, AID won't be able to prove that time saved because getting water became more convenient, resulted in increased income or productivity for beneficiaries.

o Projects in sparsely populated, remote areas which lack community organizations make cost-effectiveness improbable depending on the required level of expenditure, effort and technology.

o Improving the beneficiaries' personal hygiene and sanitation habits is often not a felt-need. It also tends to be a long process after which it can be difficult to attribute results to health education programs.

These frustrations and limitations are real and should be acknowledged by anyone planning, implementing or assessing potable water projects. However, there are several reasons why potable water projects are worth doing which include:

o Potable water is a basic, indispensible human need which can't be ignored.

o Although host-country levels of commitment and expenditures vary, most governments acknowledge that potable water is a development priority and tend to welcome appropriate collaboration.

o Provided communities can obtain access to water on more convenient, affordable and reliable terms, they tend to be willing to make significant financial sacrifices and contribute voluntary labor.

o Women report that potable water projects tend to provide clear benefits for themselves and their families which are appreciated. In some cases, women have been able to expand their participation in decision-making by working with water users' associations at the village level.

o Potable water projects can become the focal point for organizing development efforts and expanding the capabilities of local organizations.

o Despite the general lack of empirically verifiable impact data, beneficiaries value these projects and tend to believe they have provided health and economic gains plus upgrading their perceived status.

Our assessment of project experience indicates that AID should consider changing the rationale for potable water projects to emphasize the comprehensive community development benefits they can produce rather than health impacts. However, this is not meant to imply that these projects are not worth doing.

POTABLE WATER PROJECTS

Operational Assumptions

This paper examines the operational assumptions which form the rationale for potable water projects to see if the experience of AID and other development organizations tends to verify or challenge those beliefs.

Potable Water Project Assumptions:

Health Impacts:

IF poor people who get sick as a result of drinking contaminated water are given convenient, reliable access to high quality potable water

THEN the incidence of water-related disease will be reduced and people will be healthier

PROJECT EXPERIENCE indicates that this causal relationship is believed but can't be empirically verified as a project impact.
Editor's Note: Correlations between potable water project interventions and health impacts can be empirically verified without claiming causality. However, it is exceedingly expensive and time consuming, and would require a very large sample.

Economic Impacts:

IF water sites are conveniently located in rural areas

THEN women will save several hours of menial labor getting water and that time can be used to increase their productivity and earnings.

PROJECT EXPERIENCE indicates that time saved tends to result in increased earnings only if:

- o Production skills are adequate or needed training is provided
- o Markets will absorb additional production at profitable prices
- o Quality is competitive
- o Production is adequate to meet scale demands
- o Transportation is available and affordable

Integrated Impacts:

IF potable water projects add health education and sanitation components

THEN beneficiaries' personal hygiene and sanitation practices will improve and the desired health impacts will result.

PROJECT EXPERIENCE indicates that it takes decades for people's attitudes and behavior to change, and it is very hard to measure accurately or attribute to the project. In the case of sanitation, beneficiaries tend not to see a need to change and are reluctant to contribute voluntary labor or cash to such projects.

Local Manufacture:

IF equipment and/or spare parts for water projects are locally produced

THEN high import costs and frequent delays caused by depending on foreign suppliers can be avoided and projects will be more cost-effective.

PROJECT EXPERIENCE indicates this approach works where production skills are adequate and high quality control standards are strictly enforced. Otherwise, reliability suffers.

The following are some newly emerging operational assumptions. However, there is not sufficient data extrapolated from project experience to make an informed judgement about validity:

Local Equipment Assembly:

IF water project equipment is sent to LDC areas to be assembled locally

THEN the quality control problems of operating a forge can be avoided and people with lower level skills can assemble and distribute good equipment in a cost-effective manner.

Community Economic Viability:

IF potable water projects are only done in communities willing and able to pay recurring O&M costs

THEN the risk of depending on host country governments or external donors will be greatly reduced and potential for sustainability and replicability improved significantly.

External Water Quality Standards:

IF highly demanding external water quality standards are rejected as impractical for most LDCs and realistic local standards are substituted

THEN the quality of water provided by potable water projects can be a substantial improvement over the previous source without burdening project designers with unrealistic criteria.

WHAT TENDS TO WORK WELL?

WHAT TENDS TO WORK WELL, UNDER WHAT CONDITIONS:

These are recommendations about what tends to work well in potable water projects.

We have suggested conditions which tend to reinforce the probability of success (provided that:), and situations where failure appears almost inevitable (except when:). Experience indicates that it isn't realistic to expect all of the conditions which reinforce the probability of success to be present nor is that required. However, the presence of any of the negative factors tends to be sufficient to cause failure.

O&M COMPONENT

Given the required capabilities, training, advice, and and equipment, community users will operate and maintain water systems they perceive as significantly better than using traditional sources.

PROBABLE SUCCESS PROVIDED THAT:

* Tools are provided to communities for repairs, after receiving a security deposit to discourage theft and cover replacement costs.

* Local capabilities are developed to include common repairs, installation, laying pipe, digging trenches, backfilling, and building drainage aprons.

* Training is provided for operators, local maintenance people, engineers, and water system managers.

* Equipment is stockpiled in secure local storage.

* Equipment, spare parts, and designs are standardized to the fullest extent feasible.

* The community has a positive attitude toward self-help cooperative efforts and is receptive to training.

* The design anticipated and avoided potential health hazards and ecological damage from poor drainage.

* The design allowed for increasing demand from a growing population and doesn't exceed the limits of water supply.

EXCEPT WHEN:

* The community wasn't consulted adequately and are dissatisfied by a system they feel was externally imposed. There is no feeling of "ownership", nor acceptance of O&M responsibility.

* Appropriate lower level technology is rejected because it is considered "second class", and replaced with expensive and unnecessarily complex technology to provide status.

* Water system users don't perceive the benefits to be worth the effort of maintaining, expanding, and converting it.

* People become hostile toward the system because they suspect chemicals are being put into their water to lower fertility or cause impotence.

MANAGEMENT COMPONENT

Decentralized decision-making can be efficient and effective when the community has adequate authority, management capability, and support services.

PROBABLE SUCCESS PROVIDED THAT:

* Authority is delegated to allow community water use committees to assume full administrative and financial control and responsibility wherever feasible.

* Women are involved as fully as possible in decision-making.

* Monitoring provides accurate and adequate feedback of management information about progress and problems.

* Adequate training in record-keeping, procurement, and planning is provided for managers.

* Construction crews are fully staffed and local water users' groups mobilize and supervise voluntary labor.

* There are binding agreements regarding all conditions precedent for disbursement of required project funds.

* A procurement plan is prepared to reduce delays and clarify procedures regarding waivers, approvals, and special permissions.

* A full-time supervisory engineer and environmental sanitation person are available to avoid design, health, and conservation problems.

* Specific agreements exist regarding respective roles, responsibilities and accountability when the project is implemented by more than one ministry, NGO or PVO.

* Data was gathered at the planning stage on the intended uses of water, preferences, expectations, and constraints with substantial input from the community women water users.

* All institutions providing support services critical to the success of the water system projects are willing and able to function within minimum acceptable performance criteria.

EXCEPT WHEN:

* Management capabilities are hopelessly over-extended because the project's scale is unrealistically large.

* Bureaucratic in-fighting over who has jurisdiction results in undisbursed funds and unavailable personnel.

* Procurement delays are so prolonged that community momentum and political will erode, and costs soar.

* Control is centralized in an area remote from the project activities and decision-makers do not receive valid data on water users' needs, local constraints, or serious risks.

* Design assumptions and expectations are invalid, resulting in intolerable health hazards, ecological damage and waste.

* Competing government ministries co-opt transportation and gas which water system T.A. staff need to work. Monitoring, follow-up training and support services become inadequate, unreliable, and O&M deteriorates.

FINANCIAL COMPONENT

Host country governments and donor agencies tend to fund installation costs but lose enthusiasm for ongoing maintenance costs. Potable water systems must become financially self-sufficient as quickly as possible, with the community users paying all recurring O&M costs.

PROBABLE SUCCESS PROVIDED THAT:

* Fees are set realistically (affordable, yet adequate).
* Community income-generating activities (fiestas, co-ops, etc.) can meet O&M recurring costs.
* A locally administered loan fund provides start-up funds as required.
* Up-front payments are made to stockpile hardware.
* Block rates established for basic needs, higher rates for income-generating uses and amenities.
* Installation costs are covered in the proposal budget.
* When feasible and appropriate, PL-480 generated funds are used to pay short-term O&M costs.
* AID disbursements are regionally focused, phased on a yearly basis and conditional on completion of agreed upon realistic and flexible benchmarks.

EXCEPT WHEN:

* The community is unwilling to pay because the quantity of water is inadequate, access is inconvenient, and the service is unreliable. The old source is free.
* The community over-estimated its ability to pay and depended on subsidies no longer available to them.
* People who refused to help build or maintain the system now demand the same service at the same price as the others. The community cannot resolve the dispute equitably.
* People get water without paying, causing resentment and refusal to pay for what others are getting free. Those abusing the fee structure are allowed to continue.
* Fees are set much too low for social or political reasons.
* An agency external to the community keeps the collected water fees and does not use them to maintain the system.
* Foreign exchange is unavailable for necessary purchases not available locally or of unacceptable quality.

WHAT IS BEING LEARNED?

EVALUATION SUMMARY
POTABLE WATER PROJECT EXPERIENCE

PURPOSE

This study synthesizes the experience of AID and other development organizations with potable water projects around the world. The purpose is to share what has been learned from this experience with planners, designers, managers and evaluators of potable water projects.

Source Materials

AID source materials used to prepare this report include:

- Project Impact Evaluations
- Program Evaluation Discussion Papers
- Policy Paper
- Program Evaluation Report No. 7
- Several Special Studies
- Agency-Wide Working Group Reports
- Conference Recommendations and Notes

Other Organizations Providing Source Materials Include:

- The World Bank
- UN Development Program (UNDP)
- Inter-American Development Bank (IDB)
- World Health Organization (WHO)
- CARE
- Pan American Health Organization (PAHO)
- Water and Sanitation for Health (WASH)
- International Statistical Program Center, U.S. Census Bureau
- Georgia Institute of Technology, Engineering
- Experiment Station
- London School of Hygiene and Tropical Medicine
- International Reference Centre (IRC) for
- Community Water Supply (Literature Search of 145
- Relevant Works)
- Several Other PVOs and NGOs

STUDY FOCUS

The study focuses on several key questions:

(1) Impact: Have potable water projects had discernable impacts on the following objectives:

- Improving Health and Nutrition?
- Increasing Productivity and Income?

- o Saving Time and Labor?
- o Improving Perceived Quality of Life?

(2) Performance: Have these projects been successful in terms of achieving:

- o Accessibility?
- o Convenience?
- o Potability?
- o Affordability?

(3) Lessons Learned: What have we learned about critical factors affecting project impact and performance?

- o Beneficiary Participation?
- o Technology Choice?
- o Institutional Aspects?
- o Financial Aspects?

(4) Recommendations: What key recommendations can be drawn from project experience to guide future policy and project decisions?

IMPACT

(a) Improving Health and Nutrition

While it is widely perceived and believed that providing adequate quantities of quality water causes a positive impact on health, it does not tend to be statistically verifiable.

Theoretically, potable water projects provide safe drinking water which can improve health by reducing the incidence of water-borne diseases and diarrhea. Making sufficient quantities of water available can also facilitate bathing, hygiene and cleaner houses which tend to improve health. Excreta disposal facilities and/or health education may also affect health.

An adequate water supply can improve health when used to grow small vegetable gardens which supplement the family's diet.

However, project experience suggests that provision of safe water and basic sanitation are probably necessary but not sufficient for achieving good health. Other factors must also be present, including: good diets, hygiene, medical care and adequate shelter.

The AID policy paper admits . . . The provision of basic sanitation and a reliable supply of safe, convenient water

is not sufficient to guarantee improved health".

" neither improved water supply nor any other single health promoting activity can, by itself, fully meet the health objectives of LDC's in any reasonable time frame."

An Asia Bureau policy statement agrees ....

The AID Asia Bureau has a policy against programming water projects on the basis of their ability to provide health improvement. "It is unlikey that AID and other donors will have the resources at any time soon that would permit construction of water supply that would bring about statistically significant improvements in infant and child mortality rates," 1980 policy statement.

Assessment of project evaluations also agrees . . .

An assessment of potable water projects from AID and other development agencies strongly tends to agree that health impacts can't be reliably attributed to providing quality water.

A recent U.S. Census Bureau Study of a Philippine water project found . . .

The Buden evaluation was "highly quantitative" and "designed to measure actual project output delivery as well as project purpose and goal achievement." These surveys were conducted before the project-sponsored water system enhancements were made, shortly after they were completed and approximately five years later. The following observations were made on the basis of empirical testing:

- "The study revealed no clear evidence of substantial positive health impact. There was no significant direct association between the source of water and health when socio-economic variables were controlled. Installation of an improved water source alone was not found to be sufficient to result in improved health."

- The variables having the strongest impact on childhood health were the nonwater-related variables, income and diet. Water had a positive, direct impact on health

only among higher income households (the upper 25% income group).

- "Providing improved water to households which already enjoy a reasonable standard of living as well as access to adequate sanitary facilities and sound hygenic practices should result in improved health. On the other hand, providing improved service to households where those preconditions are not present is not likely to bring about significant health impacts."

- There may be long-term impacts. "The 5 years allowed in this study for health impact to appear may not have been sufficient for those impacts to mature. The requisitive behavioral changes in the study population (e.g., improved water-handling and sanitary practices) do not occur that quickly."

- "Significant increases were observed in the proportion of system user households engaged in gardening for home consumption. Many households apparently also spend less time fetching water was a result of the project. The data do not, however, permit the economic value of these impacts to be calculated.

AID should not fund longitudinal studies with quasi-experimental designs to get quantifiable data to verify health impacts from water and sanitation projects. AID's experience with this approach indicates that there are too many exogenous factors, changing conditions and measurement problems to prove statistically health impacts attributable to the project.

WASH consultants conclude . . .	"Detailed and expensive efforts to do studies of benefits are not favored and usually not a worthwhile investment of time and resources," WASH (AID water and sanitation consultants) conclude.
The Census Bureau Study concluded . . .	That conclusion is reinforced by a US Census Bureau International Statistical Programs Center study of Philippine water projects completed in June of 1984.
	"Many of the important health and economic impact indicators are difficult to measure accurately and quite sensitive to even minor changes in field and processing procedures."

"Quasi-experimental design studies are likely to deteriorate over the life of the experiment, due to migration into and out of the study population and other external factors. Under such conditons, it is very difficult to attribute observed changes unequivocally to the project intervention."

The Trouble with Studies .

*They take so long that conditions change
*Frequent staff turnovers
*Deficient data, and processing errors
*Changes are also attributable to external factors
*Escalating costs and shifting government priorities
*Isolating "control groups" isn't feasible

(b) Increasing Productivity and Income

As with impact on health, statistical evidence of the impact of potable water projects on increased productivity or income is generally lacking.

In theory, if projects provide adequate quantities of water in convenient locations, this may affect productivity, employment and income in several possible ways. Time saved by water carriers, particularly women and children, may be used more productively. Small family businesses, such as growing vegetables, raising livestock or making craft products, may become possible. When safe water improves, health, labor productivity and earning potential could increase.

However, potable water projects alone are probably not sufficient to increase productivity, employment or income unless other opportunities and support systems are available. For example, are markets, transportation, credit and technical assistance available and affordable?

Women in Panama report that AID's potable water project has enabled them to produce and market more straw hats and "molas" (small, decorative wall hangings). Cuna indian women report that their monthly production of "molas" has doubled and even tripled in some cases.

(c) Time Savings and Other Benefits for Women

Our assessment of project experience indicates that AID's potable water projects tend to benefit women comprehensively. There is a concensus that these benefits are real and valued by beneficiaries.

AID's potable water projects have resulted in the following benefits for women:

- Women have the obligation to carry water, so they benefit directly and primarily when access becomes more convenient.

- The many hours of menial labor they save can be used for teaching and playing with their children, learning new skills and/or enjoying leisure time recreation.

- Carrying water competes directly with school attendance and can require as much as six hours a day under the most demanding conditions. This can cause girls to drop out of school. Girls with more education tend to have smaller and healthier families.

- Many women report that potable water projects provided their first opportunity to participate in decision-making on issues which affect the quality of their lives.

- Some women who participate in water associations learned planning, organizational and financial management skills.

- Women with experience in successful potable water projects form attitudes and aptitudes conducive to cooperative problem-solving.

- Women also had an active role in setting users' fees so that they were adequate to pay operating and maintenance expenses but did not exclude poorer people.

- Women also reported that they used the water to grow vegetables in household gardens which diversified their families diet and served to improve nutrition levels. In some cases they were able to sell some of the crop.

(d) Perceived Benefits

It is difficult to prove statistically that improvements in the health or incomes of beneficiaries are attributable to AID's potable water projects. They have probably contributed to these objectives where other necessary conditions were also present, but proving casual relationships is very difficult if not impossible.

How can the success of water projects be measured? One way is to consider whether beneficiaries perceive the project has

improved their quality of life. Another approach is to assess whether beneficiaries support the project and use the water site.

PERFORMANCE

CRITERIA

Because of the difficulties of measuring the ultimate goals of potable water projects, one needs to search for measures of project "success" at another level.

We suggest that criteria for effective project performance should be based on the utilization beneficiaries make of the water sites, the value they place in them, and their willingness to contribute to system maintenance.

From the users' perspective, several attributes of water sites are important if they are to be used, valued and supported:

- Accessibility
- Convenience
- Reliability
- Safety
- Affordability

Accessibility - Users tend to place high priority upon availability of adequate quantities of water. AID has determined that about 20-40 liters per capita per day is the desired target level to meet basic domestic requirements.

Equity of access by various socio-economic target groups is also a consideration. Inequity can lead to vandalization and social disruption.

Convenience - Users will value the project water sites if they are more conveniently located, saving time and labor.

Reliability - When the water supply from a site is not continuously available throughout the year, due to seasonal droughts or frequent equipment breakdown they are not valued by beneficiaries. They are often vandalized or allowed to decay.

Safety - In many developing countries, the quality of the water for health reasons is often of less concern to the beneficiaries than other characteristics, such as quantity or convenience. Nevertheless, in countries with a high incidence of water-borne disease, beneficiaries may be aware (or can be made aware) of the benefits of potable water.

Affordabilty - Another consideration, which acts as a constraint, is the affordability of the water project. Costs depend upon type of water source, geological formations, population densitities, technology choice and other factors. Experience indicates that, in most cases, effective project performance requires that user fees must cover most of the project's operating and maintenance costs.

User needs assessments at the project design stage are the best way of obtaining the users' perspective on water needs and the attributes a system has which makes users willing to pay for services.

EXPERIENCE

There have been six impact evaluations of AID potable water projects done in the following times and places:

- Korea/(CARE) in May of 1981
- Peru (CARE/OPG) in October of 1981
- Panama in May of 1982
- Rural Thailand in May of 1980
- Kenya in June of 1980
- Tunisia (CARE) in October of 1980

These impact evaluations provided the following data on performance:

	Sites not operating/Sites needing repairs	Fee payments
Korea	"Faults existed in conception, design and implementation. Baseline data on only 1 of 6 projects." No reliability data. CARE phased out of Korea in June of 79.	Well water received as better for drinking than piped. Most homes not connected. 20% of those connected can't pay.
Peru	27 of 29 systems working 3 or 5 sewer systems working. 2 villages returned to their original water sources because flow was diminished.	The per-capita cost was $20.25. Both labor and capital costs were perceived as expensive. No shared meter data.

Panama	16 of 26 systems had good O&M, good managment and regular fee collection. Two-thirds of the water systems built from 79 to 80 had technical problems, only one-third of older systems. 2 of 13 gravity-fed systems had insufficient water during dry seasons. 3 systems had bursting pipes. Two systems could not meet the needs of a growing population.	3 of 6 diesel sites lacked funds to buy fuel. 4 of 26 had trouble paying operating costs. Monthly charges:$.25 cents (gravity) to $3.00 diesel. Users pay only 20% of costs. 10% surcharge on late payments.
Thailand	7 of the 52 systems evaluated were not working. AID hand-pumps "a complete disaster" - none found working. At 3 of 45 sites nobody drinks the water (bad taste and color) and at 11 others only "some" drink it.	32 of 45 systems operating at a profit. $8.75 per capita cost when built. When flat household fee - O&M not paid. "Most" public taps removed.
Kenya	10 of 23 water systems are working. 5 of 9 gravity fed systems are reliable. Ministry of water development has a policy not to repair communal water points.	GOK supplies only 25% of needed funding GOK pays $1,508 per private connection plus $100 annual subsidy. 95% and 59% cost overruns.
Tunisia	Two-fifths of the handpumps not working. Four-fifths of the water sites need repairs. 13 of 22 systems don't work during the dry season. All 5 of the diesel pumps don't work. Only 5 of 30 sites (17%) were visited by maintenance teams during the month the evaluation was done. Chlorine system doesn't work.	Average cost per site was $5,900. Average cost per user was $20. Most expensive site uses variable rate:$1 per mo. to nothing for poor people. No payment % data.

Lessons Learned Re: Performance Factors

The assessment of AID's experience with potable water projects has identified several key factors that affect project performance.

These factors include:

- o Appropriate Technological Choice
- o Beneficiary Participation
- o Institutional Aspects
- o Financial Aspects

(a) Appropriate Technological Choice

Technology choice is constrained by numerous factors, such as:

- o Type of Water Source
- o Type of Population Settlement
- o Geological Formations
- o Resources Available and Costs of Technology
- o Standards Desired by Beneficiaries
- o Standards Desired by Governments and Donors

Since these constraints vary from country to country and site to site, there is no one "appropriate" technology. Decisions must be made on a case-by-case basis.

However, some general observations can be made which have been found to have almost universal application.

Project Performance is more Successful if the Technology:

- o Satisfies the perceived water needs of beneficiaries
- o Is standardized to facilitate maintenance and repairs
- o Is locally manufactured and assembled to lower costs and facilitate repairs
- o Can be maintained by local communities via simple training sessions
- o Is low cost enough to enable widespread access and coverage of operating and maintenance costs via a user-fee system.

(b) Beneficiary Participation

Beneficiary participation can be an essential ingredient in the successful design and implementation of potable water projects because:

- o Water users' can suggest sites which maximize access and convenience

- o Water users' can identify local constraints and risks not easily observable by outsiders

- Water users' tend to know what fee structure is affordable and can suggest sliding rates for poorer people

- Water users' can help establish basic water needs for the community and identify other user patterns for amenities and income-generation

Beneficiary Participation Tends to be More Productive When:

- Women's role as water carriers is acknowledged and their participation is actively sought.

- Women are included in operation and maintenance training programs.

- Appropriate tools and spare parts are available in the village so that repairs can be made without delays.

- Problems are monitored and those requiring higher levels of expertise are promptly and accurately communicated to organizations providing good technical assistance.

- The reliability, quality and convenience of the new water site are perceived by users as significantly better than their previous source.

- There is a history of cooperative problem-solving at the village level and formal or informal structures exist for that purpose.

- Water users understand related ecological and health issues and perceive them as felt needs rather than external impositions by governments or donors.

- When data on user patterns, preferences and priorities is gathered during the planning and design stage and affects those decisions. Token participation or data collection after the project has been implemented, does not tend to be productive.

- When the project design and/or the technology selected are not overly complex for local operation and maintenance or culturally incompatable.

(c) Institutional Aspects

Project experience indicates that both the attitude and aptitude of implementing organizations affects the success of

potable water project. This tends to be true of host countries as well as technical assistance and training support service organizations.

Project Performance Tends to be Improved when Institutions:

- Have a commitment which goes beyond the installation phase to include recurring operation and maintenance costs.
- Develop both management and maintenance capabilities at the user level thereby decentralizing decision-making authority and competence.
- Provide adequate, appropriate, timely project services which meet or exceed minimal acceptable performance standards and quality controls are enforced.
- Budget allocations are fixed over the life of the project and not subject to reallocation in response to political expediencies.
- Qualified personnel and counterpart trainees are available in adequate numbers and for sufficient lengths of time.
- Maintain good communication with water users and monitor the project so that problems can be detected and corrected without delay.
- Develop the leadership potential of local human resources rather than prolonging or intensifying dependency on outside expertise.

(d) Financial Aspects

Project experience indicates that potable water projects must charge sufficient fees to become financially self-sufficient without becoming unaffordable for the targeted beneficiaries. Equity concerns are best served by subsidies and/or sliding fee structures using low cost block rates for basic needs and higher rates for ammenities and income-generation.

Financial Aspects of Potable Water Projects Tend to be Successful When:

- Water user fees are high enough to cover recurrent costs but no so high as to be a disincentive.

- There are known and accepted penalties for delinquency and default which are applied fairly and enforced promptly.
- Water user fees are collected by community organizations and stay in the community to cover O&M costs.
- Government subsidizes the installation phase and transfers financial responsibility to rural user communities as soon as it's feasible.
- It is not necessary to sustain high transport costs in addition to paying for expensive diesel fuel imports.
- Equipment and spare parts are available at reasonable prices without sacrificing reliability and durability.
- There are no import restrictions preventing the purchase of cost-effective technology.
- Population groupings are not so dispersed and isolated that the cost of providing technical assistance or training is prohibitive.

Combine next three pages →

RECOMMENDATIONS

RECOMMENDATION: AID SHOULD CHANGE THE PRIMARY EMPHASIS OF THESE PROJECTS FROM HEALTH INTERVENTION TO PROVIDING WATER FOR BASIC NEEDS.

HEALTH GOAL NOT FEASIBLE

"The provision of basic sanitation and a reliable supply of safe, convenient water is not sufficient to guarantee improved health," the AID Potable Water policy paper admits.

". . . neither improved water supply nor any other single health promoting activity can, by itself, fully meet the health objectives of LDC's in any reasonable time frame."

RECOMMENDATION: AID SHOULD FUND NO POTABLE WATER PROJECT LACKING INPUT FROM WOMEN ON NEEDS ASSESSMENT, LOCAL WATER USE PATTERNS, SITE LOCATION, LOCAL CONSTRAINTS AND FEE STRUCTURES.

WHY NOT? Our assessment of project experience strongly suggests that some design and implementation problems could be averted if water use patterns, priorities, expectations and

constraints were better understood. Women tend to be a good source for that information as well as data about what level of fees would be affordable and equitable.

RECOMMENDATION: ASSESS THE CAPABILITY OF INSTITUTIONS PROVIDING CRITICAL SUPPORT SERVICES TO WATER PROJECTS. THOSE UNABLE OR UNWILLING TO MEET MINIMUM ACCEPTABLE PERFORMANCE STANDARDS SHOULD NOT BE CONTRACTED.

Remedial training and T.A. should be provided as required to bridge the gap.

THE NEED FOR PERFORMANCE STANDARDS

Our assessment of potable water projects reveals many cases of apparently anticipatable and avoidable errors by support groups which endangered project success and/or cost-effectiveness. We are not suggesting the external impositon of rigid performance standards not responsive to local constraints. However, it is irresponsible to repeatedly contract institutions to provide support services known to exceed their demonstrated performance capabilities.

RECOMMENDATON: DO NOT AUTOMATICALLY ATTACH "ADD-ON" HEALTH EDUCATION PROGRAM COMPONENTS TO WATER PROJECTS BECAUSE THEY DO NOT TEND TO INCREASE SHORT-TERM IMPACT SIGNIFICANTLY.

RELEVANT LESSONS LEARNED

It often takes a decade or more to determine if health education projects have been able to change attitudes and behavior regarding hygiene and sanitation. Even then, it's hard to reliably attribute impacts to the project.

Health education programs are often less effective than schools and primary health promoters in changing attitudes and behavior regarding hygiene and sanitation.

SELECTING A PROJECT SITE

SITE SELECTION

Project site selection is an important decision which requires relevant information on physical characteristics, organizational capabilities, socio-cultural and political factors, technological needs, financial feasibility and other factors.

This section contains suggestions regarding factors which project experience indicates are valuable to consider when making a decision on site selection for potable water projects. The decisions themselves must be made by the individuals and organizations seeking to implement the project within different LDC environments and changing circumstances.

Water and Sanitation for Health (WASH) prepared the following general guidelines for "selecting sites where water and sanitation interventions are needed and determining the general nature and scope of the interventions." (Tech. Report # 10)

Problems and Needs:

1. Identify the current problems and needs of the community This may be done in the following manner:

   (a) Define the range of relevant water and sanitation problems.
   (b) Estimate the relative urgency of the various problems.
   (c) Collect sufficient information to accurately define the major problems and their corresponding needs. This information may be drawn from statistics, meetings, reports, files, statements of officials & villagers and/or personal observation.

2. Define an objective for dealing with the problems that is consistent with community preferences, host government goals, and USAID policies.

3. Review the water and sanitation problems identified by government, as well as those identified by other creditable institutions.
4. Identify a core set of water and sanitation needs that are common to both USAID and national government development objectives.

Socioeconomic Status

1. Determine the most relevant national poverty status indicators. Compare these indicators with current USAID targets and with other nearby countries.

2. Determine the most relevant national development performance indicators. If possible, compare these indicators with those of other countries at the same per capita GNP level.

3. Determine the Physical Quality of Life Index (PQLI) for the country and compare it to other countries in the region.

4. Use the above indicators to determine socio-economic strengths and weaknesses in the program area.

Level of Technology

1. Survey the program area for examples of successful water and sanitation technologies. It is rarely necessary to introduce radically different levels of technology.

2. Identify water and sanitation systems preferred by people in the program area.

3. Define a hierarchy of socially feasible technologies. Use level of service as a means of establishing hierarchies.

4. Make preliminary cost estimates of each different technology in the above hierarchy.

Support Conditions

1. Identify the existing conditions and available program resources necessary to support the selected technologies. These may include:

   (a) National and regional institutions.

   (b) Technical, managerial, and skilled manpower.

   (c) Equipment, supplies, materials, and money - both domestic and available from foreign sources.

   (d) Infrastructure, such as access roads, government supply offices, and power and fuel supplies.

   (e) Environmental suitability, with particular reference to water sources, soil characteristics, groundwater quality, seasonal temperature variations, rainfall frequencies, etc.

2. Determine the major complementary investments needed to correct any resource deficiencies noted above. Identify whether these investments can be made part of the proposed water and sanitation program or whether they must be part of a separate program. Indicate whether any essential complementary investments can be found in current or proposed separate programs. Complementary investments within water and sanitation programs often include health education and operator training, while those in separate programs often include general training and infrastructure development.

A few general relationships regarding the choice of preconditions for specific situations can be highlighted:

1. Problem Identification

   (a) Water and sanitation problems that are mutually recognized by the national government, the local community and USAID should have highest priority.

   (b) Water and sanitation needs should lead to the eventual solution.

   (c) The above needs should be "felt" and expressed by the affected population.

2. Socio-economic Status

   (a) Demographic statistics are more important in densely populated communities than in sparsely populated ones.

   (b) A social wealth index is useful in assessing both the technological sophistication of the community and its ability to pay for water and sanitation improvements.

   (c) The status of existing water and sanitation facilities, as measured by assessibility, quantity, and reliability, is important for all types of proposed facilities.

3. Level of Technology

   (a) For sanitation systems, increasing the level of service generally implies higher costs, greater design sophistication, greater maintenance needs, lower reliability, and more ultimate health, social, and economic benefits.

   (b) For water supply systems, increasing the level of service generally implies all of the above factors plus greater time savings.

   (c) High levels of technology are generally more acceptable in communities with high socio-economic status.

4. Support Conditions

   (a) Support conditions become more essential as water and sanitation systems become more sophisticated.

   (b) The key aspects of existing conditions are the availability of project inputs (labor, equipment, materials, finance), community organizations, community concern, development infrastructure (roads, schools, communications, and environmental conditions (rainfall, ground water, soils).

(c) There will be a need for complementary investments in water and sanitation projects to the extent that existing conditions are unable to properly support the chosen technology.

(d) Induced conditions will generally occur faster in infrastructural factors, such as roads, workshops and fuels supplies, and slower in human resource factors, such as manpower training and organizational development.

5. Benefit Potential

(a) Priority should be given to predicting short-term behavioural and institutional changes.

(b) For the prediction of health benefits, the most important behavioural changes involve water use and sanitation practices, while the most important institutional changes involve community-based organizations and maintenance programs.

(c) Long-term health, social well-being, economic and environmental quality impacts should be related to initial program needs and should logically follow the occurence of short-term behavioural and institutional changes; however, no attempts should be made to quantitatively predict these impacts.

(d) In general, the most important changes in support conditions are those involving personnel skills, local institutions, and community motivation.

Guidelines proposed to tbe World Bank for the Water And Sanitation ~~Project Identi~~fication Report (Grover, 1981) include the following aspects:

1. Definition of intended beneficiaries of the project, with a map showing the project site;

2. Statement of how the proposed project is in accordance with national and regional development strategies;

3. Brief description of the present water supply and sanitation services in the project area and deficiencies of these systems;

4. Existence or need for a strategic plan to guide the long term development of sector services in the project area. List of relevant background reports such as regional development plans, water resources studies, reconnaissance reports, etc;

5. Project objectives, including numbers and types of people to be served, anticipated standards of service and expected conditions in the project area after the project is completed;

6. Outline of proposed components of preferred project, including physical systems and software. Also outline of possible alternative projects for initial implementation;

7. Preliminary estimates of total and per capita costs for implementing the preferred project, including the annual costs of future operation and maintenance. Indication of anticipated sources of capital and operating funds, with explicit reference to prospects for assistance from international agencies;

8. Indication of institutional reponsibilities for the pre-feasibility and feasibility stages of project preparation. Also cost estimates and proposed souces of finances for these planning stages;

9. Outline of policy issues which need to be resolved before the project can proceed;

10. Preliminary terms of reference for pre-feasibility stage:

11. Schedule for all future stages of project development, indicating earliest date when project might be operational;

12. Recommendations for future action.

The World Health Organization (WHO) advocates the following checklist (Whyte, 1980) for assessing the social and economic potential for community education and participation:

1. What are the relative proportions of nucleated and dispersed populations which need services?

2. What socio-economic issues exist which may influence the socio-economic potential of a community for participation and education?

3. What religious or ethnic beliefs exist which may influence the community's social and economic receptivity for education and participation?

4. What is the economic base of communities which can be used to pay for services?

5. What levels of education can be expected?

6. What rights and obligations exist between members of a community?

7. What access to media do communities have?

8. What are the traditional water rights and beliefs?

9. Are there major social and cultural differences within communities?

10. Who are the best community leaders for water supply and sanitation projects?

11. What aspects of community decision-making patterns need to be considered?

12. What traditions of self help exist?

13. What has been the role of women and what is the potential for change over the next 10 years?

14. What health related attitudes and practices must be taken into account?

15. What is likely to be the community's willingness and capacity to pay?

Editor's Note: Whyte provided an additional checklist of factors for each of the 15 questions listed listed above.

At the USAID Project Paper stage, social analysis is focused on the operational linkage between the proposed project and the intended participants and beneficiaries. According to USAID Handbook 3. , the social analysis must assess the extent to which the proposed project is consistent with the following principles:

1. Compatibility

   - Describe the socio-cultural environment.
   - Summarize how the needs and capabilities of participants and beneficiaries have been taken into account.

2. Participation

   - Summarize the extent of beneficiary input to project design.
   - Describe how successful participation in project implementation/operations will occur.

3. Equity

   - Discuss features of the project that will facilitate the flow and equitable distribution of benefits.

4. Impact

   - Discuss how participation in the project will lead to benefits.
   - Discuss how beneficial activities will be sustained after USAID funding has ended.
   - Discuss how project activities can be replicated or spread.

USAID Handbook 3 indicates that carry out the above social soundness analysis could require between several weeks and several months, depending on the size of the project area. It stresses that precision is important and quantitative data should be developed wherever possible. However, because of the use of social variables, no specific quantitative criteria, such as those given for economic feasibility studies, are given for social soundness analysis.

PROJECT PREPARATION INFORMATION

WHO has provided guidelines to assist developing countries seeking external assistance for water supply and sanitation projects. WHO has a two-page data sheet (WHO,1981) summarizing project information needs, which contains the following main elements:

1. Describe the scope (type of work and activities involved in the project.

2. Describe the project (existing studies, how the project fits into national development plan, relationship of the to other projects, degree of communitity participation expected).

3. Describe the responsible government agency.

4. Describe the project's institutional support (operation and maintenance support, recurrent cost basis of the project, and the organization(s) responsible for implementation).

5. What is the duration of the project and each phase?

6. What is the starting date?

7. What is the estimated cost?

8. Describe the government inputs (personnel, equipment and supplies and funds).

9. Describe the external inputs (personnel, equipment and funds).

10. Describe sector development performance (related projects and government support to the sector).

11. Describe the outputs (studies, institutional aspects and investments that will come out of the project).

12. Assess the government's commitment and priority (is the project in the national development plan and what priority is it given).

13. Describe the expected benefits (which population will benefit, expected improvements in health and socio-economic conditions and personnel expected to be trained).

The overall procedure for the appraisal of water supply and sanitation projects within the World Bank (World Bank, 1980d) follows the six steps summarized below:

1. The water supply and sanitation sector:

   Describe the sector, the principal organizational entities, and the rural communities; provide information on national targets for service, planning, financing and institutional development; describe local contributions in lablr and materials and existing efforts in sanitation and health education.

2. Previous Bank involvement in rural water supply and sanitation:

   Describe completed and on-going projects; assess performance of executing agency; assess role of government counterpart funds and degree of community self-help; describe operation and maintenance requirements; assess overall system designs.

3. Existing water supply and sanitation conditions in the project area:

   Describe the areas, basic socio-economic data, health problems, levels of service, water resources, and rural population characteristics; identify participating agencies and assess their needs.

4. Description of the water supply and sanitation components of the project:

   Give basic details about the institutional, technical, and financial aspects of these components; describe the extent of community participation, the willingness to participate, and the types of training provided.

5. Project cost and financing plan:

   Describe the capital elements and outside support assistance; identify sources of financing; assess government performance in providing funds.

6. Justification:

   Describe village organization and community water and sanitation needs; assess village growth potential; compare per capita costs with other villages; assess accessibility, reliability, quantity and quality aspects.

WORLD HEALTH ORGAN TION

PWS-1

PRESENT WATER SUPPLY POSITION 19..

AGENCY: MINISTRY: _____

COMPLETED BY: _____

DATE: _____

AREA/LOCATION City, Town, etc	EST. 19.. POP. OF SUPPLY AREA (000)	POP. SUPPLIED IN SUPPLY AREA (000)	SOURCE[1] B R RN S W	SOURCE CAPACITY m^3/day	EST. GROSS PRODUCTION m^3/day	TYPE OF TREATMENT[2] A D F S	SOURCE OF ENERGY[3] D E G	LENGTH OF MAINS (Km) Transmission	LENGTH OF MAINS (Km) Distribution	NO. OF CONNEXIONS Private Metered	NO. OF CONNEXIONS Private Unmetered	NO. OF CONNEXIONS Public Standposts	NO. OF HOURS SUPPLY /day	REMARKS
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
TOTAL														

MANNING RATIO = 1 : _____

Total number in Post PWS1
Population served PWS1

KEY

[1] Source

B = Borehole
R = River/Lake
RN = Rainwater
S = Spring
W = Well with handpump
I = Impoundment

[2] Type of Treatment

A = Aeration
D = Disinfection
F = Filtration
S = Settlement

[3] Source of Energy

D = Diesel
E = Electricity
G = Gravity

[4] Remarks

If available include information on:
(a) Number of Industrial Commercial connections
(b) Government, Institutional
(c) Storage provided in cubic metres
(d) Percent of unaccounted for water.

FEE STRUCTURES AND COST RECOVERY

FEE STRUCTURES & COST RECOVERY

Fee Structures

The World Bank publication "Water Supply and Waste Disposal" and other authoritative sources agree that precise figures for recurrent costs are unavailable and estimates vary widely. The World Bank recommends that "minimum" (20 to 40 liters per capita per day) water be available to all and that the charge not exceed 5 to 6 percent of the income of the poorest household to be served. But the report acknowledges that the costs of reaching isolated groups is expensive and could be unaffordable in many LDCs.

Assessing total costs of potable water projects depends on factors which include but are not limited to the following:

- Quantity and Quality of the Water Available
- Type of Hardware Selected
- Related Training Programs and Support Services
- Administrative Fixed Costs and Salaries
- Drilling Costs
- Construction Materials (Domestic and Imported)
- Labor Costs
- Fuel Costs
- Transportation Costs
- Procurement Related Costs/Requirements and Procedures

Low Cost Options

Guidelines in this area tend to be general because specific recommendations depend on a range of project variables including but not limited to:

- Topography
- Geological Formations
- Average Rainfall and Seasonal Variations

- Clustered or Dispersed Population Clusters
- Present and Projected Needs
- Earnings of Users and Available Subsidies
- Use Patterns and Priorities
- Size of the Population to be Served

General Recommendations

Wherever possible, appropriate to the above conditions, poorer communities tend to have greater success with rainfall catchment, gravity-fed distribution from groundwater sources, potable spring water and hand-dug shallow wells when they are cost-effective. Piped connections to individual households and flush toilets are the most expensive options and tend to exclude poorer residents.

Cost-Saving Options

- Self-Closing Valves to Curtail Water Waste
- Local Manufacture of Equipment such as Well Screens Can Result in Significant Savings
- Meter Sharing to Save High Installation Costs
- Private Sector Distribution with Appropriate Equity Safeguards
- Prompt Repairs to Guard Against Water Loss
- Block Rates with Sliding Scales for Basic Needs, Amenities and Income Producing Uses.

Although responses must always be adjusted to conform to local conditions, the project experience of AID and other development organizations contain some potentially useful observations:

- A financial feasibility study of user communities is recommended to determine ability to pay start-up and recurring costs.
- Communities tend to be unwilling to pay the costs of sanitation projects because they do not respond to a priority felt need.
- Performance bonds and penalties for noncompliance have proved useful where they can be equitably enforced.

- Many residents of urban slum areas do not contribute to the tax base because of their marginal economic status. Tax based subsidies tend to be the best approach because individual users are not financially accountable.

- Selling water through the private sector effectively excludes poorer residents who are unable to pay and runs the risk of monoply price fixing. This approach can have high political and social costs.

- The direct costs of running regional offices and training middle management for potable water projects are best paid through tax revenue.

- Standpipes tend to be considered "public goods" and cost recovery is improbable.

- Initial subsidies, especially in areas with a water-related health emergency, tend to produce a favorable cost-benefit assessment. However, these subsidies tend to become permanent unless community income-generating programs can be developed. When income benefits are water related, users are less reluctant to absorb costs rather than risk losing the service and the income it generates.

- The input and participation of women has proved highly valuable in collecting water fees and safeguard equity considerations so the poor people without the ability to pay are not excluded.

- Financial viability and sustainability tend to correlate with the ability of community water users' associations to set fees high enough to cover recurrent costs and administrative control revenue. Organizations with the ability to raise funds locally to supplement fees and off-set emergency expenditures tend to have greater potential for long-term success.

Table 8. Alternative Water Tariff Structures

RATE STRUCTURE	ADVANTAGES	DISADVANTAGES
Lump sum before start of project	-simple -extent of cost recovery is known before construction	-no incentive to conserve water -unlikely to cover O&M costs -unfavorable cash flow for individuals, possibly reducing the contribution
Flat rate/month	-simple -establishes principle of recurrent cost -favorable cash flow for individual, possibly increasing contribution -can be increased for unusual costs or inflation	-no incentive to conserve water -collection after system installed requir strong institutions and sanctions
Flat rate/unit volume	-same as with flat rate/month -encourages water conservation	-requires attendant at public taps -requires expensive and difficult to maintain water meters for house connections
declining rate/unit volume	-same as with flat rate/unit volume, but encourages conservation less, consumption more.	-same as with flat rate/unit volume -economically less efficient, penalizing lower volume consumers
increasing rate/unit volume	-same as with flat rate/unit volume but encourages more conservation -subsidizes poorer consumers	-same as with flat rate/unit volume -economically less efficient, favoring lo volume consumption

INSTITUTIONAL ARRANGEMENTS

This section contains a brief description of four administrative configurations which could be used to manage potable water projects. The four alternative approaches could be characterized as:

- o External centralized decision-making/and control with no role for the user community other than passive recipient.
- o External centralized decision-making and control with the community supplying construction materials and labor.
- o Joint decision-making and control with the user community fully participating in all stages.
- o Community decision-making and control with the government providing technical assistance.

These four alternative approaches to management of a potable water project are assessed according to the following capabilities and characteristics:

- o Construction
- o Routine Maintenance
- o Major Repairs
- o Financial
- o Extent of Training
- o Community Participation
- o Advantages & Disadvantages

The next two pages are sample/formats for recording maintenance and repair. The first could be used to record the maintenance and repair history of equipment used in the project and the second records relevant data regarding shallow wells. Their purpose is to keep accurate records of what type of work was done, when, by whom, using what materials, how long it took and how much it costs.

The other two formats in this section recommend, describe and record preventative maintenance schedules for a diesel engine and a shallow well with a handpump. The formats display data on how often, specific preventative maintenance tasks were performed, whose responsibility they were and what materials need to be provided. These preventative maintenance check-lists are valuable for mointoring or supervising tasks and record-keeping.

Table 7. Alternative Institutional Arrangements

LIKELY CHARACTERISTICS	I. External Agency Responsible for All Planning Design, Implementation, OMR	II. External Agency Plans, Designs, Supervises Construction; Community Provides Labor, Local Material, & OMR	III. External Agency and Community Share Responsibilities for Planning, Design, Implementation, OMR	IV. External Agency Provides Limited Technical Assistance to Community
CONSTRUCTION	- Well-organized - High quality - Expensive	- Slower than I. - Less quality control than I. - Cheaper than I.	As in II.	- Low-quality materials - Limited construction capabilities
ROUTINE MAINTENANCE	- Nonexistent	- Rarely performed	- Perhaps some done by trained community members	- Rarely performed
MAJOR REPAIRS	- Competent staff stretched between many needs	- Not made because of lack of skills, tools	- Done by external agency	- Rarely performed
FINANCIAL	- All costs paid by external agencies out of central funds	- Agency pays for planning, design, imported materials, construction supervision - Community pays for local labor, materials, OMR	- As in II, except agency may pay portion of major repairs	- Agency only funds technical assistance
EXTENT OF TRAINING	- Trained agency staff	- Trained agency staff - Community may be trained in maintenance or health education	- Trained agency staff - Community trained in simple maintenance, request	- Trained agency staff teach, share their knowledge at community level
COMMUNITY PARTICIPATION	- Minimal, only advisory as determined by responsible agency - Complete after construction	- Nonexistent prior to construction - Some during construction	- Community participation throughout all phases of project	- Complete community control
ADVANTAGES	- Administratively clear responsibility - Technically efficient - Rapid production - Competent repair staff	- Cheaper than I. - Higher potential for community development than I.	- Greatest potential for appropriate design - Greatest potential for community development - Greatest potential for efficient OMR - Least cost to agency	- Greatest degree of community control - Widest coverage with limited technical resources of agency
DISADVANTAGES	- Greatest risk of inappropriate design - Expensive - Limited potential for community development - Health risk of failure after construction	- Slower, technically less efficient than I. - High risk of failure due to inadequate maintenance and repair - High risk of inappropriate design	- Slowest most expensive planning - Poor definition of administrative responsibility - Potential conflict over decision-making/financing	- Scope limited by funds available to community - Recurrent O&M problems - Limited potential for hygiene education

SAMPLE EQUIPMENT HISTORY CARD

FRONT OF CARD

District:

Name of Supply:

Location of Equipment:

Equipment Identification No.: Date of Installation:

Description of Equipment:

Details of Technical Specifications:

Location of Assembly Manual: Operational Manual: Spare Parts List.

REVERSE OF CARD

Record of Maintenance/Repair

Date	Work carried out	Materials, Spares, etc., used	Time taken for work	Cost	Signature

SAMPLE SHALLOW WELL HISTORY CARD

FRONT OF CARD

District: Name of Village:

Date of Installation: Location of Well:

Well Identification No.: Number of Users:

Water Quality Laboratory Reference Number and Date of Sample:

Technical Data:

A. Well

1. Hand Dug/Mechanically Dug
2. Inner Wall Diameter: m
3. Depth of Well: m
4. Average Wet Season Depth of Water: m
5. Average Dry Season Depth of Water: m

B. Pump

1. Name:
2. Type:
3. Serial No.:
4. Cylinder Diameter:

REVERSE OF CARD

Record of Maintenance/Repair

Date	Work carried out	Materials, Spares, etc., used	Time taken for work	Cost	Signature

PREVENTIVE MAINTENANCE SCHEDULE FOR A DIESEL ENGINE

Maintenance Period	Task to be performed	Materials Required	Allocation of Responsibility
Daily	(i) Check oil level and top up as necessary	Engine Oil	On-site operator
	(ii) Lubricate as per manufacturer's instructions	Lubricating Oil	
	(iii) Check all nuts and bolts and tighten as necessary	-	
	(iv) Clean outside parts of engine	Cotton Waste	
	(v) Enter up following data in operational log book	-	
	(a) Oil Pressure		
	(b) Running temperature		
	(c) Revs.per minute		
	(d) Battery Charge		
	(e) Number of hours of operation		
	(f) Total operating hours since last oil change		
	(g) Total operating hours since last overhaul		
	(h) Litres of diesel fuel consumed		
1 week	(i) Wash and clean air filter		On-site operator

Maintenance Period	Task to be performed	Materials Required	Allocation of Responsibility
1 month	(i) Dismantle injector, test spray, replace defective nozzles	Injector nozzles	On-site operator (plus maintenance team depending on level of training and competence of on-site staff)
	(ii) Check and adjust transmission belt tensions/coupling alignments	-	
3 months	(i) Check and clean injectors and valves	-	On-site operator plus maintenance team
	(ii) Check and clean oil filters	-	
	(iii) Renew fuel filter elements	Fuel Filter Elements	
	(iv) Check starting system (battery operated)	Distilled Water	
	(v) Change engine oil	Engine Oil	
1 year	(i) Check and re-grind valves as necessary and adjust valve clearances		On-site operator plus maintenance team
	(ii) Clear deposits from cylinder heads and pistons		
	(iii) Check and adjust clutch system		
2 years	(i) Complete overhaul - dismantle and replace worn and defective parts	Spare parts as required	Workshops

PREVENTIVE MAINTENANCE SCHEDULE FOR A SHALLOW WELL/HANDPUMP INSTALLATION

Maintenance Period	Task to be performed	Materials Required	Allocation Responsibil
Daily	(i) Check operation of the pump	-	On-site caretaker
	(ii) Check all nuts and bolts and tighten as necessary	-	
	(iii) Clean the concrete slab	-	
	(iv) Clean the wastewater drain	-	
	(v) Inspect and repair protective fence	-	
	(vi) Control use of area as playground/work area	-	
Monthly	(i) Check for damage, rotting of wooden handle, etc.	-	On-site caretaker
	(ii) Grease and oil all pivot points, oil wooden handle (if fitted)	Lubricating Oil	
	(iii) Check concrete slab for cracks and make temporary repairs as necessary	-	
6 months	(i) Remove and dis-assemble pump unit, rising main, cylinder, etc.. Inspect and repair as necessary	Spare parts as required	On-site caretaker plus main team
	(ii) Pump out well, remove all debris and disinfect with bleaching powder	Bleaching Powder	
	(iii) Repair all cracks in well slab, base and wastewater drain	Cement	

OPERATIONS AND MAINTENANCE

INSTITUTIONAL ARRANGEMENTS

This section contains a brief description of four administrative configurations which could be used to manage potable water projects. The four alternative approaches could be characterized as:

- o External centralized decision-making/and control with no role for the user community other than passive recipient.
- o External centralized decision-making and control with the community supplying construction materials and labor.
- o Joint decision-making and control with the user community fully participating in all stages.
- o Community decision-making and control with the government providing technical assistance.

These four alternative approaches to management of a potable water project are assessed according to the following capabilities and characteristics:

- o Construction
- o Routine Maintenance
- o Major Repairs
- o Financial
- o Extent of Training
- o Community Participation
- o Advantages & Disadvantages

The next two pages are sample/formats for recording maintenance and repair. The first could be used to record the maintenance and repair history of equipment used in the project and the second records relevant data regarding shallow wells. Their purpose is to keep accurate records of what type of work was done, when, by whom, using what materials, how long it took and how much it costs.

The other two formats in this section recommend, describe and record preventative maintenance schedules for a diesel engine and a shallow well with a handpump. The formats display data on how often, specific preventative maintenance tasks were performed, whose responsibility they were and what materials need to be provided. These preventative maintenance check-lists are valuable for mointoring or supervising tasks and record-keeping.

Table 7. Alternative Institutional Arrangements

LIKELY CHARACTERISTICS	I. External Agency Responsible for All Planning Design, Implementation, OMR	II. External Agency Plans, Designs, Supervises Construction; Community Provides Labor, Local Material, & OMR	III. External Agency and Community Share Responsibilities for Planning, Design, Implementation, OMR	IV. External Agency Provides Limited Technical Assistance to Community
CONSTRUCTION	- Well-organized - High quality - Expensive	- Slower than I. - Less quality control than I. - Cheaper than I.	As in II.	- Low-quality materials - Limited construction capabilities
ROUTINE MAINTENANCE	- Nonexistent	- Rarely performed	- Perhaps some done by trained community members	- Rarely performed
MAJOR REPAIRS	- Competent staff stretched between many needs	- Not made because of lack of skills, tools	- Done by external agency	- Rarely performed
FINANCIAL	- All costs paid by external agencies out of central funds	- Agency pays for planning, design, imported materials, construction supervision - Community pays for local labor, materials, OMR	- As in II, except agency may pay portion of major repairs	- Agency only funds technical assistance
EXTENT OF TRAINING	- Trained agency staff	- Trained agency staff - Community may be trained in maintenance or health education	- Trained agency staff - Community trained in simple maintenance, request	- Trained agency staff teach, share their knowledge at community level
COMMUNITY PARTICIPATION	- Minimal, only advisory as determined by responsible agency - Complete after construction	- Nonexistent prior to construction - Some during construction	- Community participation throughout all phases of project	- Complete community control
ADVANTAGES	- Administratively clear responsibility - Technically efficient - Rapid production - Competent repair staff	- Cheaper than I. - Higher potential for community development than I.	- Greatest potential for appropriate design - Greatest potential for community development - Greatest potential for efficient OMR - Least cost to agency	- Greatest degree of community control - Widest coverage with limited technical resources of agency
DISADVANTAGES	- Greatest risk of inappropriate design - Expensive - Limited potential for community development - Health risk of failure after construction	- Slower, technically less efficient than I. - High risk of failure due to inadequate maintenance and repair - High risk of inappropriate design	- Slowest most expensive planning - Poor definition of administrative responsibility - Potential conflict over decision-making/financing	- Scope limited by funds available to community - Recurrent O&M problems - Limited potential for hygiene education

SAMPLE EQUIPMENT HISTORY CARD

FRONT OF CARD

District:

Name of Supply:

Location of Equipment:

Equipment Identification No.: Date of Installation:

Description of Equipment:

Details of Technical Specifications:

Location of Assembly Manual: Operational Manual: Spare Parts List.

REVERSE OF CARD

Record of Maintenance/Repair

Date	Work carried out	Materials, Spares, etc., used	Time taken for work	Cost	Signature

SAMPLE SHALLOW WELL HISTORY CARD

FRONT OF CARD

District: Name of Village:

Date of Installation: Location of Well:

Well Identification No.: Number of Users:

Water Quality Laboratory Reference Number and Date of Sample:

Technical Data:

A. Well

1. Hand Dug/Mechanically Dug
2. Inner Wall Diameter: m
3. Depth of Well: m
4. Average Wet Season Depth of Water: m
5. Average Dry Season Depth of Water: m

B. Pump

1. Name:
2. Type:
3. Serial No.:
4. Cylinder Diameter:

REVERSE OF CARD

Record of Maintenance/Repair

Date	Work carried out	Materials, Spares, etc., used	Time taken for work	Cost	Signature

PREVENTIVE MAINTENANCE SCHEDULE FOR A DIESEL ENGINE

Maintenance Period	Task to be performed	Materials Required	Allocation of Responsibility
Daily	(i) Check oil level and top up as necessary	Engine Oil	On-site operator
	(ii) Lubricate as per manufacturer's instructions	Lubricating Oil	
	(iii) Check all nuts and bolts and tighten as necessary	-	
	(iv) Clean outside parts of engine	Cotton Waste	
	(v) Enter up following data in operational log book	-	
	(a) Oil Pressure		
	(b) Running temperature		
	(c) Revs.per minute		
	(d) Battery Charge		
	(e) Number of hours of operation		
	(f) Total operating hours since last oil change		
	(g) Total operating hours since last overhaul		
	(h) Litres of diesel fuel consumed		
1 week	(i) Wash and clean air filter		On-site operator

Maintenance Period	Task to be performed	Materials Required	Allocation of Responsibility
1 month	(i) Dismantle injector, test spray, replace defective nozzles	Injector nozzles	On-site operator (plus maintenance team depending on level of training and competence of on-site staff)
	(ii) Check and adjust transmission belt tensions/coupling alignments	-	
3 months	(i) Check and clean injectors and valves	-	On-site operator plus maintenance team
	(ii) Check and clean oil filters	-	
	(iii) Renew fuel filter elements	Fuel Filter Elements	
	(iv) Check starting system (battery operated)	Distilled Water	
	(v) Change engine oil	Engine Oil	
1 year	(i) Check and re-grind valves as necessary and adjust valve clearances		On-site operator plus maintenance team
	(ii) Clear deposits from cylinder heads and pistons		
	(iii) Check and adjust clutch system		
2 years	(i) Complete overhaul - dismantle and replace worn and defective parts	Spare parts as required	Workshops

PREVENTIVE MAINTENANCE SCHEDULE FOR A SHALLOW WELL/HANDPUMP INSTALLATION

Maintenance Period	Task to be performed	Materials Required	Allocation Responsibil
Daily	(i) Check operation of the pump	-	On-site caretaker
	(ii) Check all nuts and bolts and tighten as necessary	-	
	(iii) Clean the concrete slab	-	
	(iv) Clean the wastewater drain	-	
	(v) Inspect and repair protective fence	-	
	(vi) Control use of area as playground/work area	-	
Monthly	(i) Check for damage, rotting of wooden handle, etc.	-	On-site caretaker
	(ii) Grease and oil all pivot points, oil wooden handle (if fitted)	Lubricating Oil	
	(iii) Check concrete slab for cracks and make temporary repairs as necessary	-	
6 months	(i) Remove and dis-assemble pump unit, rising main, cylinder, etc.. Inspect and repair as necessary	Spare parts as required	On-site caretaker plus main team
	(ii) Pump out well, remove all debris and disinfect with bleaching powder	Bleaching Powder	
	(iii) Repair all cracks in well slab, base and wastewater drain	Cement	

PROCUREMENT PLAN

THE PROCUREMENT PLAN*

Commodities essential element of project proposal

The procurement plan -- identify needs and how to satisfy them

Plan within framework of AID regulations

Identify barriers and eliminate them early

KEY ELEMENTS OF PROCUREMENT PLAN

Determine commodity requirements

Develop description/specs

- Price and lead time estimates
- Procurement/delivery schedule

Identify potential

- Supply Sources
- Procurement agents
- Required waivers

* This material is taken from Development Associates, Inc.

Procurement Plan Checklist

I. Designation of Procurement Responsibility

A. Host Government - Specify organization or official that has authority to approve procurement activities.

B. Choice of who will procure (HB 1, Supp. B, Chapter 3)

Host country government agency
Services contractor
Procurement services agent
U.S. government agency
AID

II. Descriptive List of Equipment and Materials

A. Specifications - color, quantity, unit size, special provisions. Include source of information, e.g., catalog name and number, manufacturer's list (HB 15, App. G4)

B. Price, exclusive of freight, insurance fees

III. Procurement Budget

A. Equipment and materials cost - delivery to port of export, include inland transportation, export packing.

B. Freight and insurance

C. Compare costs on basis of FAS, FOB, and C&F, CIF

D. Contingency

E. Inflation

F. Projected costs over life of project by fiscal year

IV. Probable Source of Commodities

A. Code 000, United States, or Code 941, Selected Free World (HB 1, Supp. B, Ch. 5; and HB 15, Ch. 2)

B. Local Procurement
Indigenous goods
Shelf items
(HB 1, Supp. B, Ch. 18; and HB 15, Ch. 11)

V. Eligibility of Commodities

A. Prior approval requirements

B. Special source requirements

C. Special provisions

D. Identify any necessary waivers
(HB 1, Supp. B, Ch. 4; and HB 15, Ch. 2 and App. B)

VI. Method of Procurement

A. Excess property - (HB 16)

B. Country contracting - (AID HB 11)

Formal competitive bidding
Informal competitive procedures
Small value procurement
Proprietary procurement
Noncompetitive procurement

C. U.S. government contracting (including AID) (HB 14)

Formal advertising
Negotiation
Noncompetitive negotiation

D. Identify any necessary waivers

VII. Method of Financing

A. Direct reimbursement

B. Direct L/COM to supplier

C. Bank L/COM and letters of credit

D. Disbursements for local procurements (HB 15, CH. 9; HB 15, Ch. 2)

VIII. Shipping

A. Preparation for shipment
(Packing - HB 15, App G5; Marking - HB 15, App. G2)

B. Consolidation of cargoes for shipment

C. Transportation flag eligibility requirements (HB 1, B, CH. 7 & HB 15, Ch. 2)

D. Cargo Preference (HB 1, B, Ch. 10; HB 15, Ch. 7)

E. Marine insurance (HB 1, B, Ch. 11; HB 15, Ch. 8)

F. Identify any necessary waivers

IX. Delivery

A. Required delivery schedule

B. Arrival and disposition (HB 15, Ch. 10) - Customs clearance

C. Delivery to project site

X. Procurement Schedule

PILs or PIOs prepared - date

B. IFBs or other solicitation documents prepared and advertised - date

C. Bids or offers received - date

D. Award or contract finalized - date

E. Required delivery time - date

TECHNOLOGY CHOICE

TECHNOLOGY REFERENCE GUIDE

This section is a collection of reference information on appropriate technology for potable water projects. It is intended to provide project designers with concise and relevant technical information useful for selection of appropriate technology.

WHAT IS APPROPRIATE TECHNOLOGY?

There is no one appropriate technology for all situations. Each situation should be judged individually and decisions made on a case-by-case basis. It is not necessarily true that simple technology is always better or that cheaper hardware will be more cost-effective than more expensive equipment.

FACTORS TO CONSIDER IN TECHNOLOGY CHOICE

Factors that should be considered when selecting an appropriate technology include:

Type of Water Source

- o rainwater?
- o surface water?
- o ground water?

Type of Population Settlement

- o urban?
- o urban fringe?
- o rural village?

For Wells, Type of Geological Formations

- o Is the type of well suitable for the geological formation of the site?

Cost Considerations

- o Is the technology cost-effective for this particular site?

Maintenance Considerations

- o Can materials and equipment be maintained by local communities?
- o Can materials and equipment be manufactured in-country?

- Can technologies be standardized to facilitate maintenance?

Human Considerations

- Will the technology increase accessibility and reliability of water?
- Will the technology improve water quality?
- Is it convenient and otherwise acceptable to the users?
- Will it affect equity of access among users?

TECHNOLOGY REFERENCE TABLES

Several tables from various sources are reproduced in this section because they provide the water project designer with concise and useful information for selecting appropriate technologies.

TABLE 1: Available Technologies By Water Sources

This table provides a summary of available technological devices according to major water source, whether it is:

(1) rainwater

(2) surface water, such as ponds, lakes, steams and rivers

(3) ground water, reached by wells or surfacing of springs

The advantages and disadvantages of each technology are assessed.

The source of the information is AID Program Evaluation Report No. 7, entitled Community Water Supply in Developing Countries: Lessons Learned from Experience, September 1982.

TABLE 2: Appropriate Water Connections by Type of Population Settlement

This table summarizes the types of water connections and water sources that can be considered for different types of population settlements:

- urban
- urban fringe
- rural village

Some advice is given concerning analysis and choice among the types of water connection and water sources

The source is - - - - - -

TABLE 3: Methods of Well Construction to Extract Ground Water

Table 3 describes the main methods of constructing wells to extract ground water:

- o Hang - dug wells
- o Bored holes
- o Driven tube wells
- o Bored tube wells
- o Jetted tube wells

For each method, the table provides information on practical depths, usual diameters, and suitability for different geological formations.

The source of this information is a report entitled The Transfer of Technology To Water Supply, Sanitation and Waste Disposal Systems in Developming Countries published in 1979 by Urban Resources Consultants, sponsored by AID's Office of Urban Development.

TABLE 4: Standards for Constructing Wells

Table 4 provides recommended standards for constructing wells indifferent water-bearing formations and overburden formations. Standards are provided for:

- o diameter and depth of oversized drillhold for grout
- o well diameters for cased and uncased portions
- o minimum length or depth of casing
- o liner diameter
- o miscellaneous requirements

The source of this information is a report entitled The Transfer of technology To Water Supply, Sanitation and Waste Disposal Systems in Developing Countries. (Ibid.; see Table 3).

TABLE 5: Results of Laboratory Testing of Various Handpumps

Table 5 presents concise results of laboratory testing of various types of handpumps conducted by the Consumer's Association Testing and Research (CATR) based in the U.K.

The source is World Bank Technical Paper Number 19, Rural Water Supply Handpumps Project, produced in conjunction with the UNDP.

TABLE 6: Low Maintenance and Inexpensive Handpumps

Table 6 discusses handpumps that have come closest to the requirement for "village-level operation and maintenance" and that are inexpensive. The information was drawn from various sources.

Table 1. Technology Summary

Rainwater Catchment	Advantages	Disadvantages
Individual Private Cisterns	1. No pumping systems required 2. Gravity feed possible 3. Easily accessible 4. Low cost 5. Simple technology 6. Good quality water	1. Rainfall not always sufficient 2. Supplementary system 3. Inlets need protection 4. Catchment areas must be kept clean 5. Rainwater separators to reject first rain may be needed 6. Simple roofs of leaf and similar materials unsuitable
Individual Private Natural Catchment and Storage	1. Easily accessible 2. Low cost for overall maintenance	1. More pollution likely 2. Lower quality water 3. Frequent cleaning required 4. Greater land area required
Communal Underground Storage with Paved Catchment Areas	1. Larger storage capacity	1. High cost 2. Pollution likely, so routine disinfection required 3. Management required for maintenance 4. Low accessibility, and water must be carried
Communal Underground Storage with Natural Catchment Areas	1. Low cost/m^3 storage	1. Water quality doubtful 2. Protection of area and regular maintenance required 3. Least desirable option (except where natural remote rock catchment area exists)
Surface Water		
Rivers and Temporary Springs, Small Dams	1. Gravity feed 2. Minimum maintenance 3. Greater volume and variety of water usage possible	1. Construction sometimes difficult with high costs 2. Vulnerable to pollution 3. Possible breeding areas for vectors of disease if not properly managed 4. Supply may be variable 5. Possible contamination of water

Table 1. Technology Summary (cont.)

Surface Water (cont.)	Advantages	Disadvantages
Subterranean Dams	1. May be appropriate in arid areas 2. May be constructed with hand labor	1. Geological knowledge required 2. Subject to pollution
Ground Water		
Upland and Lowland Springs	1. Gravity feed (if upland) 2. Usually good quality water 3. Low cost construction and maintenance	1. Water may be highly mineralized 2. Yield may be limited 3. Proper design and development required to avoid growth of unsanitary areas around spring
Hand-Dug Wells (large diameter)	1. Generally low-cost construction and maintenance 2. Cheap if less than 7 meters deep 3. Yield may be increased by infiltration galleries or deepening	1. Potential for contamination 2. Possible danger during construction 3. Construction is time consuming 4. Transport of heavy lining materials 5. If depth over 7 meters, construction becomes more expensive (need for dewatering equipment)
Hand-Drilled Boreholes	1. Simple technology 2. Few skills required 3. Least expensive construction 4. Rapid construction	1. Difficult to penetrate hard rock 2. Hand pump required 3. Manual drilling difficult over 25 meters
Machine-Drilled Boreholes	1. No limit to depth 2. Water usually safer 3. Rapid construction	1. Very expensive operating costs 2. Skilled operators required 3. Pump required
Hand Pumps	1. Low cost 2. Appropriate for boreholes and hand dug wells serving small number of people (less than 200) 3. Possibility of local manufacturing	1. Not appropriate for large communities 2. Breaks often if not properly maintained 3. Parts are difficult to obtain if not manufactured locally
Windmills	1. Energy-free low maintenance 2. Continuous pumping with suitable wind velocity (5 mph)	1. Does not operate without sufficient wind 2. Pumping capacity limited

Table 1. Technology Summary (cont.)

Ground Water (cont.)		
Diesel Fuel Pumps	1. Unlimited output 2. Unlimited depth of well	1. High operation costs (fuel, transportation) 2. Relatively sophisticated maintenance
Electric Pumps	1. Unlimited output 2. Unlimited depth of well	1. Operational costs relatively high 2. Limited application 3. Relatively sophisticated maintenance
Solar Energy	1. Energy free 2. Relatively low maintenance 3. Easy assembly	1. Limited application 2. High capital costs at present time 3. Relatively fragile and easily damaged

Table 2: Appropriate Water Connections By Type of Settlement

TYPE OF AREA	TYPE OF WATER CONNECTIONS WHICH CAN BE CONSIDERED	WATER SOURCES TO BE CONSIDER
Rural Village	(a) Hand pump(s) (b) Limited distribution to: —Public fountains —Courtyard connections —House connections (c) Extensive distribution: —Public fountains —Numerous house and courtyard connections	1. Springs 2. Protected shallow wells 3. Protected deep wells 4. Infiltration galleries 5. Small treatment plants 6. Rain water collectors REMARKS Sources listed in order of cost effectiveness, safety, dependability and serviceability. Gravity systems which can eliminate need for pumping have many advantages. Treatment plants need to be avoided if possible because c difficulties experienced with operation.
URBAN	(a) Public fountains (b) Courtyard connections (c) House connections (d) Combinations of a, b, c.	1. Only the municipal system should be used unless ver unusual circumstances prohibit this arrangement REMARKS 1. Check on capacity of existing municipal system. If inadequate it must be expanded before project connectic is made.
URBAN FRINGE	(a) Public fountains (b) Courtyard connections (c) House connections (d) Combinations of a, b, c.	1. Municipal system extension. 2. Compare discounted cost c supply by connection to municipal system against discounted cost of a new supply for project area only. Select least cost solution.

TYPE OF AREA	TYPE OF WATER CONNECTIONS WHICH CAN BE CONSIDERED	WATER SOURCES TO BE CONSI
		3. Shallow or deep wells
	(e) Hand Pumps	REMARKS 1. Check on capacity of existing municipal sy: If inadequate, it mus expanded before proje connection is made. 2. If comparison of discounted costs betw two solutions is reas ably close, always se the one involving con tion to existing urba system.

able 4

RECOMMENDED STANDARDS FOR CONSTRUCTION OF WELLS
IN-DIFFERENT WATER-BEARING FORMATIONS AND OVERBURDEN FORMATIONS

ater-Bearing Formation nd Overburden	Oversized Drillhole for Grout		Well Diameter		Minimum Casing Length or depth	Linear Diameter (if req.)	Miscellane Requiremen
	Diameter	Depth	Cased Portion	Uncased Portion			
ind or gravel with an verburden of:							
Unconsolidated caving material sand or sand and gravel	None req.	None	2" min; 5" or more pref.	Does not apply	20 ft. min., but 5 ft. below pumping level	2" min.	Well scre may be ne for sandf water; mi diameter
Clay, hardpan, shale or similar material to a depth of more than 20 ft.	Casing size plus 4"	Minimum 20 ft.	ditto	ditto	5 ft. below pumping level	ditto	Well scre may be required. Fill annu space arc casing wi
Clay, hardpan, shale or similar material containing layers of sand or gravel within 15 feet of surface.	Casing size plus 4"	Minimum 20 ft.	2" min., 5" or more pref.	Does not apply	5 ft. below pumping level	2"min.	Well scre may be required. Fill annu space arc casing wi cement gr
Creviced or fractured rock such as lime-stone, basalt lava, granite or quartzite	ditto	Through rock formation	4" min.	ditto	5ft. below over-burden of rock	ditto	ditto

ater-Bearing Formation nd Overburden	Oversized Drillhole for Grout		Well Diameter		Minimum Casing Length or depth	Linear Diameter (if req.)	Miscellane Requiremen
	Diameter	Depth	Cased Portion	Uncased Portion			
eviced, shattered, or herwise fractured mestone, basalt lava anite, quartzite, or milar rock with an erburden of:							
Unconsolidated caving material chiefly sand or sand and gravel to a depth of 40 feet or more and extended at least 2,000 feet in all directions from the site.	None req.	None	6" min 5" or more pref.	6" pref. apply	Through caving over-burden	4" min.	Seat casin firmly in rock.
Clay, hardpan, shale or similar material to a depth of 40 feet or more and extending at 2,000 feet in all directions.	Casing size plus 4"	Minimum 20 ft.	6" min	6" pref.	Through over-burden	4" min.	Seat casir firmly in rock. Fil annular space arou casing wit grout
nconsolidated materials to a depth of less than 40 feet and extending at 2,000 feet in all directions.	Casing size plus 4"	Minimum 40 ft.	6" min	6" pref.	40 ft. minimum	4" min.	Seat casir firmly in rock. Fil annular space arou casing wit grout
dstone with an over-den of:							
Any material except creviced rock to a depth of 25 feet or more	Casing size plus 4"	15 ft. into firm sandstone or to 30 ft.	4" min	4" pref.	Same as over-sized drill-hole or greater	2" min.	Seat casir firmly in sandstone Fill annul space arou casing wi grout. W screen ma required sand-free water.

Mixed deposits, mainly sand and gravel, to a depth of 25 feet or more	None req.	None	ditto	ditto	Through over-burden into firm sandstone	ditto	Seat casir firmly in sandstone. Well scree may be required.
Clay, hardpan, or shale to a depth of 25 feet or more and extending at 2,000 feet in all directions.	Casing size plus 4"	Minimum 20 ft.	4" min	4" pref.	Through over-burden into sandstone	2" min.	Seat casing firmly in sandstone. Well screen may be rour required. Fill annul. space arou casing wit. grout.
Creviced rock at variable depth	ditto	15 ft. into firm sandstone	6" min	4" pref.	15 ft. into firm sand-stone	4" min.	Fill annul space arou casing wit cement gro Well scree may be required.

*Table 2 was adapted from Public Health Service Publication, "Recommended State Regulations ater Well Construction and Pump Installation Act and Regulations ", July 1965.

Table ~~A-1~~ 4-A. Alternative Methods of Well Construction

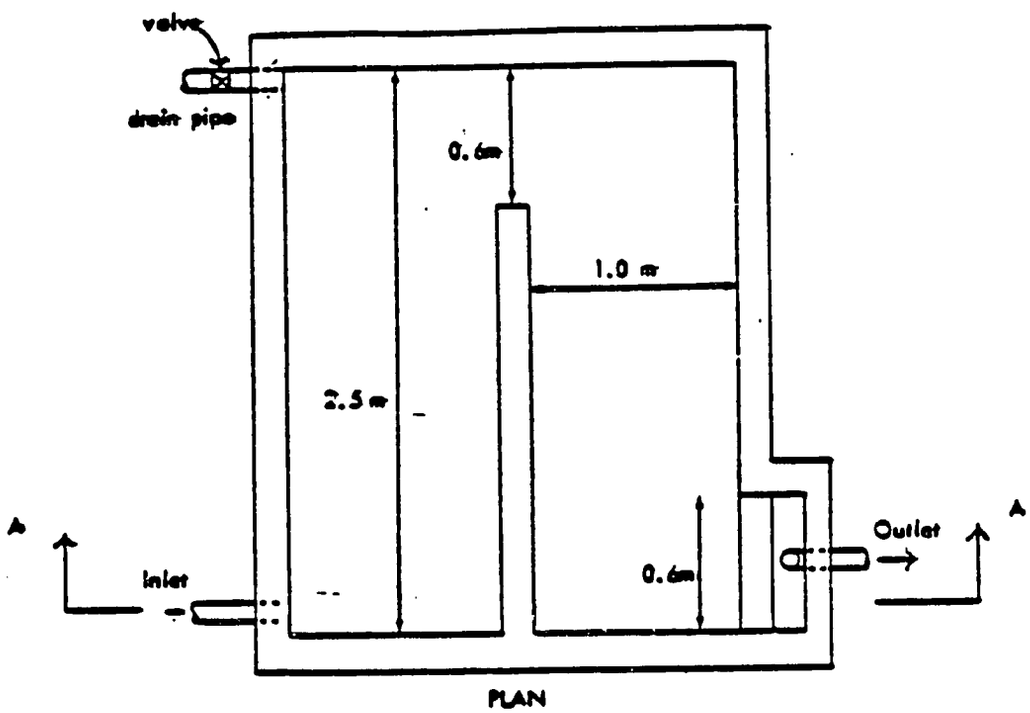
WELL TYPE	HAND DUG	TUBEWELLS				DRILLED WEL
		DRIVEN	BORED	JETTED (Sludger)	JETTED (Mechanically)	
Max. Common Depth (m)	60	10-15	15-25	30	60	as require
Principle	Hand Excavation	Drivepoint Hammered into Ground	Auger or Bit Turned By Hand	Percussion Cutting & Residue Flushing by Hand	Rotary Cutting & Residue Flushing By Pump	Mechanized Per or Rotary Dri
Suitable Soil Conditions	Any But Rock	Loose, Caving formations. No Good in Clay, Rock.	Without Driven Casing: Clay, Silt, Sand Not Subject to Caving With Driven Casing: Any But rock	Fine or Sandy Soil without Large Gravel or rocks	Anything But Hard Rock	Any
Advantages	-Low Capital Cost -Low Training Requirement -Local Resources -High Self-Help Potential	-Quick -Easy -Fairly Cheap -Simple Tools	-Quick -Easy -Fairly Cheap -Simple Tools	-Quick -Easy -Fairly Cheap -Simple Tools and Locally Built "Rig"	-Quick -Moderate Difficulty -Moderate cost	-Quick -Not Limited Type or Depti
Disadvantages	-Dangerous to Workers -Slow -Useless in Hard Rock -Requires Liner and Stable Water Table	-Limited Depth -Requires Quality Drivepoints -Useless in Rock	-Limited Depth -Useless in rock	-Useless in Rock	-Requires More Equipment Than Other Tubewells	-Very High Co -Requires Tra Personnel an lized Equipme

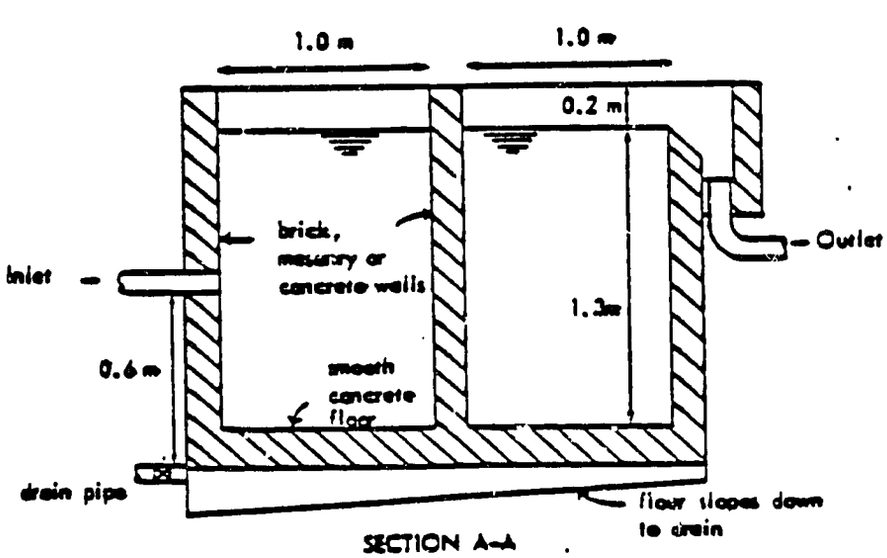
WATER TREATMENT TECHNOLOGY

TABLE B-1: SIMPLE COMMUNITY WATER TREATMENT TECHNOLOGIES

	SEDIMENTATION (SETTLING)	SLOW SAND FILTRATION	AERATION	STORAGE	CHLORINATION
QUALITY IMPROVEMENT	-Turbidity reduction -Some bacterial reduction	-Bacterial reduction -Some turbidity reduction	-Iron & Manganese removal -Odor & taste improvement -Corrosion control	-Bacterial reduction -Turbidity reduction	-Disinfection (Bacterial & pathogenic reduction)
APPROPRIATE RAW WATER CHARACTERISTICS	-Surface water Muddy or cloudy with suspended solids which settle quickly	-Fairly clear water (surface or ground) subject to bacterial contamination	-Groundwater in which Iron, Manganese, Carbon Dioxide, or tastes and odors are present	-Any	-Relatively clear but microbiologically suspect water
RELATIVE COSTS CAPITAL O & M	HIGH LOW	MODERATE MODERATE	LOW LOW	HIGH LOW	LOW HIGH
REQUIRED MAINTENANCE	-Tank cleaning	-Periodic cleaning of top layer -Maintenance of water level	-Inspection elimination of algal, insect, fungus growth on surfaces	-Tank cleaning	-Maintenance of dosing system -Check on chlorine residual -Steady supply of chlorine
COMMON DESIGN CRITERIA	Detention time: 1-4 hrs Minimum surface area: 0.02-0.04 m/m/day	Surface area = 0.36 m/m/day	No central standards: Maximum exposure and mixing of air & water	Schisto control: 2 Days	-Residual of 0.5 mg/l after 30 minutes -Residual of 0.3 mg/l at the tap
ADVANTAGES	-Simple -Effective against coarse material -Good filter pretreatment for turbid waters -Supplemental storage	-Simplest means of filtration -85-99% Bacterial reduction -All materials locally available	-Simple -Minimal O & M	-Simple -Combines improved quality with reliability of supply -Can be combined with sedimentation	-Assures microbiological quality of supply more effectively than any other process -Low capital cost
DISADVANTAGES	-High capital cost -Ineffective against fine suspended matter -Possible site for insect breeding, algal growth	-Requires good O & M -Requires Approx. 1-2m drop in water level -Poor results with algae -Possible insect, algae growth	-Uncertain, requires pilot testing for each situation -Possible insect, algal growth -Requires approx. 1-3m drop in water level	-High capital cost, as much additional storage required to improve quality -Possible insect, algea growth	-Requires high level of O & M -Requires steady supply of chlorine

Figure B-1. Sedimentation Tanks
(Cairncross and Feachem, 1978)





A sample sedimentation tank for flows up to 2,000 litres/hour.

Figure B-2
A Slow-Sand Filter
(Cairncross and Feachem, 1978)

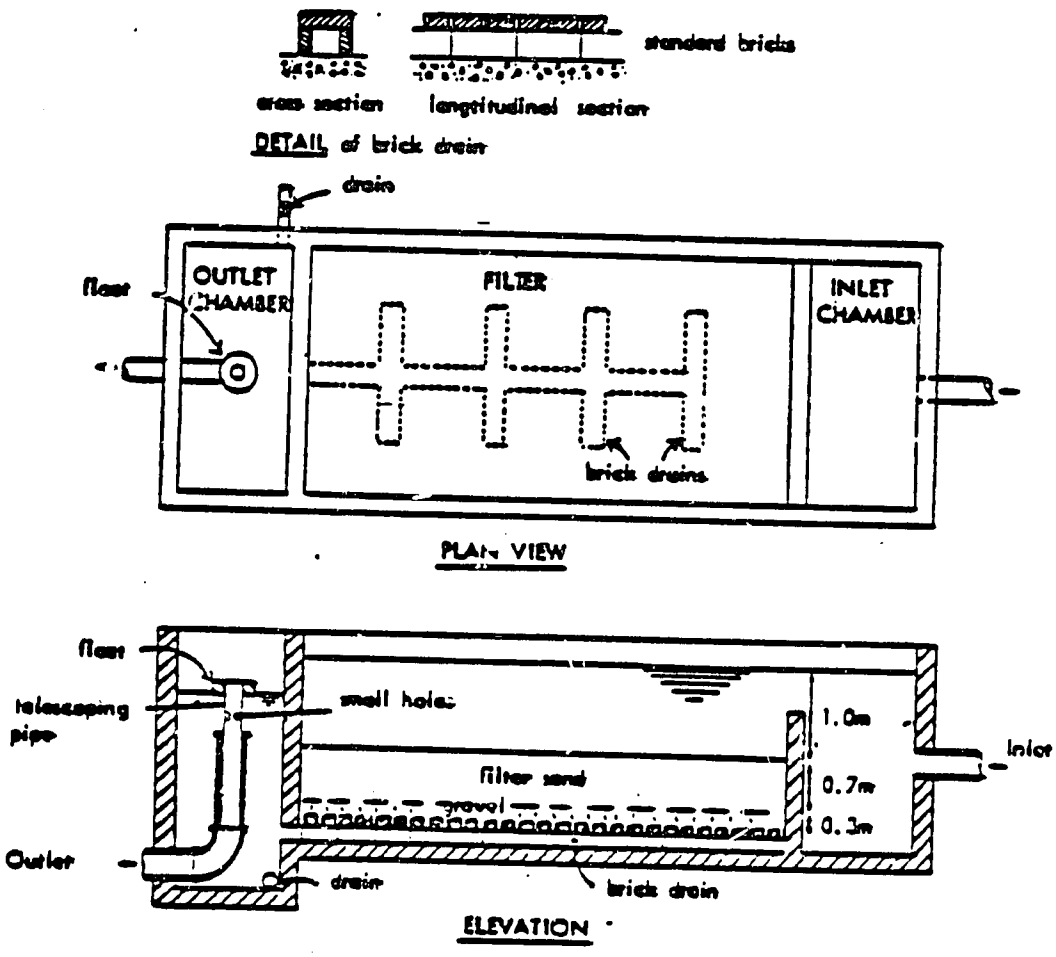
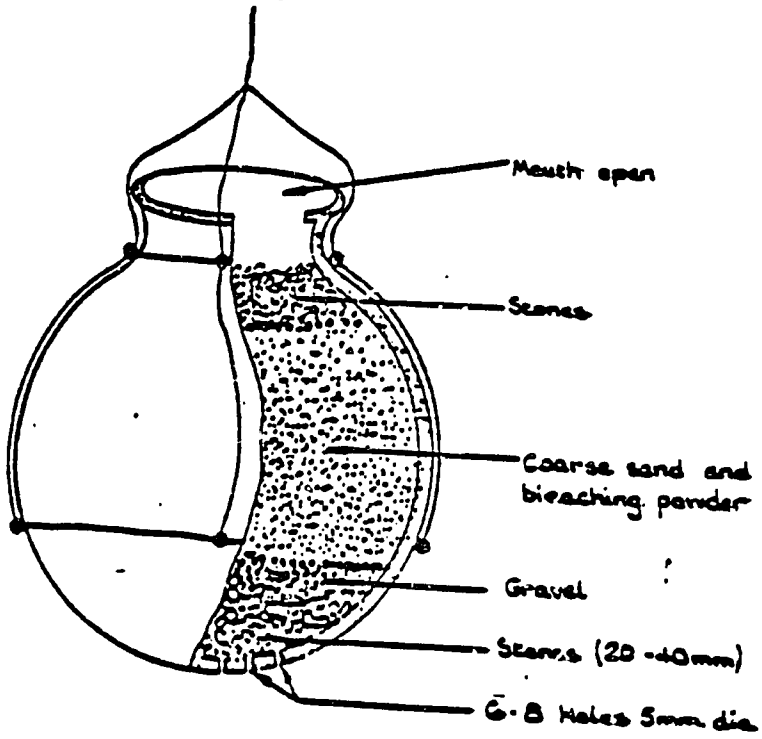
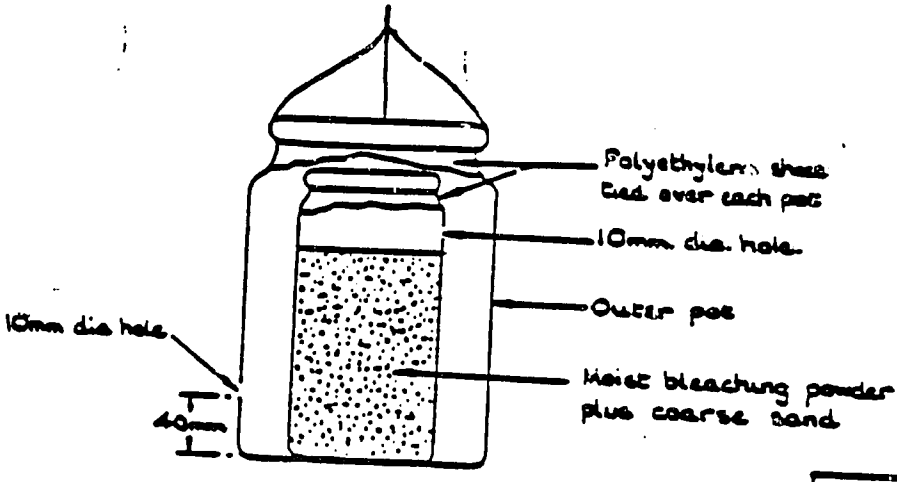


Figure B-5
The Pot Chlorinator Single Pot System and Double Pot System
(From McJunkin)



(a) SINGLE POT SYSTEM



(b) DOUBLE POT SYSTEM

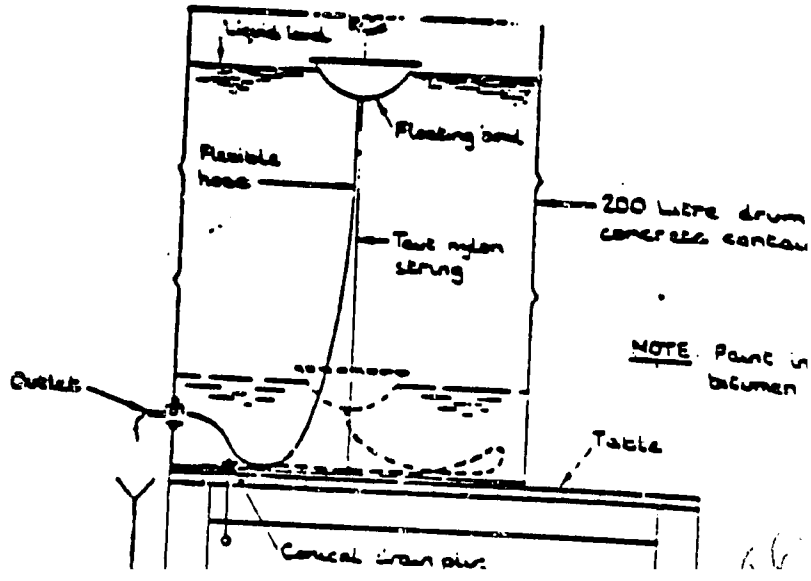


Figure B-6
Detail of Floating Bowl; Two Alternative Arrangements
(From McJunkin)
(Cairncross and Feachem, 1978)

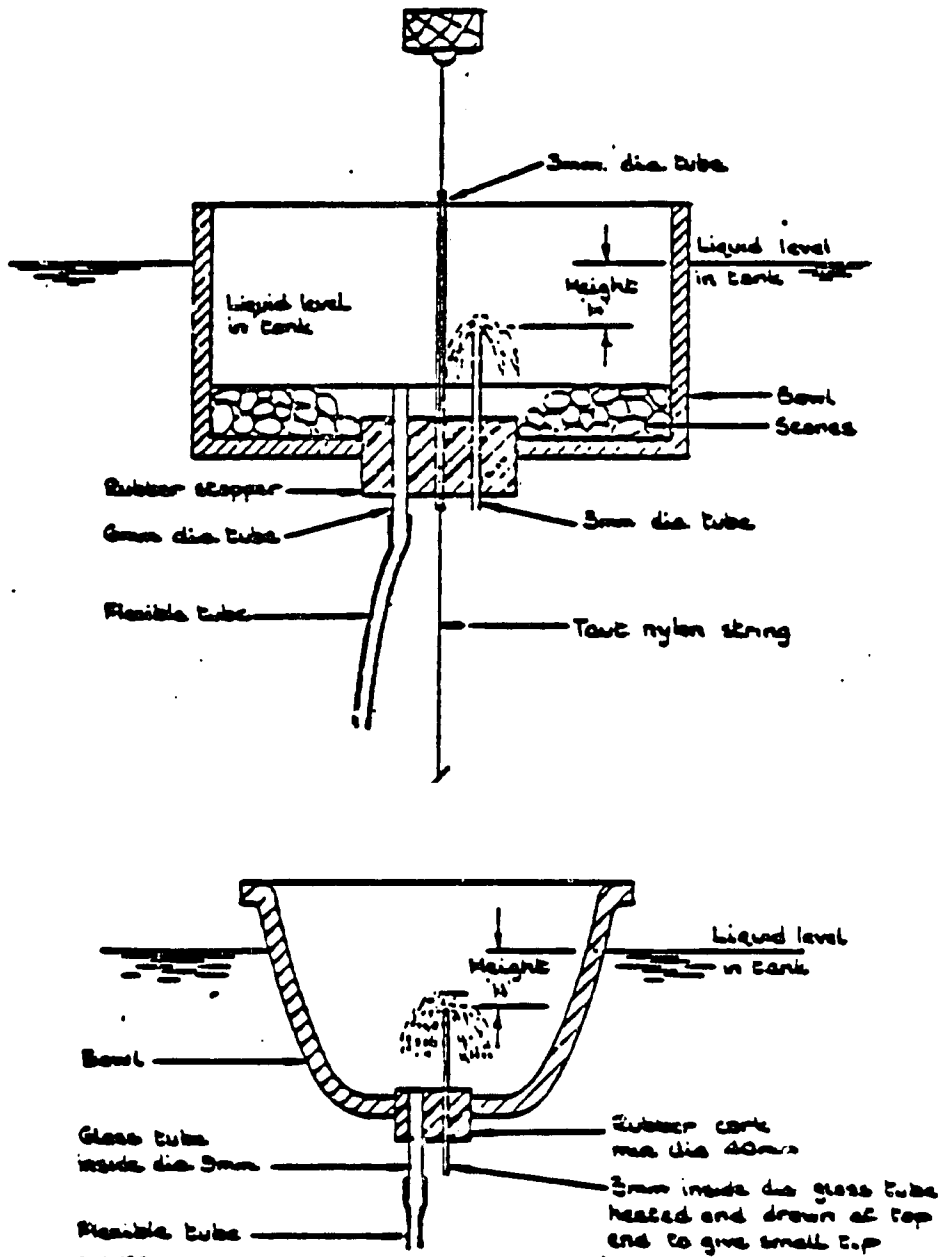


FIGURE 28: Detail of floating bowl: two alternative arrangements. (From McJunkin).

SANITATION TECHNOLOGY

TABLE F-3

CRITERIA FOR SELECTION OF DIFFERENT TYPES OF LATRINES

	Cost to Build	Depth of Soil Needed	Potential for Better Hygiene	Technical Assistance Needed	Best Anal Cleaning Material	Design Features	Construction Skills	Slab Materials	Handling of Wastes	Maintenance
Simple pit latrine	Low	Deep soil, not water-logged	Medium	Simple; mainly with floor slab	Any	Pit; slab (squat or seat); lid; shelter	Minimal	Bamboo, wood, or concrete	None	Clean slab weekly; dig new pit and move slab and shelter every 4-6 years
Pit latrine with vent pipe	1½ times pit latrine	Deep soil, not water-logged	Good	Simple vent pipe to be supplied	Any	Same as pit privy plus either pour-flush bowl, vent pipe, off-set pit, or combination	Minimal	Bamboo, wood, concrete, ceramic or plastic	None	Same as pit privy; if off-set pit, clean chute weekly and dig new pit every 10 or more years
Soakage pit latrine, water-seal	1½ to 2 times pit latrine	Deep soil, not water-logged	Good	Skilled builder needed	Water					
Aqua privy	2 times pit latrine	Not water-logged	Good	Skilled builder needed	Water	Vault; slab (squat or seat); shelter; soakaway	Some Masonry	Concrete	Every 2-6 years as sludge	Maintain water leve in vault; clean sla weekly; remove sludge and refill with water every 2- years
Compositing latrine	2 times pit latrine	Any	Good	Skilled builder needed	Paper	Double vault; two slabs (squat or seat); shelter	Some Masonry	Concrete	Every 6-12 months as compost	Clean slab weekly; alternate use of vaults every 6-12 months by removing composite, cleaning one vault, sealing the other
Bucket latrine	Low	Any	Poor	Simple	Any	Platform; slab (squat or seat); bucket; shelter; large containers; cart	Minimal	Bamboo, wood, or concrete	Every 1-3 days as excreta	Clean slab weekly; remove excreta ever 1-3 days; cart excreta to trenching ground and bury it or to compositing area

Table F-4 Alternative On-Site Sanitation Technologies

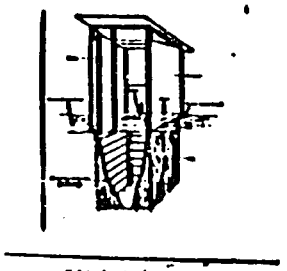
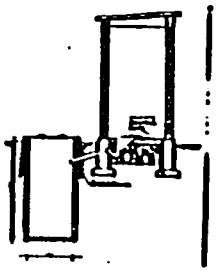
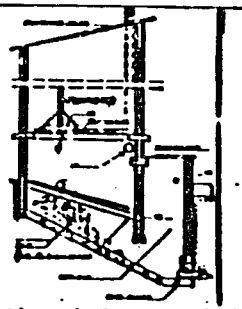
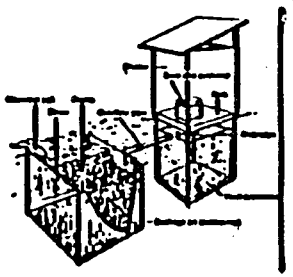
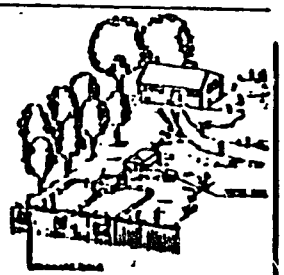
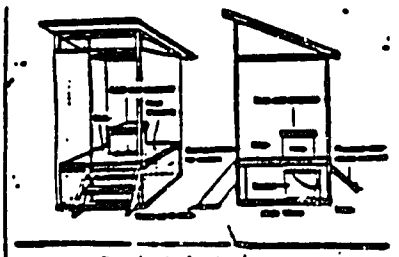
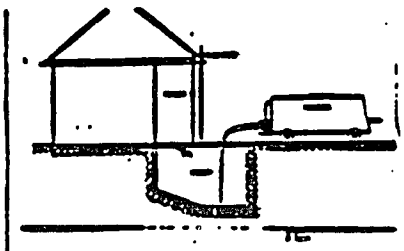
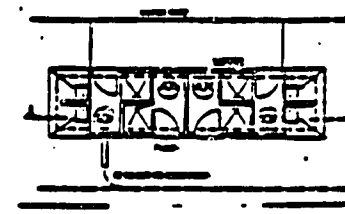
On-Site Sanitation Technologies	 Pit Latrine	 Pour Flush Latrine	 Double Vault Composting Toilet	 Aquaprivy	 Septic Tank
Principle	- Isolation of excreta in pit until nearly full, at which point privy relocated.	- Excreta flushed by water into decomposition; pit separated from user by water seal.	- Decomposition of excreta and refuse in absence of air for atleast 1 year to produce safe humus.	- Excreta flushed into water-tight tank for settling & decomposition; drop pipe maintains simple water seal; effluent drains to soakaway for ground disposal.	- Excreta flushed into tank for settling and decomposition; effluent drains to soakaway for ground disposal.
Water Requirements and Sullage Disposal Capacity	- No water requirements other than for slab cleaning. - No capacity for sullage disposal.	- Requires 3-6 lpcd for flushing. - No capacity for sullage disposal.	- No water requirement other than for slab cleaning. - No capacity for sullage disposal.	- Requires minimum of 3-6 lpcd for maintenance of water seal. - Sullage disposal capacity varies with soakaway and site.	- Requires large volumes of wastewater (excreta & sullage). - Complete sullage disposal capacity.
Maintenance Requirements (in addition to cleaning of superstructure interior)	- Low - Insect control in wet pits via addition of woodash, lye, etc. - Periodic relocation.	- Low - Water seal must be maintained to prevent odor, fly breeding. - Periodic relocation or emptying of pit contents.	- High - Ash, grass and/or vegetable wastes must be added to maintain carbon/nitrogen ratio. - Moisture content must be kept low.	- Moderate - Waterlevel must be maintained to prevent odor, fly breeding. - Tank contents must be desludged every 2-3 years. - Soakaway must be relocated after soil is blocked.	- High - Periodic monitoring & tank desludging. - Soakaway or drainfield must be extended about every ten years (after soil is blocked).
Construction Costs	- $50 - $200	- $75 - $225	- $100 - $300	- $150 - $400	- About $1500 - $2000
Health Aspects	- Clean slab essential - Insect control required, unless VIP or ROEC.	- If clean interior and water-seal maintained, comparable to tank flush toilet.	- Clean slab essential. - Insect control required. - Contents must be isolated for atleast one year before application to land.	- If clean interior and water seal maintained, comparable to tank-flush toilet.	- With clean interior represents high standard of health.
Advantages	- Low cost - Simple construction and maintenance. - All anal cleansing materials accepted.	- Low cost - Simple construction and maintenance. - Water seal prevents fly & odor problem.	- Moderate cost - Produces safe, stable humus for soil conditioning. - Simple construction.	- Moderate cost - Water seal prevents fly & odor problem - Offset design & water seal allow use inside house	- Provides highest attainable level of service, including tank flush toilets and complete sullage disposal.

Table F-5 Alternative Off-Site Sanitation Technologies

Off-Site Sanitation Technologies	 Bucket Latrine	 Vault Latrine	 Communal Facilities
Principle	-Wastes disposed of in a bucket which is periodically carted away by a sanitation worker and disposed of at a central site.	-Wastes are stored in a vault nearby the house. They are removed mechanically, manually or by vacuum every 2-6 weeks.	-These may be anything from a series of pit latrines to a group of vault latrines.
Water Requirements And Sullage Disposal Capacity	-No water requirements for operation, but needs water for washup of buckets at disposal site. -Does not receive sullage.	-No water requirement other than that needed for the water seal and slab cleanup. -Can receive sullage.	-Depends on type of facility used. Disposal is usually a problem if shower and laundry facilities are attached.
enance Requirements	-High -Change&clean bucket every 1-3 days. -Maintain transports for carrying waste to disposal site. -Maintain disposal site.	-High -Vault must be emptied every 2-6 weeks. -Transport & removable equipment require maintenance.	-High because of multiple usage and no personal ownership. -Needs an attendant.
Construction Costs	-Construction cost of structure are low, but operation can be expensive.	-Need a vault of 1.25M3 for a family of six with vault being emptied every two weeks.	-Depends on facilities provided. Unit cost. -Require large amounts of water.
Health Aspects	-Persons handling the wastes are in contact with raw sewage. They are exposes to many health hazards.	-Facilities in house can be a ceramic water seal toilet.	-Good, if well maintained. If not, can be a focui of disease.
Advantage	-Construction costs are low -No ground water pollution -Reuse of water after treatment is possible. -Labor vs capital intensive	-Is very flexible to changes in urban patterns. -Is indicated for medium rise buildings.	-Allows for low-cost facilities for a large number of users.

HAND TECHNOLOGY

92

HANDPUMPS

TECHNOLOGY CHOICE

"Appropriate" means the most cost-effective, feasible, locally acceptable system that community water users can afford and are able to operate and maintain. Those decisions must be made on a case-by-case basis. There is no single best technology model. Nor is it true that simple is always better, or that cheaper hardware will be more cost-effective than more expensive equipment.

YOUR CONFUSION IS APPROPRIATE

Words such as "disastrous" and "frustrating" are frequently used to describe project experience with handpumps. There are often a dozen different handpump designs in an LDC at any point in time. "The landscape of the Third World is littered with pumps that do not work" (C. Payne Lucas in WASH Technical Report No. 14).

YOUR HANDPUMP PROBABLY ISN'T

Discovering the "appropriate" pump is made more difficult by research and implementation agencies who praise their own pump design. Comparative tests of various designs under the same local conditions tend to be few and far between.

REACH STILL EXCEEDS GRASP

There is no such thing as a "maintenance free" handpump. But some are closer than others. No handpump completely satisfies the requirements for VLOM (Village Level Operation & Maintenance).

WHICH PUMPS COME CLOSER TO MEETING REQUIREMENTS

The Consallen Pump gets good marks for durability, performance, and low maintenance costs. The pump has two independent pumping systems in the same unit, so that when one breaks, the other still works and the borehole isn't abandoned to await repairs. It also delivers more water per stroke, to reduce waiting time.

The India Mark II pump requires minimum maintenance and is able to run up to 16 hours a day continuously with low O&M costs. This pump was designed for UNICEF to be more durable than cast iron pumps which tend not to wear well when given heavy use.

The Georgia Institute of Technology has developed a new steel sealed-bearing handpump which improves upon the cast iron AID Battelle design. Sealed ball bearings don't require lubrication. Small machine shops can produce this pump rather than foundries, where quality control has been a problem.

The Blair/Prodite pump developed in Salisbury, Zimbabwe claims to have a "no maintenance unit" on the basis of showing "no detectable wear" after three months of non-stop testing. The pump was examined after 6 million strokes, which is equivalent to about 90 years of use by a single family.

The SWN 80 and 81, tested extensively in Tanzania, are praised because "their sturdiness, simplicity, and responsiveness to village-level maintenance may now be considered nearly optimal". The Dutch consulting firm, DHV, recommends replacing the galvanized steel riser/pump rod with PVC and stainless steel to avoid corrosion.

DHV also gives the Kangaroo pump used in Tanzania a satisfactory rating for durability, but other tests report contradictory results.

VERY CHEAP INNOVATIVE PUMP DESIGNS

The Indonesian Bamboo Handpump design has a total cost of $6.25, and has been operating continuously for 8 years which indicates reliability. Further information is available from Development Technology Centre, P.O. Box 276, Bandung, Indonesia.

The Malawi PVC pump has a total cost of $25 and is built entirely of PVC pipes which are light weight and easily installed by hand. Maintenance is easy for villagers who can saw the pipes and glue it back together again. Information is available from UNICEF.

The Demotech Rope Pump can be made by villagers in one to three days without special skills or tools. Materials are available in most villages for about $15. It has been tested in Burkina Faso (Upper Volta), Indonesia, and Peru. Information is available from DEMOTECH, P.O. Box 303, 6950 AH Dieren, The Netherlands.

A GOOD SOURCE FOR COMPARISON TESTS

The World Bank and UNDP have published a report on laboratory testing of handpumps which provides a comparative analysis. The tests were done by Consumer's Association Testing and Research (CATR) based in the UK. Tests will continue until mid-1985. An addendum to this report presents information on 12 handpumps tested by CATR. The information is presented concisely in a matrix published as part of World Bank Technical Paper No. 19 (June 1984).

A GOOD SOURCE FOR WATER T.A.

Write to the WASH Information Director, 1611 N. Kent St., Room 1002, Arlington, VA., 22209/USA. AID Missions and Regional Bureaus can request data on behalf of mission programs, host government organizations, PVO's, Peace Corps, and/or multilateral/ international programs.

HELP THEM HELP YOU

People providing technical advice about which handpump would best suit the needs of your project can respond more quickly and accurately if you tell then your needs:

Describe the local water: contamination, silt, color, etc.

How deep is the water source?

How much water needs to be pumped?

How many hours of estimated daily use?

How high does the water need to be lifted?

How many people will be served by each pump?

What local manufacturing facilities are available?

How much can you afford for purchase and maintenance?

What kind of operation and T.A. skills are available?

What kinds of tools are available locally?

Describe the climate and topography of the project site?

Figure C-1. Illustration of Operation of Plunger-type Pump
(McJunkin, 1977)

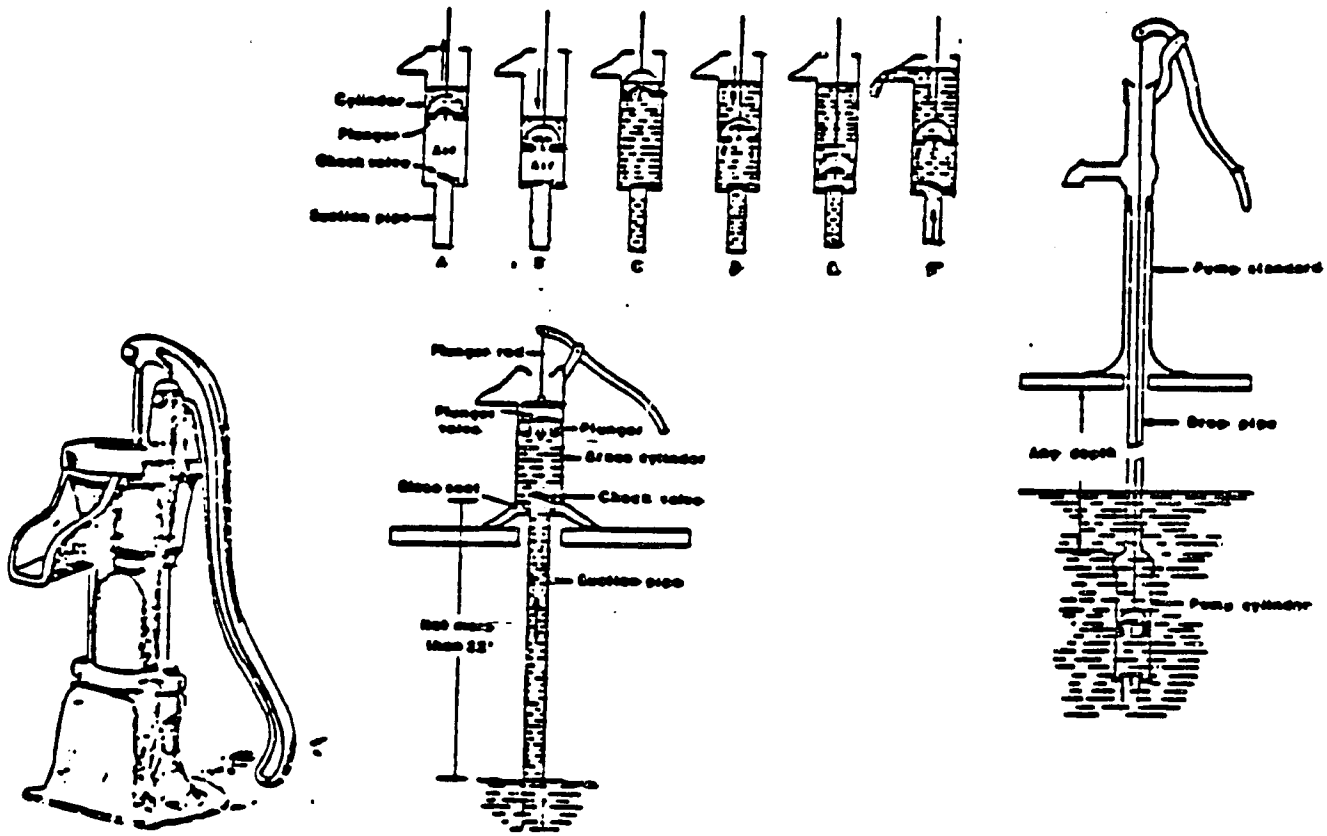


Figure C-2. Mono/Moyno Pumps
(McJunkin, 1977)

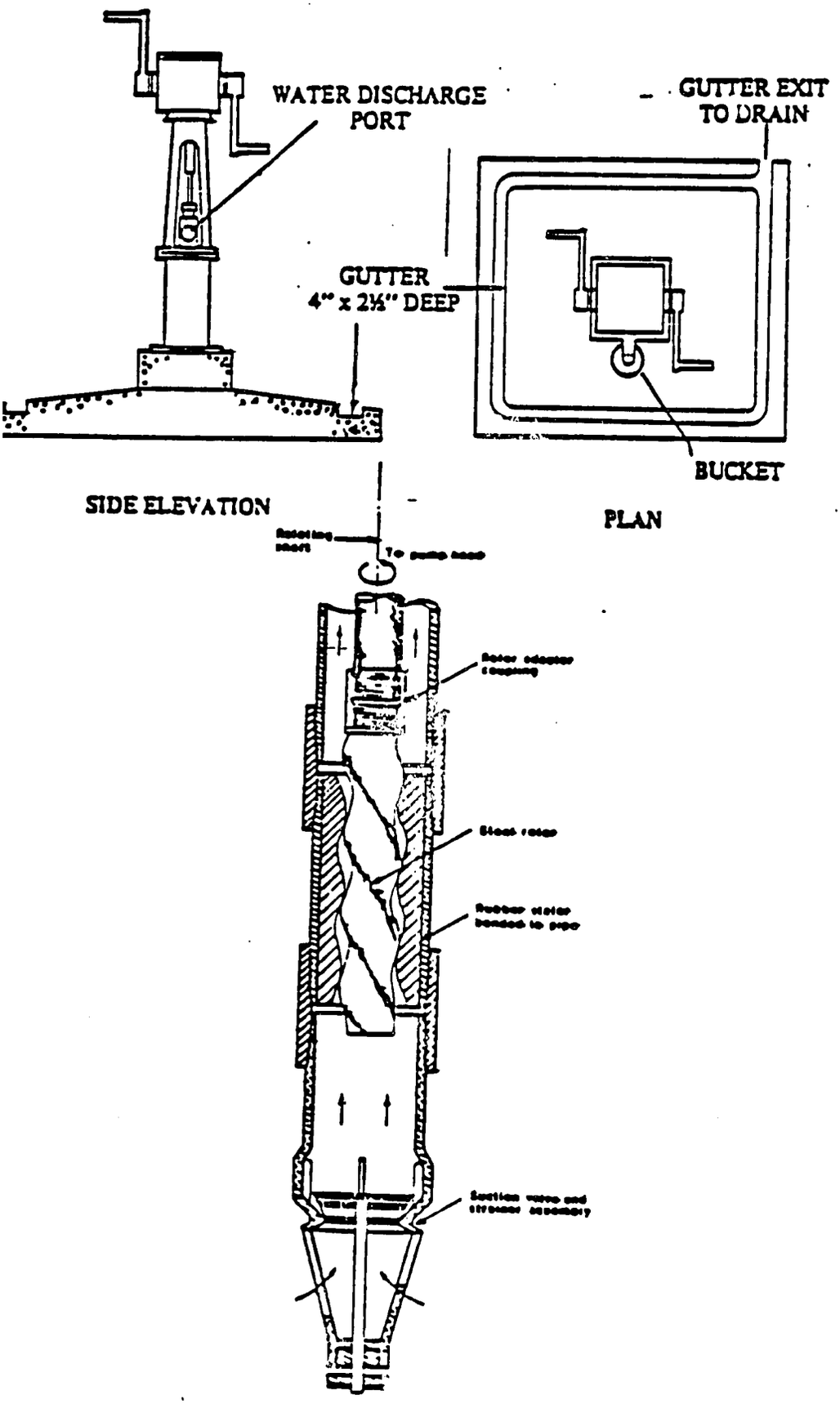


Figure C-3. The Petro Pump
(McJunkin, 1977)

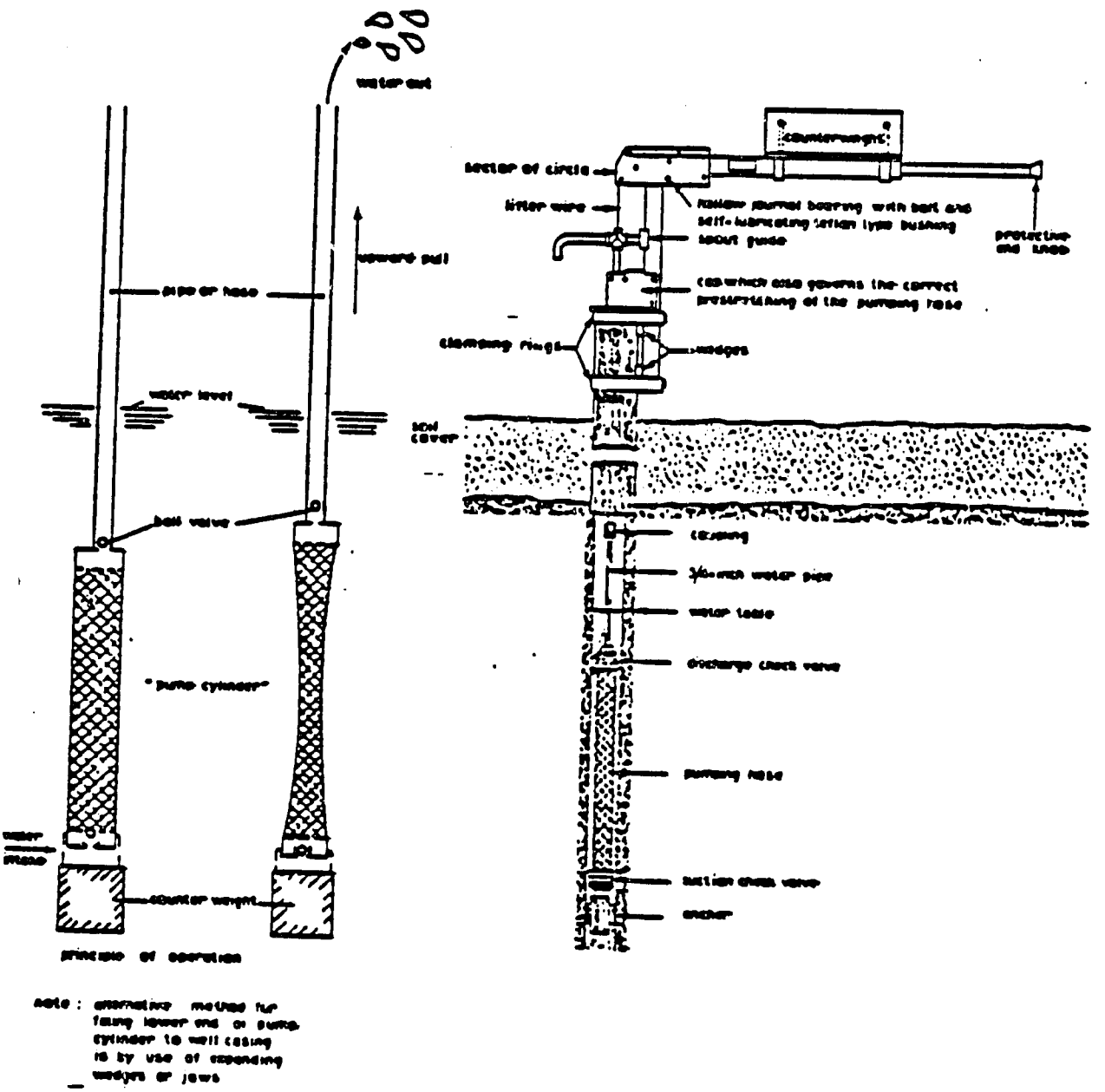


Figure C-4. The Vergnet Pump
(McJunkin, 1977)

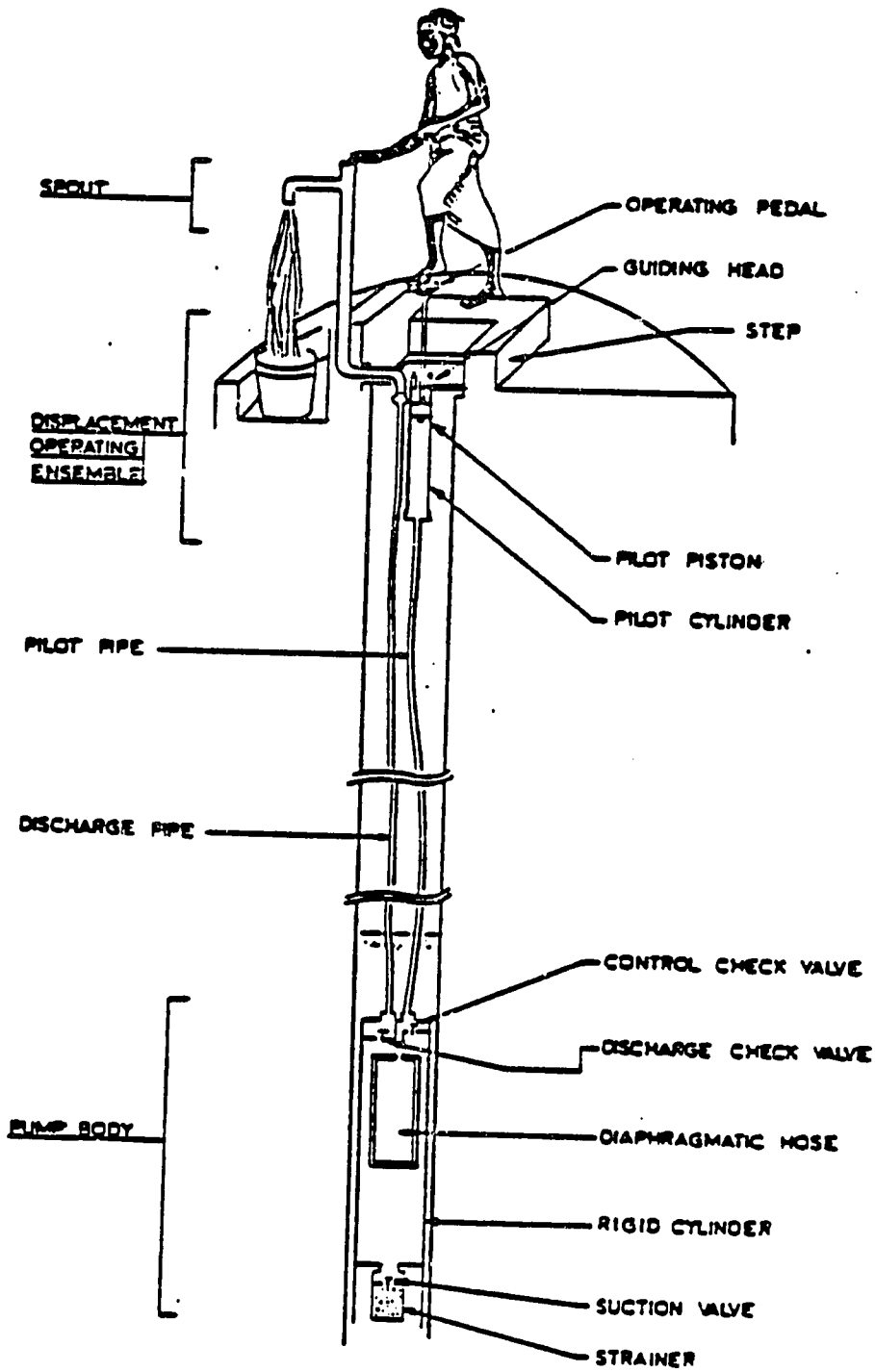
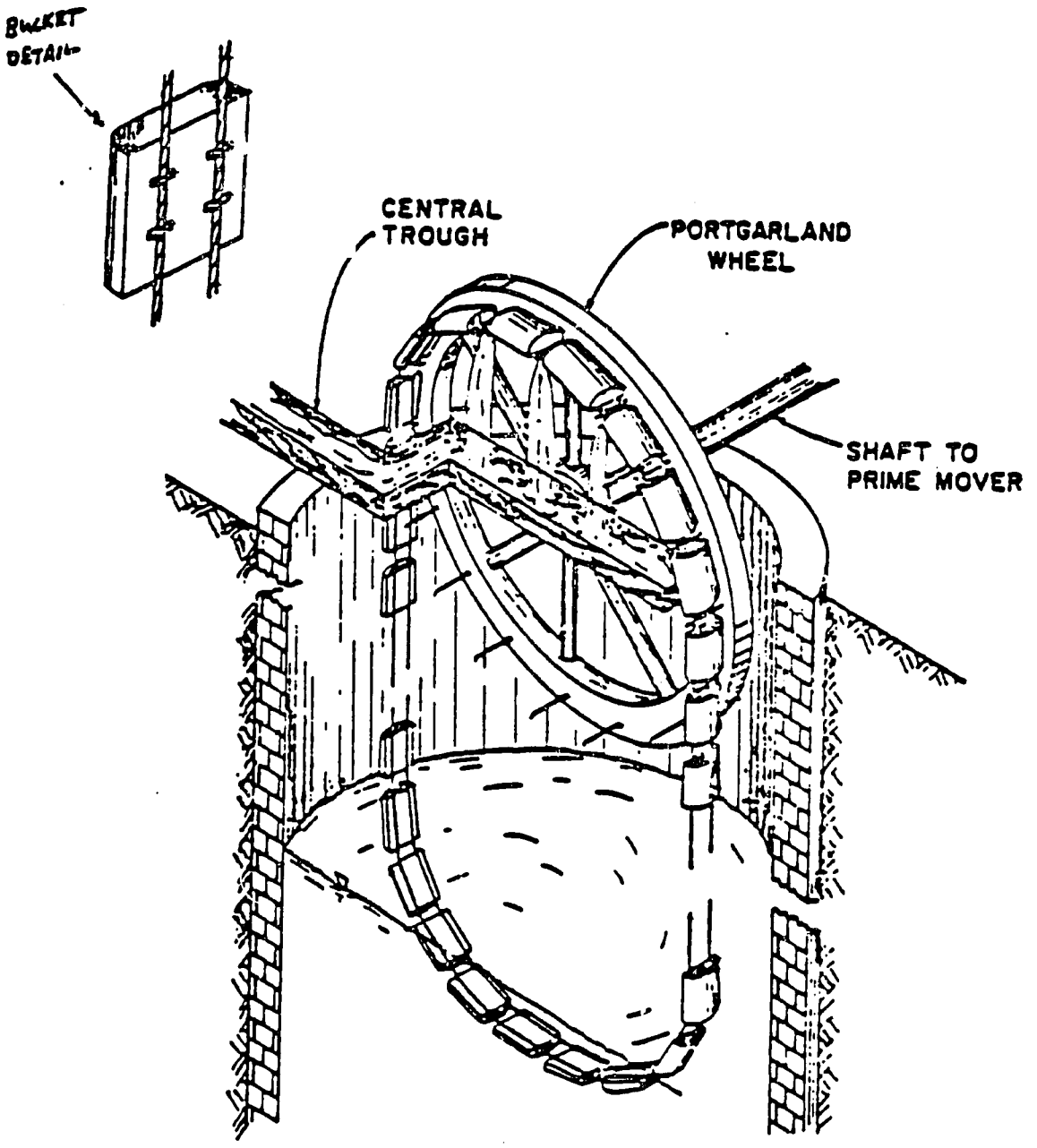
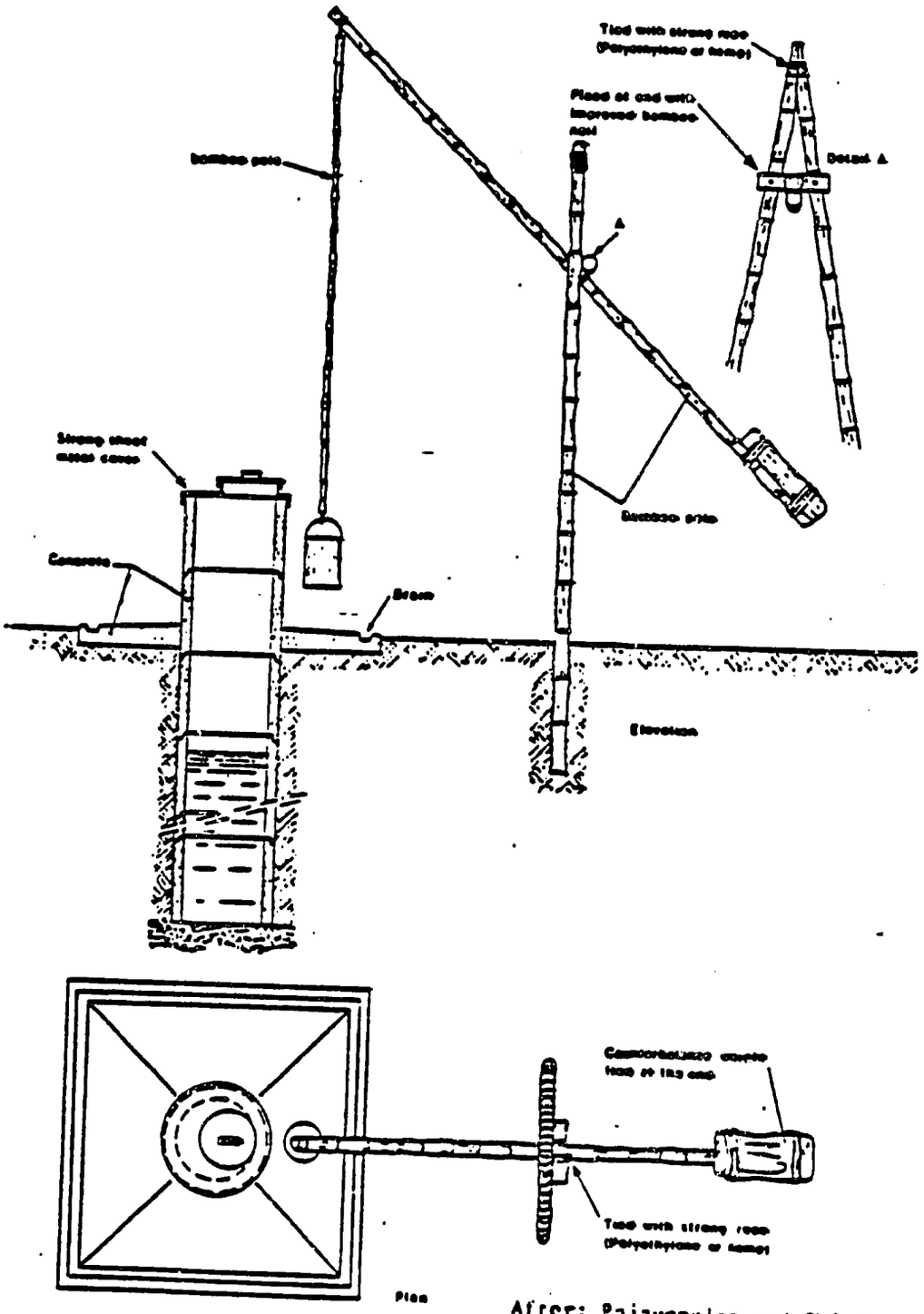


Figure C-5. A Bucket Pump



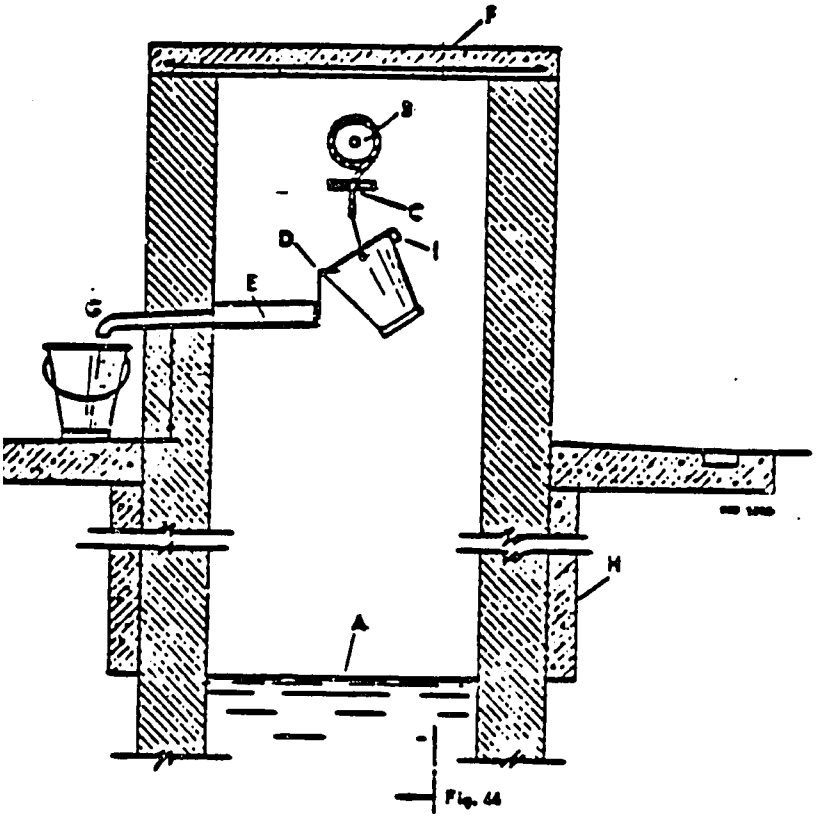
A chain of buckets (persian wheel) device for raising water, such a 'portgarland wheel' drawn by a horizontal shaft. (From Wood).

Figure C-6. A Modified Shaduf
(Cairncross and Feachem, 1978)



After: Rajagopalan and Shiffman.
Reproduced by kind permission of
World Health Organization

Figure C-7. An Improved Rope-and-Bucket Well
(Wagner & Lanoix, 1959)



A = Water level in well
B = Windlass
C = Guide hole for rope
D = Stop hook
E = Trough
F = Tight cover, removable
G = Discharge opening
H = Compacted clay, or concrete grout
I = Weight attached to top side of bucket to make it tilt when bucket is lowered onto water surface

Figure C-8. A Chain and Washer Pump
(Cairncross & Feacham [after VITA], 1978)

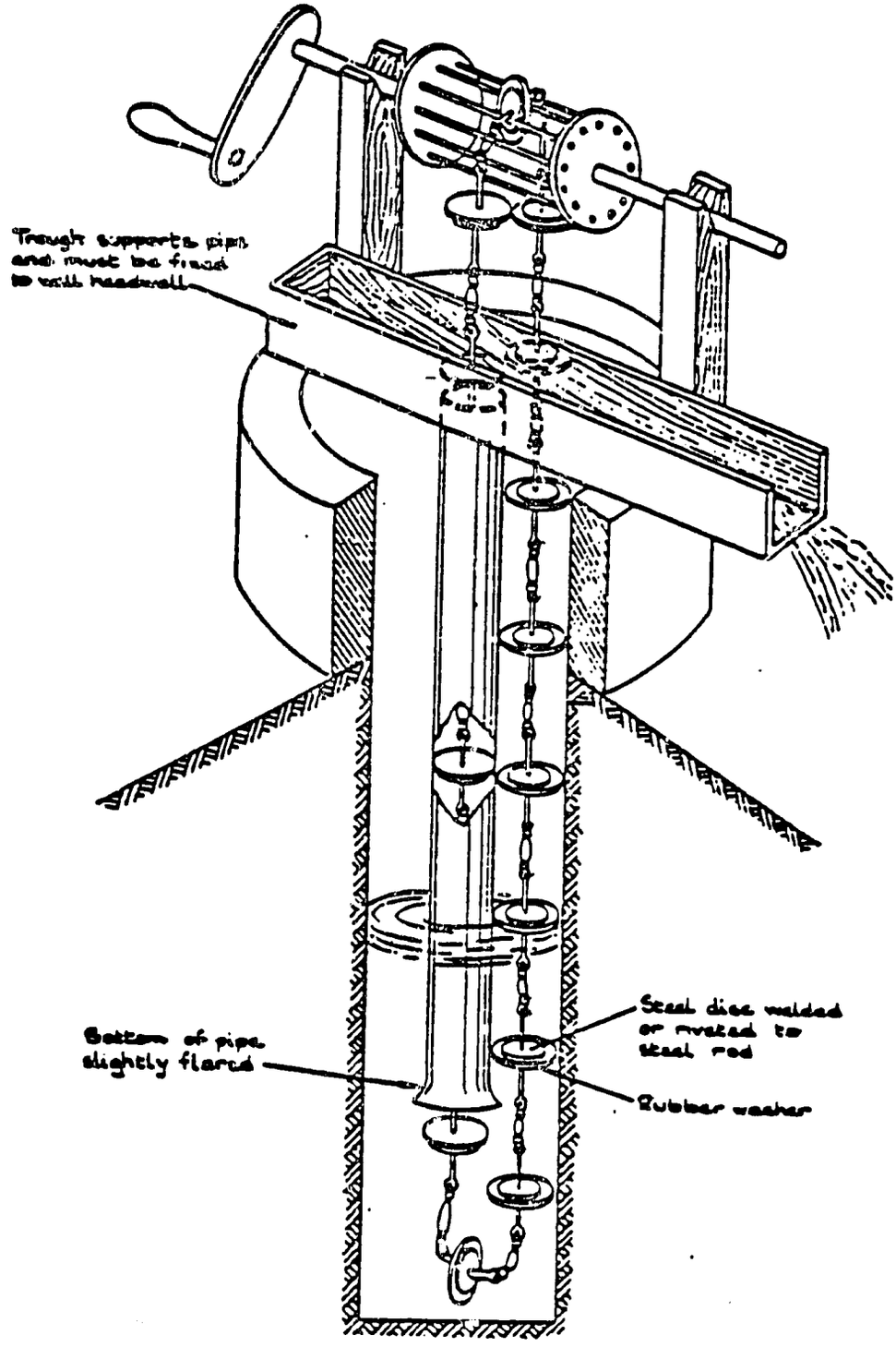
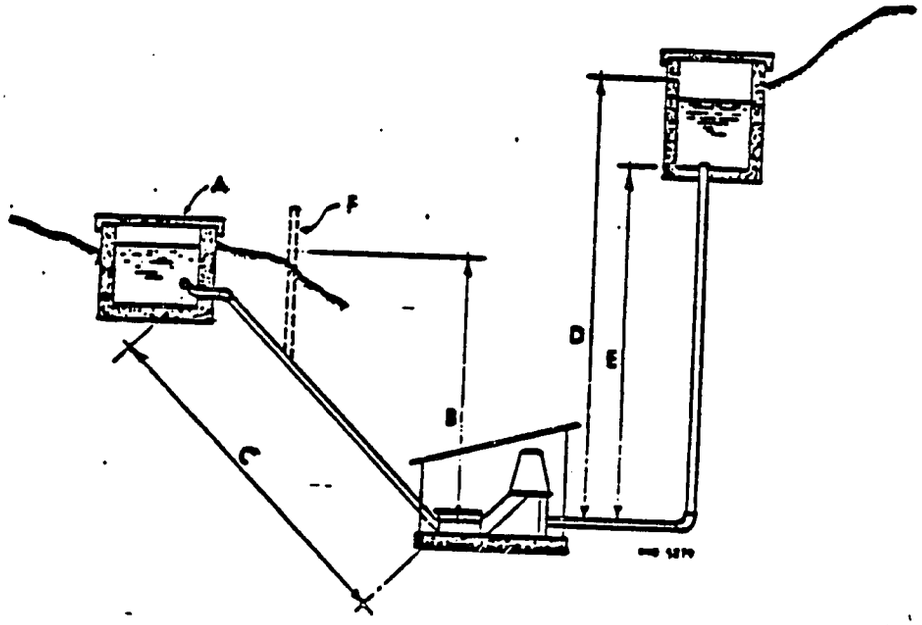


Figure D-1. A Hydraulic Ram
(Wagner & Lanoix, 1959)



A = Supply—litres/minute
B = Difference in elevation between ram and supply-power head
C = Length of drive pipe
D = Difference in elevation between ram and highest point to which water is to be elevated—pumping head
E = Total length of supply pipe
F = Stand-pipe, necessary in case of exceedingly long drive pipe

Under the proper circumstances—a situation similar to that shown, in which the supply of water is considerably in excess of the needs, and is situated so that the ram can be located well below the supply—the hydraulic ram can be an excellent solution to a pumping problem.

When writing to manufacturers about ram sizes, the information in items A, B, C, D, and E is necessary. With this the factory will be able to recommend the correct size, feasibility, etc.

TECHNICAL ASSISTANCE SOURCE

WATER AND SANITATION FOR HEALTH PROJECT (WASH)

PURPOSE

The WASH Project was created to provide AID program managers with inter-disciplinary technical assistance and information services in water-supply and sanitation.

Description

A centrally funded project, WASH provides expertise at no cost to AID Missions, Regional Bureaus and Central Offices in:

- o planning
- o economics
- o socio-cultural aspects
- o training
- o technology

The WASH project provides services in the following four areas of assis-nce in rural and urban fringe water supply and sanitation:

(1) General Technical Assistanc

(2) Technology Transfer

(3) Manpower Development and Training

(4) Information Support

HOW TO APPLY FOR ASSISTANCE

AID offices may request WASH assistance on behalf of:

- o Missions programs
- o Host Government Organizations
- o Peace Corps
- o International/multilateral programs
- o Private voluntary organizations

ie AID User sends request to the appropriate backstopping office in the gional Bureau with an information copy to SaT/H/WS WASH Project .ficers outlining:

- The Problem
- Scope of services required
- Coordinating organizations/contact persons
- Start/Stop Time for services

HOW TO REQUEST INFORMATION SERVICES

Information or bibliographic requests can be sent directly to:

Information Director
WASH Project Coordination
and Information Center
Room 1002
1611 North Kent Street
Arlington, Virginia 22209
(703) 243-8200

WASH PUBLICATIONS

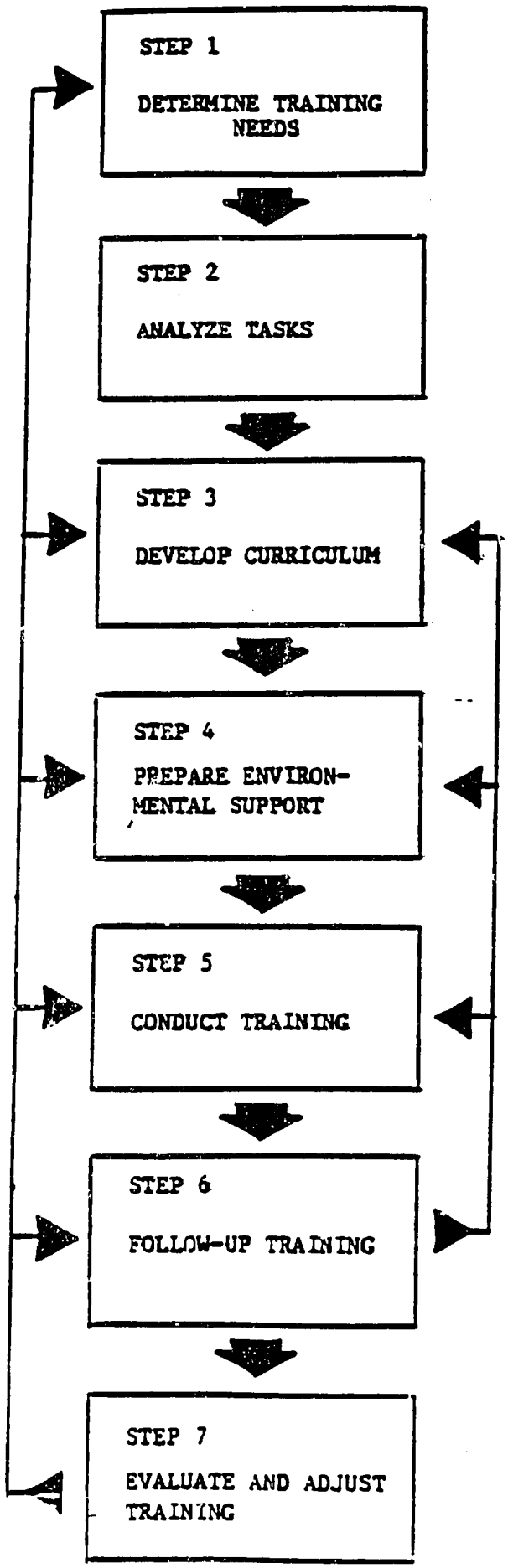
WASH Technical and Field Reports listed below may be obtained from:

AID Document and Information Handling Facility
7222 47th Street, Suite 100
Chevy Chase, Maryland 20815

TRAINING MATERIALS

WORLD HEALTH ORGANIZATION

THE SYSTEMATIC APPROACH



Study performance deficiencies within the organization. Determine which are due to a lack of skills and/or knowledge and will respond to a training solution

Study the task. Determine precisely what skills are necessary for its accomplishment

Determine precisely what the successful trainee must be able to do at the end of the proposed training in order to accomplish the task. Write objectives in terms of observable behaviour. Determine the necessary pre-requisites, the proper sequences of instruction and the instructional system components

Ensure that adequate facilities and training aids will be available. Support staff (e.g., secretarial help) should also be considered

Conduct training using activities that will enable the trainees to do the task described in the performance objectives

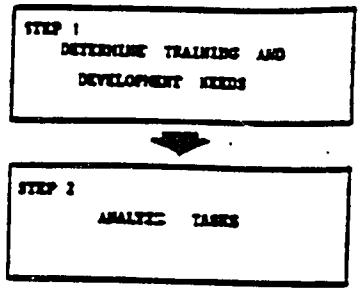
Observe trainees to determine if they have achieved the course objectives and are applying the new skills back on the job. Give reinforcement and feedback

Assess the training course to determine if it is adequately designed to eliminate the intended performance problem

STEP TWO: SELECT AND ANALYZE TASKS

WHAT IS IT?

When you have found performance deficiencies that will respond to a training solution, you must determine which specific tasks in the overall job are causing the performance problem. These are the tasks that a training course should deal with. Selection of specific tasks is one aspect of Step Two.



Analysis is another. Analysis means breaking down into simpler elements. A Task Analysis, therefore, means breaking down a task in order to identify the skills, the knowledge and the abilities required of a worker for mastery job performance.

HOW IS IT DONE?

In order to carry out a Task Analysis you should observe a worker who is a master performer. Note down all the steps of the task as he performs them. You might also want to ask him to write or tell the steps because he may be aware of steps that your observation has missed. Then carefully think through the steps of the task. Ask yourself such questions as:

- What must a worker be able to do to accomplish this task? What type of skills are involved.
- What prior skills must he have?
- What prior knowledge must he have?
- What concepts or meanings must he understand before he can perform?
- Can the steps in the task be broken down into sub-steps?
- Do the sub-steps require different prior skills, knowledge, understandings?

USEFUL AIDS TO STEP THREE

1. The Task Analysis previously prepared is an invaluable tool for determining the skills, knowledge and attitudes that are necessary for the performance of the task. You will be able to determine the pre-requisites for entry into the course from a study of the Task Analysis. When examining the Task Analysis ask yourself such questions as:

A. What mental abilities are required here? e.g. reading? writing? discriminating? analyzing? recognizing? evaluating? appraising? making mathematical calculations? reporting?.

B. What physical abilities are required here? e.g. lifting? withstanding temperature extremes? driving? using tools?

C. What social abilities are required here? e.g. communicating? cooperating? supervising? criticizing? organizing?

Consider selecting only those employees who have the pre-requisite skills and knowledge.

TASK ANALYSIS WORKSHEET

POSITION: *Utility Plumber*

TASK: *Installs New Services*

WHAT THE WORKER DOES (Operation)	HOW HE DOES IT (Step)	WHY HE DOES IT	WHAT HE NEEDS TO KNOW
Cuts and threads pipe	*Measures length, cuts pipe with hand hacksaw and threads with hand die.*	*To connect pipe and fittings for service supply.*	1. *Skill in taking and reading measurements.* 2. *Skill in manipulating hacksaw and hand die.* 3. *Knowledge of thread types, quality and defects.*
Makes soldered joints	*Cleans ends, assembles ends, applies solder using butane torch.*	*To secure joints and ensure leak-free connections.*	1. *Knowledge of solder and soldering process.* 2. *Process on applying solder.* 3. *Skill in identifying defects in soldered joints.*
List concisely and accurately each operation performed to complete the job task.	Describe simply but completely how each of the operations are performed.	Explain very concisely the reasons for performing each operation.	List all that is required in order that each operation is performed efficiently - reading, calculation, colour, smell or taste, recognition, etc

TASK ANALYSIS WORKSHEET

POSITION: *Utility Plumber* TASK: *Install New Services (Cont'd)*

WHAT THE WORKER DOES (Operation)	HOW HE DOES IT (Step)	WHY HE DOES IT	WHAT HE NEEDS TO KNOW
Install meter	*Prepares ends, positions and aligns meter, couples up meter and pipe and tightens with hard wrench.*	*To provide measurement of water consumed.*	*1. Knowledge of the several types of meters.* *2. Knowledge of the installation procedure of each type.* *3. Skill in using the tools required.* *4. Ability to make leak-free threaded joints.*
Install valves	*Determine position, prepares end then positions and couples valve ends and tightens with pipe wrench.*	*To provide a control point in the service main.*	*1. Knowledge of the types and working principles of valves.* *2. Knowledge of the installation procedure of each type.* *3. Skill in manipulating the installation tools.*
List concisely and accurately each operation performed to complete the job task.	Describe simply but completely how each of the operations are performed.	Explain very concisely the reasons for performing each operation.	List all that is required in order that each operation is performed efficiently - reading, calculation, colour, smell or taste, recognition, et

TASK ANALYSIS WORKSHEET

POSITION: *Utility Plumber*

TASK: *Installs New Services (Cont'd)*

WHAT THE WORKER DOES (Operation)	HOW HE DOES IT (Step)	WHY HE DOES IT	WHAT HE NEEDS TO KNOW
Installs valves (Cont'd)			4. *Skill in making leak-free threaded joint.*
Taps main and installs ferrule	*Identifies point to tap, sets up tapping machine and attaches to main: operates machine until main is tapped then removes machine with ferrule in position.*	*To facilitate the connection of service line to main.*	1. *Knowledge of the tapping machine including how it is operated.* 2. *Knowledge of the size of taps and their code classification.* 3. *Skill in setting up tapping machine and operating the machine.*
Lays distribution pipe	*Positions and connects pipe, seals and tightens joints using the pipe wrench.*	*To provide a continuous flow of water from the main to consumer.*	1. *Knowledge of the several types of pipes in use.* 2. *Knowledge of the several pipe sizes and grades.*
List concisely and accurately each operation performed to complete the job task.	Describe simply but completely how each of the operations are performed.	Explain very concisely the reasons for performing each operation.	List all that is required in order that each operation is performed efficiently - reading, calculation, colour, smell or taste, recognition, etc

CTION TWO: DEVELOPING AND IMPLEMENTING A TRAINING PROGRAMME (cont'd)

STEP THREE:
DEVELOP CURRICULUM

Part 1: Statement of Performance Objectives

First, write Performance Objectives.
Performance Objectives are a very precise statement of exactly what the trainees are expected to BE ABLE TO DO as a result of the training course. Of course, in order to write sensible performance objectives, you will have to look at the Task Analysis.

Why?

Because, the Task Analysis tells you everything that is involved in the performance of the skill you intend to teach. If there are many skills in the task(s) that will be taught in the training programme, you will have many Performance Objectives. Be sure that you write the Performance Objectives carefully. You will use them not only as a guide to tell you what to teach in the training programme, but you will also use them as a guide to evaluation: Did the trainees actually learn to do what we wanted them to do? Was the training programme successful?

Here is an easy way to organize and write Performance Objectives. Answer the questions.

(**) 1. What observable behaviour do you require of the trainee in order to prove that he has learned the task (or sub-task?). Here is an example:

THE TRAINEE WILL BE ABLE TO:
Install by-pass connections on main for leak detection meter.

(**) 2. Under what conditions will the trainee show this observable behaviour? Will you provide him with anything? Here is an example:

UNDER THE FOLLOWING CONDITION:
given correct tools and size of pipe, three (3) valves, flange sockets and spigots, two (2) tees, two (2) bends and meter.

(**) This symbol is used throughout SECTION TWO to denote those questions which are, in effect, keys to help you follow the step.

SECTION TWO: DEVELOPING AND IMPLEMENTING A TRAINING PROGRAMME (cont'd)

STEP THREE:
DEVELOP CURRICULUM

(**) 3. What will you consider success? How well must h perform? Here is an example.

TO THIS STANDARD:
Must be in keeping with standard procedure outlined. No leaks should occur at connections Flanges should be correct distance apart to allo installation of meter between them, and allo bolting of meter flanges to pipe flanges. Mete chamber should be correct size to allow workme enough room to make necessary adjustments for lea detection meter.

Use the above three questions as guidelines to write all the Performance Objectives that are necessary to cover all the tasks you want taught in the training programme.

	Module I	Module II	Module III
A. Title of Module	Health & Hygiene Promotion	Construction of WSS facilities	Operation & Maintenance of WSS facilities
B. Objectives	(i) To promote behavioural change by awakening the communities to the importance and need of hygienic practices for health care. (ii) To improve capability of communication between the C.H. workers and the communities. (iii) To improve knowledge of ways and means of ensuring safe water supply and proper sanitation. (iv) To promote community participation in planning, constructing & operating WSS facilities	(i) To provide knowledge on basic and appropriate construction techniques to the community workers and skilled workers to enable them assist the communities in constructing the facilities. (ii) To demonstrate ways and means of mobilizing community participation in construction.	(i) To impart basic skills in operation & maintenance of WSS facilities at the community level. (ii) To demonstrate ways and means of mobilizing community participation in operation & maintenance.
C. Persons to be trained Community-based volunteers/ workers	Health leaders or guides Community health volunteers/workers Community health communicators Family health workers; School teachers Traditional healers & birth attendants	Community volunteers/workers Community skilled workers (masons, smiths, etc.)	Community volunteers/workers Community skilled workers (masons, smiths, etc.) Community Development Committee members School teachers Health leaders/guides
D. Trainers	Sanitarians; Water technicians; Auxiliary health workers; Health assistants; Midwives, nurses; Experienced C.H. workers/volunteers Note Module I will first be offered to above category to prepare them (after field experience) as "trainers" for community-based volunteers/workers.	Sanitarians; Water technicians; Experienced skilled workers/volunteers Note Module II will first be offered to above category to prepare them (after field experience) as "trainers" for the community-based volunteers/workers.	Sanitarians; Water technicians; Experienced skilled workers/volunteers Note Module III will first be offered to above category to prepare them (after field experience) as "trainers" for the community based volunteers/workers.
E. Duration	1-2 weeks	3-4 weeks Note Prior to exposure to Module I is not essential.	1-2 weeks Note Prior exposure to Module II is not essential but recommended wherever possible.
F. Follow-up Activities i) Supervised field work. ii) Refresher Courses (with some advanced topics).	Recommended for 6-8 months after completion of Module I. 1-week refresher course recommended every 2-3 years after completion of first exposure course.	Recommended for 6-8 months after completion of Module II. 1-week refresher course recommended every 2-3 years after completion of first exposure course.	Recommended for 6-8 months after completion of Module III. 1-week refresher course recommended every 2-3 years after completion of first exposure course.
G. Evaluation	(i) Observation of Response from individuals & community in actually practicing personal hygiene themselves. (ii) Decrease in insanitary surroundings. (iii) Actual participation of the community in planning, construction & operating WSS facilities. (iv) Modes of transportation of drinking water from source and possibility of contamination. (v) Impact on the community health standard through improved clean environment and reduction in infection rate especially among children.	(i) Efficiency of utilization of knowledge in the proper construction of WSS facilities. (ii) Extent of community participation secured in the provision of facilities (iii) Satisfactory consultation with individuals & community prior to provision of facilities.	(i) Extent of community involvement in operation & maintenance of its water and sanitation facilities. (ii) The existing condition of community water supply and sanitation facilities (its operability & state of maintenance. (iii) Ability to give technical guidance to community whenever required. (iv) Efforts to keep adequate stock of spare parts in stock. (v) Extent of usage made of unauthorized sources of unsafe water. (vi) Capability of the community to undertake sanitary surveillance for protection of the drinking water source.

MODULE 1

Health and Hygiene Promotion (Duration: 1-2 weeks)

1. Personal Hygiene

   (a) Locally endemic diseases and value of personal hygiene in preventing them.

   (b) Need for washing hands clean with soap and water always after work and before meals and after use of toilets.

   (c) Need of cleansing plates, glasses, utensils, spoons, etc., for water- and food-handling.

   (d) Use of clean and washed personal clothes.

   (e) Need for taking regular baths or other methods of cleaning the body at regular intervals.

   (f) Need for eating well cooked and heated food and need of preventing flies from coming into contact with food.

   (g) Need for taking safe drinking water (safe means not contaminated from pollution from human and animal excreta and waste disposal).

2. Community Hygiene

   (a) Locally endemic diseases and their causes through poor hygienic community practices.

   (b) Need for getting the food-handlers in such public eating places to wash their hands clean after the use of toilets for serving food and to use clean spoons, plates, glasses for handling food.

   (c) Need of using clean and safe drinking water in clean glasses for consumers and to avoid touching (contaminating) the inside of the clean glasses with hands before serving.

   (d) Need of preventing flies, worms, insects, rats, etc., and animals eating the food or touching the food before and while eating.

   (e) Need of protection of food from the sun, wind and rain.

   (f) Need to prevent spread of diseases from food handlers in the public eating places through physical health examination of food handlers to see they are not carriers of diseases.

   (g) Need to use clean hands and clean storage spaces by traders handling public food for sale in community markets and to protect it from flies and other insects with proper covers.

2. Community Hygiene (cont'd)

(h) Need of taking boiled or cooked foods, especially where sewage is used as fertilizer.

(i) Need of keeping the premises and drains clean of garbage and rubbish waste, dirty water etc., to prevent breeding and harbourage of flies, mosquitoes, insects and rodents and need to dump such waste in common and protected pits away from wells, springs, etc.

3. Drinking Water and Excreta Disposal

(a) Different types of sources of water normally used by the people like spring, river, wells (tubewells), ponds, lakes, rain water and snow, and their different qualities.

(b) Modes of contamination of drinking water, from dirty roofs and storage tanks for rain water, in transportation, storing, in use of contaminated pots, ropes, buckets (in wells) and simple methods of disinfection of drinking water such as boiling.

(c) Modes of transmission of diseases like diarrhoea, dysentary, cholera, worm infestation, etc., and methods of prevention.

(d) Modes of pollution of drinking water sources and its prevention from waste disposal, excreta disposal, surface water run-off, from human and animal contacts by fencing or other; need of sanitary surveillance of drinking water sources.

(e) Modes of transmission of communicable diseases by indiscriminate defecation in the open area through flies, through pollution of drinking water sources and ground around by surface run-off, by the children playing around in the polluted ground through hands and feet.

(f) Methods of proper disposal of human excreta through sanitary latrines and simple low-cost sanitation facilities properly constructed and maintained clean.

(g) Use of wastewater draining from wells, and family water system to irrigate family gardens planted with vegetables, and recovery of resources from waste disposal wherever applicable.

4. Community Capability

(a) Use of simple charts and available audio-visual aids and local materials to facilitate understanding of above aspects and communicating them to others.

(b) Need for organizing meetings, talks, demonstrations, etc. using specific approaches to facilitate communication to various community groups (e.g. women, elders, children, etc.).

(c) Demonstration of ways and means of mobilizing community involvement. Listening to their concerns; shaping their message to build upon those concerns.

MODULE II

Construction of WSS Facilities (Duration: 3-4 weeks)

1. **Construction**

   (a) Typical types of simple (appropriate technology) structures needed to be constructed in local area for (i) water supplies from springs, wells, ponds, rain water systems, etc. (including fixing of handpumps); (ii) excreta disposal on site; (iii) wastewater drains; (iv) soakage pits.

   (b) Construction techniques related to (a) above, pointing out health hazards resulting from poor construction.

   (c) Health hazards of wrong location of structures (e.g. location of latrines very near and upstream of wells).

   (d) Construction consideration in choice of location (e.g. type of soil and depth of ground water affecting foundations and excavations.

   (e) Available local sources of construction materials and their suitability. Estimation of quantity of materials required for different types of structures.

   (f) Ability to secure advice, assistance, clarification on construction aspects from referral centres.

2. **Community Involvement**

   (a) Use of simple charts and devices to facilitate understanding of above aspects and communicating them to others.

   (b) Demonstration of ways and means of mobilizing community involvement for labour and for transporting essential construction materials not locally available.

MODULE III

Operation & Maintenance (Duration: 1-2 weeks)

1. **Operation & Maintenance**

   (a) Periodic Inspection requirements for sanitary survey of water sources and typical, locally used water supply facilities such as:

      (i) Dug and tube-wells with handpumps
      (ii) Spring sources; protected ponds
      (iii) Gravity piped supplies with standposts
      (iv) Disinfection systems
      (v) Rain water systems.

MODULE III (cont'd)

(b) Periodic inspection requirements of typical, locally used sanitation facilities such as:

(i) On-site excreta disposal units
(ii) Open drains
(iii) Soakpits

(c) Undertaking simple repair and maintenance tasks for locally used equipment and facilities from among (a) and (b) above.

(d) Ability to draw water samples in sterile fashion and transport to testing laboratories. Ability to follow-up on adverse reports of water quality by undertaking specific sanitary surveys, inspecting disinfection and other equipment/arrangements and adjusting disinfection dose.

(e) Requirements of spare parts and tools to be stocked at site.

(f) Ability to secure advice, assistance, clarification on operation and maintenance difficulties from referral centres, and provide feedback to the centres for improving technology, etc.

Community Involvement

(a) Role of community members in operation and maintenance.

(b) Use of charts and simple devices to help communicate operation and maintentance requirements to the community-based workers and volunteers.

(c) Demonstration of ways and means of mobilizing community participation in operation and maintenance activities, transporting and storing spare parts, disinfectants, etc.

DATA COLLECTION GUIDELINES

DATA COLLECTION GUIDELINES

The purpose of this paper is to provide general guidance for baseline data collection and follow-up surveys to be used for the design, implementation, monitoring, and evaluation of potable water projects. The suggested data collection framework focuses on the following categories of variables and indicators:

o Design Variables and Indicators to Assess:

1.) Priority Beneficiary Needs

A.) Quality Drinking Water as a Health Intervention
B.) Adequate Water for Cleanliness
C.) Water for Small-Scale Gardens and Livestock

2.) Conditions Affecting Project Implementation

A.) Type and Distance of Water Source
B.) Technology Choice
C.) Financial Viability and Sustainability
D.) Settlement Pattern and Population
E.) Capabilities of Implementing Organizations
F.) Average Rainfall and Seasonal Variations

3.) Opportunities for Change

A.) Time Saved Getting Water
B.) Participation in Decision-Making

o Implementation Variables and Indicators to Assess:

1.) Performance Objectives to be Monitored In-Process

A.) Reliability (Continuous Months In Service Withou
B.) Wet and Dry Season (Comparable Reliability)
C.) Convenient Access Compared to Previous Water Source
D.) Adequacy of Water Supply for Users' Priority Needs
E.) Users' Preferences (Taste, Color, Odor, Temperature, etc.)

2.) Service Delivery Objectives and Performance

A.) Convenience of Hours When Communal Taps Operate
B.) Time Spent Waiting in Lines Compared to Previous Water Carrying
C.) Frequency and Duration of Breakdowns
D.) Affordability of Water Fees (Delinquency, Default, Fee Avoidance)
E.) Training to Meet O&M Needs

3.) Intended and Expected Results for Beneficiaries

A.) Less Water-Related Illness
B.) More Time for Productive and Leisure Activities
C.) Cleaner Households and Clothes
D.) Improved Family Nutrition
E.) Increased Status Because Homes Have Piped Water

o <u>Evaluation and Monitoring Variables and Indicators</u>

1.) Direct Development Impacts at Project's End-Point

A.) Reduction in Infant and Child Mortality
B.) Increased Production Due To Decreased Sick Time
C.) Financially Self-Sufficient Community Water Systems
D.) Self-Reliant and Competent Community O&M Operations
E.) Safeguard Equity So Poorer People not Excluded

2.) Direct Development Impacts 5 Years Expost

A.) Further Improvements in Infant and Child Mortality
B.) Reduced Incidences of Water-Related Disease
C.) Improved Attitudes and Behavior Regarding Hygiene and Sanitation
D.) Higher Standards of Living

3.) Direct Development Impacts at Project's Mid-Point

A.) Less Diarrhea (Frequency and Intensity)
B.) Fewer Work Days Missed Because of Diarrhea
C.) More Household Garden Cultivation, Diversification, and Yields
D.) Increased Quantity and Quality of Livestock
E.) Water Being Used and Fees Paid Promptly and Fully

4.) Derived (Indirect) Development Impacts at Project's End-Point

A.) Organizing or Strengthening Community Water Users' Associations
B.) Increased and Improved Participation of Women in Decision-Making
C.) Standardization of Water System Equipment and Designs
D.) Cost-Effective and Efficient O&M Operations
E.) Competent, Appropriate, and Prompt Project Support Services
F.) Established Capability to Locally Assemble Water Equipment

5.) Derived (Indirect) Development Impact 5 Years Expost

A.) Potable Water Activities Integrated Into a Regional or National Health Care Delivery and Education Program
B.) Reduced Rural-Urban Migration
C.) Routine and Efficient Sanitary Surveys to Identify and Avoid Ecological Risks
D.) Social Soundness Analysis to Identify Use Patterns and Constraint as a Pre-Condition for Project Approval
E.) Women's Organizations Grow Out of Involvement in User's Associations
F.) Successful and Cost-Effective Replication

G.) Formation of Community Problem-Solving Networks
H.) Community Groups Able to Raise Funds Externally From Donors
I.) Established Capability to Locally Manufacture Water Equipment

6.) Derived (Indirect) Development Impacts at Project's Midpoint

A.) Organizational Development Initiatives Gain Support
B.) Efforts Made to Promote and Establish Local Manufacture or Assembly of Water Equipment
C.) Women Show Increased Interest and Enthusiasm
D.) Efforts Begin to Coordinate Water Projects and Equipment Used
E.) Support Service Organizations Up-Grade Skills and Efficiency
F.) Training is Improved for O&M Personnel

Project experience indicates that the data collection approach with the highest potential for success is to conduct informal interviews with intended water users to determine:

- The community's financial ability to sustain recurring O&M costs, pay fees, and/or provide labor and in-kind contributions.

- The organizational capabilities and training needs of local water users' groups which would set and collect fees plus provide O&M oversight.

- What women consider to be the best site location to maximize convenience. Also, what women see as a priority water uses and local constraints which could impede implementation.

- The water-related health problems of the community and the most cost-effective way to provide needed services and training in response to felt needs.

CRITICAL FACTOR FOR ANALYSIS

CRITICAL FACTORS FOR PLANNING, ANALYSIS AND EVALUATION OF POTABLE WATER PROJECTS

Our analysis of potable water projects indicates that success tends to correlate with the following mutually reinforcing factors: reliability, user benefits, affordability, capability and equity.

The following are brief rationales explaining why each of these factors is critical to the success of potable water projects, and a list of key questions.

We recommend that these critical factor categories and key questions serve as the primary focus of subsequent evaluations of potable water projects.

Where feasible and appropriate, we also recommend their use by project planners, designers, project managers and people monitoring potable water projects.

Reliability:

It is estimated that 35% to 50% of rural water taps are out of order three to five years after they are installed, largely because of inadequate operation and maintenance. Communities won't pay for or maintain unreliable water systems and they tend to be abandoned.

1. How many months a year do the water systems work? Is the supply adequate.

2. Are systems broken during the wet (low demand, no scarcity) season, or dry?

3. Are water systems still working three to five years after installation?

4. What type of system, using what source of supply, serves how many people in dispersed or concentrated communities? Describe topography and rainfall.

5. How available are water system equipment, materials, spare parts and fuel?

6. Is there adequate, affordable transport? How many months are roads usable?

User benefits:

"Those systems that provided water as direct inputs to agricultural or non-agricultural processes (crafts or cattle),

and those that saved substantial amounts of time, were perceived by users to provide most obvious benefits. Systems that were built to fulfill AID's perceived need to provide only bigger quality water were not valued and did not survive." Community Water Supply in Developing Countries: Lessons from Experience, AID Evaluation Office.

1. Who are the primary water users and what are their priority needs?

2. What was the role of women in needs-assessment, site location, identification of constraints and description of expected benefits?

3. What are community perceptions regarding health improvements believed to be caused or strongly influenced by improved water quality or quantity?

4. Does the community perceive that income-producing activities such as agriculture, cattle-raising or crafts benefitted from the water project.

5. Is there a perception that improved water supply caused or contributed signficantly to children's learning ability or general health?

6. Does the time women save because the water supply is more convenient result in more earnings or opportunities for learning or participation?

Affordability:

Host countries tend to be unable or unwilling to pay recurring and replacement O&M costs. Community water users are then required to pay these costs, with or without some type(s) of (cross) subsidy. When capital costs per unit are too high, community users tend to believe expenses outweigh perceived benefits and revert to previous sources. Potential replicability also decreases.

1. Do water users pay the full O&M costs? How are fees set and collected?

2. What type and level of subsidies, assessed how, pay what portion of costs?

3. Is there individually metered, piped water, or communal taps?

4. Is there a local financial institution to make short-term O&M loans?

5. What is the estimated cost of providing water per capita or per family?

6. Does the community have a realistic plan for generating sufficient funds to cover recurring costs? What about replacement and expansion costs?

7. What is the estimated cost of labor, fuel, materials and T.A. consultants?

8. Will the host country use foreign reserves to import water necessities?

Capability:

Water projects should have capable local financial and technical institutions with sufficient, competent personnel to oversee construction and provide T.A. to community water users' associations responsible for ongoing O&M.

1. What training is provided for engineers, training specialists, management and administrative staff and skilled labor re: installation and O&M?

2. Are users taught whom to notify about malfunctions, conservation measures, potential health hazard and care of pump mechanisms and valves?

3. Does the national plan concentrate on hardware and construction to the exclusion or detriment of pre-project or post-construction phases?

4. Are systems managed by a community water users' association or group?

5. Can these groups set adequate and acceptable fees, collect, record and locally bank them and accomodate changing conditions and concerns?

6. What roles, responsibilities and relative influence do women have in these groups or associations?

7. Can local institutions provide adequate, reliable support services?

Equity:

Equitable distribution of benefits is more likely to occur where there is substantial community involvement in planning and

implementing the water system. Inequitable distribution can be divisive and promote vandalism.

1. Does the system use block rate pricing, with low charges for basic needs and incremental price increases for additional consumption and amenitites?

2. Is there a pattern of decreasing reliability, quantity and convenience as population concentration or political influence diminish?

3. Does the distribution of water benefit elites in ways which foster divisive resentments or hostilities within the community?

4. Is anyone excluded from water benefits? On what basis?

5. Does there appear to be a pattern of deliberately providing poor service to communal taps to pressure users to accept individual metered connection?

6. When meters are shared, what fee structure is used and how determined?

7. What provisions are made for those who refused to participate or arrived later?

8. Can water system equipment and/or spare parts be manufactured locally?

This approach could also be very useful as a means of disseminating the sectoral project experience of AID and other development agencies. It would be more concise, focused and cost-effective than disseminating full evaluations and, in most cases, would contain sufficient data to fill the needs of those seeking background information.

AID FUNDING CRITERIA

130

The AID policy paper on Domestic Water and Sanitation, prepared in May of 1982, clearly states the Agency's program objectives and priorities: ". . . concentrates primarily on the health rationale for investments in domestic water supply and sanitation".

This emphasis fits within the Agency's development strategy that "water is not only a basic requirement for life, but also contributes to overall economic growth and development".

The Agency seeks to accomplish this by funding projects which provide "water used for drinking; for hygiene (handwashing, bathing, cleaning the home, washing the kitchenware and eating utensils, food preparation, and frequently for washing clothes as well); also for watering poultry and livestock in small numbers, near the dwelling; and, in minor amounts, for irrigation in small household gardens."

A.I.D. CRITERIA

1. **Evidence of need and effective demand:** *The need for improved water and sanitation is clearly indicated by high prevalance of disease caused by (a) insufficient water, (b) consumption of highly contaminated water, and/or (c) inadequate or inappropriate sanitation systems; and consumers are willing to (a) support recurrent costs through some combination of fees, contributions, and local or national budget allocations, and (b) cover some portion of the investment costs to improve traditional systems or build new ones. Where consumers are unable to make such a commitment, but the absence of basic water and sanitation systems poses a public health hazard for the community at large, the government must demonstrate a commitment to shoulder a substantial portion of the investment costs, as well as those recurrent costs which the community cannot cover in the short-run while local arrangements for financing are being developed. A.I.D. will not fund projects where there is inadequate assurance that the community can and will support operation and maintenance costs of the system within a reasonable time frame.*

2. **Institutional responsibility and capacity.** *The local or national institutions responsible for national domestic water supply and sanitation policy must have the responsibility, personnel, and budgetary resources to ensure the construction, expansion and continued operation and maintenance of the improved water and sanitation systems. At a minimum, there must be evidence that the institution can be strengthened to the point where it can assume such responsibility with only modest outside support.*

3. **Infrastructure:** *Roads and other aspects of transportation and communications must be sufficiently developed to permit routine contact with local communities for the purposes of supervision, technical assistance, maintenance, and the delivery of fuel and spare parts. Alternatively, the technology adopted in the improved water and sanitation systems must be such that the system can be maintained by the community without outside assistance or supervision.*

Among the factors that will guide the design of A.I.D.-supported domestic water and sanitatio projects designed to improve health are the following:

— a minimum of 20-40 liters of relatively safe water per capita per day;
— improvements in water quality (as opposed t quantity) where improvements can be introduced at reasonable cost without compromising the reliability of the system;
— selection of a technology that can be maintained and operated easily and is acceptable within the local culture;
— measures to promote water conservation anc reuse;
— project design and implementation that responds to the needs of the community and, wherever feasible, encourages or requires active community involvement in all phases of the pro ject;
— sustained educational efforts to instruct users in proper water use and hygiene;
— a demonstrated means of financing and ensur ing operations and maintenance of the project over the long-term;
— training of community level workers and of personnel at the regional and national level in th maintenance, operation and repair of water sup ply and sanitation systems;
— technical assistance or training, as required, t improve the administration of water supply anc sanitation systems.

In addition, A.I.D. encourages attention to other factors which may have implications for domestic water water supply and sanitation, including: the strength of existing institutions that govern the allocation of water resources; opportunities to incorporate water supply and sanitation activities into primary health care, agriculture (irrigation) and other programs; and the implications of rapid urbanization for existing water supply.

A.I.D. will give particular attention to identifying and promoting opportunities for private sector involvement in the construction, operation, and maintenance of water and sanitation systems and in the manufacture of related equipment.

Where these conditions are met, A.I.D. will consider funding water and sanitation programs to improve health in rural areas as well as market towns, secondary cities, squatter settlements, and urban centers.

A.I.D.'s policy on domestic water supply and sanitation can be summarized as follows:

The availability of a minimum of 20-40 liters of relatively safe water per person per day is essential to achieve sustained health improvements in developing countries. Where this minimum quantity is not readily accessible and where there are significant health problems associated with inadequate water and sanitation, water supply and sanitation programs deserve attention.

However, domestic water supply and sanitation programs require considerable initial investment and are difficult (financially and logistically) to maintain. To ensure that domestic water and sanitation systems will be maintained over the long run, A.I.D. believes that projects sponsored by the Agency must address certain critical issues, among them:

— coverage of recurrent costs through fees, taxes or other means;
— proper education of users of the system;
— adequate operation and maintenance;
— encouragement of the involvement of private enterprise;
— adequate national or regional governmental capability for policy formulation and oversight.

When these and other policy issues are satisfactorily addressed, domestic water supply and sanitation programs rank high within A.I.D.'s health sector priorities.

As noted above, A.I.D. will not support water supply and sanitation programs whose operation and maintenance costs cannot be financed over the long-term by some combination of consumers, the local community, and the regional and central government. Where possible, consumers themselves should bear primary responsibility for covering all costs, since it is under these conditions that the systems are most likely to remain in operation over the long-term.

Specifically, A.I.D. will consider funding projects for improvements in domestic water supply and sanitation where:

1. A clear need exists, as indicated by high prevalence of disease caused by (a) insufficient water, (b) consumption of highly contaminated water, and/or (c) inadequate or inappropriate sanitation systems; and demand for services is indicated by a willingness on the part of users to (a) support recurrent costs through some combination of fees, taxes or labor contributions, and (b) cover some portion of the investment costs to improve traditional systems or build new ones; or

2. The absence of basic water and sanitation services poses a public health hazard for the community at large and the national government demonstrates a commitment to shoulder a substantial portion of investment costs where demand is insufficient to generate the revenue necessary to cover these costs[25]; and

3. The local or national institution responsible for water and sanitation programs has the personnel and budgetary resources to assist in the construction, operation, and maintenance of the improved systems, or, with modest outside support, can be strengthened to the point where it has that capacity; and

4. Infrastructure (both roads and other means of communication) is developed enough to permit routine contacts for supervision, technical assistance, maintenance, and the delivery of fuel or spare parts; or where the technology adopted is such that the system can be sustained by the community itself.

---

[25] In situations where the public need is compelling, host government subsidization of recurrent costs may be necessary on an interim basis, with the expectation that consumers will eventually assume these costs.

IMPACT EVALUATION ABSTRACT

IMPACT EVALUATION ABSTRACTS

TUNISIA CARE WATER PROJECTS

THE PROJECT

During 1975 - 1979 four water projects were implemented by CARE for $1.9 million. The goals were to improve the health and quality of life for rural Tunisians living in four of the poorer provinces. The three basic purposes of the project were:

(1) to make potable water available by renovating and enclosing about 300 existing wells and springs

(2) to institutionalize a provincial maintenance and disinfection system

(3) to increase health awareness among beneficiaries

THE EVALUATION

An impact evaluation team visited 31 project sites in three weeks 1980. The sample of sites was selected randomly, stratified by ty water point (well or spring) and by geographic area. Interviews w conducted with both men and women users at these sites.

MAJOR FINDINGS

(1) The evaluation was not able to demonstrate any impact of the CARE water projects on the incidence of water-related disease. Water use patterns were not altered by the project, and there was no increase in water supply intended.

(2) The projects generally failed to improve the availability and use of potable water. Ministry of Public Health records showed that about three fourths of the project sites were not producing water that was potable by Tunisian public health standards. About four-fifths of the projects sites visited required repairs. Only one half of these sites were fully operational and showed no signs of contamination. At two-fifths of the sites where handpumps were installed they were not working. All diesel pumps visited were operating.

(3) Beneficiary participation in project design, implementation or maintenance was very limited at most sites. It was greatest in the driest project area where users created a system of fees to cover diesel fuel costs. This participation was associated with better site maintenance. Participation was nearly non-existent at sites where alternative water sources were available.

(4) Maintenance/Disinfection and Health Education Teams created by the project still existed, but appeared not to be making sufficient site visits or coping with the problems as envisioned. There was little or no change in health awareness.

(5) The project did not address the users' major perceived need of greater access and more water. The project was designed to improve water quality, not to tap new sources or increase existing supply.

LESSONS LEARNED

- Health benefits cannot be expected from potable water projects if water quality is not improved

- Project design should reflect demonstrated community need rather than prepackaged donor solutions

- Local participation might be encouraged by including beneficiaries in the planning process and addressing their percieved water needs.

AID EVALUATION ABSTRACTS

KOREAN POTABLE WATER SYSTEM PROJECT

THE PROJECT

During 1977-79, AID funded a CARE program to help the Korean government establish six potable water systems in communities with populations between 5,000 and 10,000 people. The basic purposes of this project were:

- To develop water systems which could be used as models in Korean communities of comparable size.
- To improve health conditions in the six target communities and others where the model would be replicated.

THE EVALUATION

The impact evaluation team was comprised of two AID staff people from Washington, two Korean experts and four graduate students of sociology who conducted household surveys. All of the respondents in the household survey were women and men were also interviewed during the six site visits.

MAJOR FINDINGS

(1) The density of housing and the closeness of pit latrines to shallow wells increases the danger that diseases will be transmitted by contaminating the ground water table.

(2) The health education campaign was poorly conceived, organized and managed. The material covered was already available through school and public health programs.

(3) Studies to determine the impact of piped water on community health were inconclusive and of questionable professional quality. No supportable evidence could be found that the program influenced health positively in the communities served.

LESSONS LEARNED

- A health education program is not always a required adjunct to a potable water project. Existing programs, attitudes and practices may be adequate.

- Environmental assessments should always be conducted where piped water is introduced into urban or semi-urban communities.

- An unanticipated negative impact was that runoffs from flush toilet holding tanks was piped into open drains and the risk that water borne diseases could result.

IMPACT EVALUATION ABSTRACTS

PERU: CARE OPG WATER HEALTH SERVICES

During 1978-1980, 29 projects were completed which combined construction of water and sewer systems with health education components. AID's role consisted of funding the foreign exchange cost of construction materials, providing technical assistance and project monitoring. CARE planned and managed the project. The Ministry of Health provided health services to the project. The Organization for the Reconstruction and Development of the Earthquake Zone (ORDEZA) designed and built water supplies and sewer systems with help from villagers.

The purposes of the projects were:

- Build water supplies
- Build sewer systems
- Give vaccinations
- Provide health education

THE EVALUATION

A three member evaluation team arrived in Lima on November 30th and completed their field study on December 15th and visited six project sites. Project sites were selected on the basis of geographical representation degree of accessibility and different types of project interventions.

MAJOR FINDINGS

(1) Health education components, especially movies, were enthusiastically received by villagers but did not appear to make any impact.

(2) For a $20 fee and less than 15 cents per month, 2,600 households in small villagers received water from gravity-fed systems which supplied 60 liters of potable water a day.

(3) "There is no reason to expect that this project will produce any data that unquestionably link improvements in the health of beneficiaries to the installation of piped water supplies."

LESSONS LEARNED

- Project planners should take into account the disruptive impact that bureaucractic interagency conflicts can have on development projects.

- Because of the complexities involved, perfunctory attempts to measure the health impacts of a project whose main purpose is to provide drinking water will not produce conclusive data and should not be funded.

- The use of local construction materials should be encouraged even where their initial costs is greater than U.S. imports. Imported materials tend to produce rigidities in project design and implementation.

IMPACT EVALUATION ABSTRACTS

KENYA RURAL WATER SUPPLY PROJECTS

THE PROJECT

The government of Kenya had a five year development plan (1979-1983) to provide potable water for an additional 2.5 million rural residents. The CARE-Kenya Water Development Program started in 1975. AID financial assistance was to provide materials and equipment to self-help Harambee projects which raised at least half the required funding from the community. The basic purpose of the project was:

- To have CARE-Kenya complete 30 projects annually that would serve 300,000 people.

THE EVALUATION

Beginning on June 23 of 1979, a two-person evaluation team spent five weeks visiting 22 communities. The four types of systems surveyed were:

1. Built and operated by the Ministry of Water Development (MWD)
2. Built by other but operated by the MWD
3. Harambee or self-help projects; and
4. Water projects built, owned and operated by associations of members.

MAJOR FINDINGS

(1) These large complex systems are not working well. There are problems of design, construction, and maintenance that make the systems unreliable. Maintenance problems are primarily the results of low funding by the government.

(2) The government discourages the use of communal facilities by locating them inconveniently and sometimes closing them completely. The result is that rural systems often deliver water only to a small number of elite users.

(3) Ground water resources should be developed and the use of shallow wells and handpumps encouraged.

- 1440

(4) Delivering piped water to individual metered connections is inappropriate for rural Kenya due to the lack of engineers, high capital costs, ineffective administration and lack of adequate operations and maintenance funding.

LESSONS LEARNED

- As the technology level becomes more sophisticated, the support required becomes more extensive. An assessment should be made of what systems are currently being supported reliably by the existing agencies and projects should be designed at that technological level.

- The government of Kenya produces only a quarter of the funds necessary to support the system. Additional funding sources for the program should be located.

- Complexity of design, lack of supervision and government support, widely scattered site locations and the large number of users were the reasons given for project failures.

141

IMPACT EVALUATION ABSTRACTS

PANAMA RURAL WATER PROJECT

THE PROJECT

In 1972 and 1976, AID assisted Panama's Department of Environmental Health (DEH) to provide 500 piped water systems and 1,800 handpumps to small villages. Occasionally gasoline pumps. Villagers organized community health committees which contributed labor, local materials and cash. Villagers were trained to do minor repairs. The basic purposes of the project were:

(1) To raise the marginal population's health level to acceptable standard.

(2) To institutionalize an improved, low cost, rural public health delivery system providing both preventative and curative services.

(3) To provide adequate environmental sanitation conditions.

(4) To improve the training of health assistants and better utilize them.

THE EVALUATION

In August of 1980, a three person evaluation team spent three weeks in Panama. They visited 26 randomly selected village health committees with piped water systems which had been in operation during 1980. The sample was expanded to include 42 site visits in 13 days. The team examined the reliability of the water systems, their usage and the effects of beneficiaries. Both men and women were interviewed.

MAJOR FINDINGS

(1) The average cost of handpump installation was $1,200 or about $24 per person. The estimated cost of a piped water system was $25,000 or approximately $50 per person. Despite the higher cost of piped water systems, they may not cost significantly more per person in the long run if repair and expansion costs are considered.

(2) The criteria and technology of the handpump program should be reevaluated. Service could become more reliable by: establishing community responsibility for some maintenance and repair, ascertaining community demand and selecting alternative technologies.

(3) Conversion, expansion and major repairs to piped water systems to cope with increased populations and/or escalating energy costs require more funds than communities could raise funds to pay those costs.

LESSONS LEARNED

Rural piped water systems tend to be more likely to succeed when the following community participation requirements are met:

- There must be community demand for household water.
- The implementing agency enter into a written contract with community water users specifying roles and responsibilities.
- Villagers should be trained to operate and maintain equipment and known when to request technical assistance.

IMPACT EVALUATION ABSTRACTS

THAILAND RURAL POTABLE WATER PROJECT

THE PROJECT

Between 1966 and 1972, AID assisted the Thai government to install some 250 water systems. The project was implemented by the Sanitary Engineering Division of the Thai Ministry of Public Health (MOPH) through a contract with a New York engineering firm. Systems were installed in villages and rural market towns. Each system contained a water treatment plant with storage tower and piped distribution all of which included chlorination. Villagers were asked to help construct the system and develop a rate structure that would pay for operation and maintenance costs. One person was trained as a plant operator and also collected water fees.

The basic purposes of the project were:

- To help the Thai Government win the political loyalty of rural residents threatened by communist insurgency.
- To help the Thai Government gain the capacity to plan and administer a national potable water program serving some 12,000 rural communities within 30 years
- To improve health in 600 "security sensitive" communities

THE EVALUATION

A two person evaluation team visited a stratified random sample of 52 systems between October 20th and December 4th of 1979. The 52 systems serve 133 communities with a combined population of approximately 110,000 persons.

MAJOR FINDINGS

(1) Insurgency diminished some 10 years later, but probably due to political changes rather than this single project.

(2) The Thai Government has planned and built some 800 systems and proved itself capable of administering a national program.

(3) Although many people don't drink the water, communities tend to perceive a health improvement.

(4) The greatest impacts were economic gains not anticipated by project personnel. Economic gains resulted from gardening, livestock raising, and crafts.

(5) No statistics exist to confirm improved health in project communities.

LESSONS LEARNED

- In nearly all cases where systems did not continue to function, the problem appears to have been managerial rather than technical.

- Projects should be considered for their economic benefits not only possible health gains.

- Successful village systems were characterized by the following characteristics: contribution of time, labor and funds plus training and support of local operators and evoluntionary development of a viable rate structure.

A.I.D. IMPACT EVALUATION PUBLICATIONS

The following evaluation reports on potable water have been conducted by the A.I.D. Center For Information and Evaluation (CDIE). Copies of the documents can be obtained from:

AID Document and Information Handling Facility
7222 47th Street
Chevy Chase, Maryland 20815

IMPACT EVALUATIONS

The Potable Water Project in Rural Thailand (May 1980), No. 3; PN-AAH-850

Kenya Rural Water Supply: Program, Progress, Prospects (June 1980), No. 5, PN-AAH-724

Tunisia: Care Water Projects (October 1980), No. 10

Korean Potable Water System Project: Lessons from Experience (May 1981) No. 20, PN-AAJ-170

Peru: Care OPG Water Health Services Project (October 1981) No. 24, PN-AAJ-176

Panama: Rural Water (May 1982) No. 32, PN-AAJ-609

PROGRAM EVALUATION

Community Water Supply in Developing Countries: Lessons from Experience (September 1982) No.7, PN-AAJ-624

SPECIAL STUDIES

Water Supply and Diarrhea: Guatemala Revisited (August 1980) No. 2, PN-AAH-747

Rural Water Projects in Tanzania: Technical, Social and Administrative Issues (November 1980) No.3, PN-AAH-974

WORKING PAPERS

Rural Water Supply: A Studies Division Workplan (September 1978)

Patterns in Potable Water Projects: An Analysis of AID's Automated Data, Practical Concepts, Inc.
(October 1978)

Potable Water: Results of AID Workshops, AIDTO Circ. A-500
(December 1978)

Rural Potable Water Supply: Background Paper
(January 1979)

Rural Potable Water Supply Evaluation Study: Draft Scope of Work
(June 1979)

OTHER SELECTED A.I.D. EVALUATIONS

AID Regional Bureaus and Missions have also undertaken a number of special evaluations of potable water projects. Audits by the Inspector General's Office and by the GAO are also included. Below is a bibliography of such evaluations available from CDIE's Development Information System. Copies of the documents may be obtained from:

AID Document and Information Handling Facility
7222 47th Street
Chevy Chase, Maryland 20815

BIBLIOGRAPHY
SELECTED WATER PROJECTS (EVALUATIONS)

PD-AAP-391 Special Evaluation Report.....ISN=35211
Small rural water systems project evaluation: Yemen Arab Republic. Oct. 1983. 2790044

PD-AAI-534 Project Evaluation Summary (PES) ISN=785
Siliana rural development. Sept. 1980. 6640285 PES#664-80-2.

PD-AAJ-760 Project Evaluation Summary (PES) ISN=1335
Integrated rural development. Jan. 1980. 5320046 PES#532-80-1.

PN-AAJ-170 Special Evaluation Report ISN=12379
Korean Potable Water System Project: Lessons from Experience. 1981. 4890251.

PD-AAL-701 Special Evaluation Report ISN=14027
Well drilling assistance for the health sector loan II project in the Dominican Republic. Jul. 1982. 9311176.

PD-AAA-162-C1 Audit Report ISN=16911
Audit Report of the National Water Supply and Sewer Program in the States of Goias, Para, Parana, and Santa Catarina under Project Agreement #512-11-520-062. Oct. 1965.

PD-AAA-161-A1 Final Report ISN=23027
Urban Water and Sewer Systems Improvement. Oct. 1974. 512006201.

B4930206001801 Audit Report ISN=24518
Audit Report: USOM Thailand Water Resources Projects - Potable Water Project #493-11-521-186, Labor Intensive Water Resources Project #. 4930186; 4930206. July 1972.

PD-AAD-901-B1 Project Evaluation Summary (PES) ISN=25073
Surakarta Potable Water. Dec. 1978. 4970262.

PD-AAA-945-B1 Project Evaluation Summary ISN=25087
Rural Potable Water and Latrine Construction. Dec. 1978. 5200231. PES#520-79-4.

PD-AAA-635-A1 Project Evaluation Summary (PES) ISN=25434
PES-Columbia-Small City Environmental Sanitation. Mar. 1979. 5140183.

PD-AAA-945-A1 Project Evaluation Summary (PES) ISN=26122
Rural Potable Water Systems and Latrine Construction. Sept. 1977. 5200231. USAID Guatemala: 77-10.

PD-AAJ-938 Audit Report ISN=26145
Use of Treated Sewage for Irrigation July 1979. 5270150.

PD-AAF-273-A1 Project Evaluation Summary (PES) ISN=26205
Nutrition Program (Costa Rica) Sept. 1979. 5150121. USAID-Costa Rica 80-81.

PD-AAF-957-B1 Project Evaluation Summary ISN=26678
CARE/Hacho Potable Water II June 1980. 5210112. USAID-Haiti: 521-80-6.

PD-AAH-238-A1 Project Evaluation Summary (PES) ISN=26280
Central African Republic - Rural Village Wells. Mar 1980. 6760003

XD-AAH-850-1 Audit Report ISN=26854
Water Resources Projects (Potable Water Project and Labor Intensive Water Project): Audit Report. July 1972. 4930186; AID Proj Impact Evaluation Report #3.

B4970262001502 Project Evaluation Summary (PES) ISN=27444
Surakarta Potable Water Project. June 1981. 4970262.

PD-AAH-405 Project Evaluation Summary (PES) ISN=27513
Community Development: West Bank/Gaza Strip (OPG). Aug. 1981. 2980143. USAID-Israel 81-1

PD-AAH-671 Project Evaluation Summary (PES) ISN=27529
Rural Water Systems - CARE OPG. Aug. 1981. 5110479. USAID-Bolivia: 81-7.

PD-AAM-437 Special Evaluation Report ISN=27634
PL480 Title III Evaluation: Basic Village Services, Egypt. Feb. 1980. 2630103.

PN-AAL-010 Special Evaluation Report ISN=29786
Bangladesh Small-Scale Irrigation. April 1983. 3880019.

PD-AAN-974 Project Evaluation Summary (PES) ISN=33714
Siliana wells/rural hygiene (OPG/AID/NE-G-1641). Sept. 1983. 664031205.

PD-AAP-221 Project Evaluation Summary ISN=34610
Water and Sanitation for Health (WASH). April 1984. 9311176. PES#931-84-07.

WHAT'S BEEN FUNDED WHERE?

A.I.D. Obligations and Water Needs

- From 1977 onward most of the large water and sanitation projects, specifically designated as such, have been concentrated in the Near East region (see Table 5).

- The greatest need for safe water in urban areas is in the Sahel region of Africa (see Figure 1). The greatest need for potable water exists in the rural areas where, with the exception of the Near East, fewer than thirty percent of the population has access to potable water (see Figure 2).

- Those countries in which A.I.D. has obligated more than 10 million life of project dollars include (see Table 4):

  Africa
  - Togo
  - Burkina
  - Sudan
  - Somalia

  Asia
  - Philippines
  - Sri Lanka

  Latin America
  - Brazil
  - Honduras
  - Panama
  - Peru

  Near East
  - Egypt
  - Jordan
  - Portugal
  - Syria
  - Tunisia
  - Yemen

- Over 80 percent of life of project dollar obligations for water and sanitation projects have been in the Near East (see Table 5).

- Most of the large water projects are urban or have an urban component. In the Near East all large water projects have been urban except in Tunisia where provincial projects predominate (see Table 4).

A.I.D. FUNDED WATER AND SANITATION PROJECTS*

COUNTRY	PROJECT # Grant/Loan	PROJECT TITLE	YR BEGIN	YR END	SCOPE	LIFE OF PROJECT US$ thousands
Burundi	G6950109	Community Water & Health	1983	1986	National	330
Lesotho	G6320088	Rural Water & Sanitation	1979	1987	Multiprov	12,142
Malawi	G6120207	Rural Water	1980	1985	Regional	6,000
Mali	G6880229	Sahel Wells	1981	1984	Pilot	405
Mali	G6250937	Yelimane:Tambacara Wells(9)	1981	1985	Pilot	155
Somalia	G6490104	Comprehensive GRDWTR Dev.	1979	1983	Regional	6,556
Sudan	G6500065	GEDAREF Municipal Water Supply	1983	1987	Urban	7,500
Sudan	G6500050	Port Sudan Water Supply	1981	1984	Urban	2,000
Sudan	G6500065	Water & Sanitation Project	1982	1985	Urban	6,000
Togo	G6930210	Rural Water & Sanitation	1980	1987	Regional	11,739
Burkina	G6860228	Rural Water Supply	1979	1984	Provincial	12,280
Phillipines	G4920333	Barangay Water II	1980	1984	Provincial	2,537
Phillipines	L4920333	Barangay Water II	1980	1984	Provincial	19,600
Asia Reg.	G8790269	Rural Water Supply	1980	1984	Rural	600
Sri Lanka	G3830063	Market Town Water Supply	1980	1982	Urban	2,000
Sri Lanka	L3830063	Market Town Water Supply	1980	1982	Regional	6,000
Bolivia	G5110458	Rural Sanitation	1977	1984	Provincial	310
Bolivia	L5110458	Rural Sanitation	1977	1984	Provincial	4,000
Dom. Republic	L5170120	Health Sector II	1979	1984	Provincial	8,000
E. Carib Reg.	G5380098	Antigua Water Supply	1983	1986	National	3,075
E. Carib Reg.	L5380098	Antigua Water Supply	1983	1983	National	6,625
Haiti	G5210169	NGO Support I: Community Water	1983	1984	Rural	0
Haiti	G5210147	Potable Water III	1981	1983	Regional	495
Honduras	G5220233	Bay Island Development	1983	1984	Pilot	245
Honduras	L5220165	Municipal Development II	1980	1984	Urban	3,000
Honduras	G5220166	Rural Water & Sanitation	1980	1985	National	1,000
Honduras	L5220166	Rural Water & Sanitation	1980	1986	National	19,500
Peru	G5270221	Rural Water System/Sierra	1981	1985	Regional	1,000
Egypt	L2630089	Alexandria Sewage I	1977	1984	Urban	15,000
Egypt	G2630100	Alexandria Sewer Expansion II	1979	1986	Urban	198,700
Egypt	G2630161	Basic Village Services	1980	1985	National	145,000
Egypt	G2630091	Cairo Sewage	1978	1986	Urban	129,000
Egypt	G2630038	Cairo Water System	1977	1985	Urban	61,400
Egypt	L2630038	Cairo Water System	1977	1985	Urban	30,000
Egypt	G2630048	Canal Cities Water & Sanitation	1979	1985	Urban	109,000
Egypt	L2630048	Canal Cities Water & Sanitation	1978	1985	Urban	60,000

COUNTRY	PROJECT # Grant/Loan	PROJECT TITLE	YR BEGIN	YR END	SCOPE	LIFE OF PROJECT US$ thousands
Israel	G2710005	Desalting Plant	1975	1985	Pilot	20,000
Jordan	L2780220	Amman Water & Sewerage	1978	1984	Urban	39,000
Jordan	L2780206	Aqaba Sewerage	1979	1985	Regional	7,500
Jordan	G2780233	Irbid Water & Sewerage	1980	1989	Urban	2,500
Jordan	L2780233	Irbid Water & Sewerage	1980	1985	Urban	21,000
Jordan	G2780259	Water Systems & Services Mgt.	1983	1985	Urban	4,000
Jordan	L2780259	Water Systems & Services Mgt.	1983	1988	Urban	17,000
Jordan	G2780234	Zarqa-Ruseifa Water	1983	1983	Urban	5,000
Jordan	L2780234	Zarqa-Ruseifa Water Supply	1982	1982	Urban	10,000
Lebanon	G2680330	Potable and Envir. Sanitation	1984	1984	Urban	22,000
Tunisia	G6640312	CTRD: Potable Water	1979	1983	Provincial	750
Tunisia	G6640312	CTRD: Siliana Water	1979	1983	Rural	492
Tunisia	G6640312	CTRD: Well Drilling	1979	1984	Provincial	2,190
Tunisia	L6640318	Siliana Rural Centers	1978	1984	Provincial	3,500
Yemen	G2790044	Small Rural Water Systems	1979	1989	Rural	7,477
Yemen	G2790039	Taiz Water & Sewage	1977	1983	Urban	11,200
Yemen	L2790039	Taiz Water & Sewers	1981	1983	Urban	5,000

*Updated 10/19/84 from AID/S&T/H

Table 5

A.I.D. OBLIGATIONS FOR WATER AND SANITATION PROJECTS BY REGION

DOLLAR AMOUNTS*

FISCAL YEAR	AFRICA	ASIA	LATIN AMERICA	NEAR EAST	ALL REGIONS
1973	0	0	2,400	630	3,030
1974	0	3,267	0	1,116	4,383
1975	300	14,000	7,889	69,605	91,794
1976	500	20,000	0	26,127	46,627
1977	500	6,800	4,748	98,738	110,786
1978	1,992	3,684	581	125,752	132,009
1979	7,528	3,500	8,754	163,371	183,153
1980	9,373	15,904	18,621	96,863	140,761
1981	15,015	10,150	676	176,150	201,991
1982	17,888	3,233	5,520	13,800	40,441
1983	12,750	1,300	13,845	206,906	234,801
1984	7,362	8,200	1,650	139,949	157,161
1985	5,162	5,100	1,739	109,000	121,001
Total	78,370	95,138	66,423	1,228,007	1,467,938

A.I.D. WATER AND SANITATION LIFE OF PROJECT OBLIGATIONS, 1961-1990**

LIFE OF PROJECT $	82,461	103,177	135,938	1,522,200	1,843,776
PERCENT OF LOP $	4	6	7	83	

* In thousands of dollars
** Some projects may not have been identified.
Information from A.I.D. S&T/Health

RENT A.I.D. FUNDED WATER AND SANITATION PROJECTS*

COUNTRY	PROJECT # Grant/Loan	PROJECT TITLE	YR BEGIN	YR END	SCOPE	LIFE OF PROJECT US$ thousands
Burundi	66950109	Community Water & Health	1983	1986	National	330
Lesotho	66320088	Rural Water & Sanitation	1979	1987	Multiprov	12,142
Malawi	66120207	Rural Water	1980	1985	Regional	6,000
Mali	66880229	Sahel Wells	1981	1984	Pilot	405
Mali	66250937	Yelimane:Tambacara Wells(9)	1981	1985	Pilot	155
Somalia	66490104	Comprehensive GROWTR Dev.	1979	1983	Regional	6,536
Sudan	66500065	GEDAREF Municipal Water Supply	1983	1987	Urban	7,500
Sudan	66500050	Port Sudan Water Supply	1981	1984	Urban	2,000
Sudan	66500065	Water & Sanitation Project	1982	1985	Urban	6,000
Togo	66930210	Rural Water & Sanitation	1980	1987	Regional	11,739
Burkina	66860228	Rural Water Supply	1979	1984	Provincial	12,280
Phillipines	64920333	Barangay Water II	1980	1984	Provincial	2,537
Phillipines	L4920333	Barangay Water II	1980	1984	Provincial	19,600
Asia Reg.	68790269	Rural Water Supply	1980	1984	Rural	600
Sri Lanka	63830063	Market Town Water Supply	1980	1982	Urban	2,000
Lanka	L3830063	Market Town Water Supply	1980	1982	Regional	6,000
Bolivia	65110458	Rural Sanitation	1977	1984	Provincial	310
Bolivia	L5110458	Rural Sanitation	1977	1984	Provincial	4,000
Dom. Republic	L5170120	Health Sector II	1979	1984	Provincial	8,000
E. Carib Reg.	65380098	Antigua Water Supply	1983	1986	National	3,075
E. Carib Reg.	L5380098	Antigua Water Supply	1983	1983	National	6,625
Haiti	65210169	NGO Support I: Community Water	1983	1984	Rural	0
Haiti	65210147	Potable Water III	1981	1983	Regional	495
Honduras	65220233	Bay Island Development	1983	1984	Pilot	245
Honduras	L5220165	Municipal Development II	1980	1984	Urban	3,000
Honduras	65220166	Rural Water & Sanitation	1980	1985	National	1,000
Honduras	L5220166	Rural Water & Sanitation	1980	1986	National	19,500
Peru	65270221	Rural Water System/Sierra	1981	1985	Regional	1,000
Egypt	L2630089	Alexandria Sewage I	1977	1984	Urban	15,000
Egypt	62630100	Alexandria Sewer Expansion II	1979	1986	Urban	198,700
Egypt	62630161	Basic Village Services	1980	1985	National	145,000
Egypt	62630091	Cairo Sewage	1978	1986	Urban	129,000
Egypt	62630038	Cairo Water System	1977	1985	Urban	61,400
Egypt	L2630038	Cairo Water System	1977	1985	Urban	30,000
Egypt	62630048	Canal Cities Water & Sanitation	1979	1985	Urban	109,000
	L2630048	Canal Cities Water & Sanitation	1978	1985	Urban	60,000

NTRY	PROJECT # Grant/Loan	PROJECT TITLE	YR BEGIN	YR END	SCOPE	LIFE OF PROJECT US$ thousands
Israel	G2710005	Desalting Plant	1975	1985	Pilot	20,000
Jordan	L2780220	Amman Water & Sewerage	1978	1984	Urban	39,000
Jordan	L2780206	Aqaba Sewerage	1979	1985	Regional	7,500
Jordan	G2780233	Irbid Water & Sewerage	1980	1989	Urban	2,500
Jordan	L2780233	Irbid Water & Sewerage	1980	1985	Urban	21,000
Jordan	G2780259	Water Systems & Services Mgt.	1983	1985	Urban	4,000
Jordan	L2780259	Water Systems & Services Mgt.	1983	1988	Urban	17,000
Jordan	G2780234	Zarqa-Ruseifa Water	1983	1983	Urban	5,000
Jordan	L2780234	Zarqa-Ruseifa Water Supply	1982	1982	Urban	10,000
Lebanon	G2680330	Potable and Envir. Sanitation	1984	1984	Urban	22,000
Tunisia	G6640312	CTRD: Potable Water	1979	1983	Provincial	750
Tunisia	G6640312	CTRD: Siliana Water	1979	1983	Rural	492
Tunisia	G6640312	CTRD: Well Drilling	1979	1984	Provincial	2,190
Tunisia	L6640318	Siliana Rural Centers	1978	1984	Provincial	3,500
Yemen	G2790044	Small Rural Water Systems	1979	1989	Rural	7,477
Yemen	G2790039	Taiz Water & Sewage	1977	1983	Urban	11,200
Yemen	L2790039	Taiz Water & Sewers	1981	1983	Urban	5,000

pdated 10/19/84 from AID/S&T/H

137

REG	COUNTRY	TITLE	PROJ.NO.	STATUS	BEG	END	SCOPE	APPR	LOAN	FY73	FY74	FY75	FY76	FY77	FY78	FY79	FY80	FY81	FY82	FY83	FY84	FY85
AF	Botswana	Environmental Sanitation	G 6330084	C	79	83	Multi.Prov	HE	499	0	0	0	0	0	0	499	0	0	0	0	0	0
AF	Burundi	Community Water & Health	D 6950189	D	83	86	National	HE	330	0	0	0	0	0	0	0	0	0	0	330	0	0
AF	Cameroon	Margoi-Wardala Water Supply	G 6310025	C	80	82	Region	HE	1460	0	0	0	0	0	0	0	534	925	425	0	0	0
AF	Cameroon	Self-Help:Egbang Water System	G 1631170	C	81	81	Village	SD	4	0	0	0	0	0	0	0	0	4	0	0	0	0
AF	Cameroon	Self-Help:Zoetele Water System	G 1631040	C	81	81	Village	SD	4	0	0	0	0	0	0	0	0	4	0	0	0	0
AF	Cameroon	Self:Help:Diangene Water Supp.	G 1631070	C	81	81	District	SD	4	0	0	0	0	0	0	0	0	4	0	0	0	0
AF	Cape Verde	Mindelo Desalination	G 6550004	C	78	82	Urban	HE	604	0	0	0	0	0	200	300	100	0	0	0	0	0
AF	Cape Verde	Mindelo Desalination	G 6550004	C	81	82	Urban	SH	127	0	0	0	0	0	0	0	0	127	0	0	0	0
AF	Cape Verde	Sal/Desalination/Power	G 6550005	C	78	83	Prov.	HE	575	0	0	0	0	0	575	0	0	0	0	0	0	0
AF	Cen. African R.	Rural Village Water Supply	G 6760292	C	76	80	Reg.	DR	500	0	0	0	500	0	0	0	0	0	0	0	0	0
AF	Chad	Rural Sanitation & Water	D 6770022	C	70	81	Reg.	SH	1665	0	0	0	0	0	1000	660	0	0	0	0	0	0
AF	Ghana	Rural Dev. Village Water	G 6410073	C	77	77	Prov.	FN	500	0	0	0	0	500	0	0	0	0	0	0	0	0
AF	Kenya	Water Development (Care)	G 6150146	C	75	76	Nat.	FN	300	0	0	300	0	0	0	0	0	0	0	0	0	0
AF	Kenya (R)	Water Supply,(IRT 30)	G 6980407	C	82	82	District	FN	35	0	0	0	0	0	0	0	0	0	35	0	0	0
AF	Lesotho	Rural Water and Sanitation	D 6320080	D	79	87	Multiprov.	HE	12142	0	0	0	0	0	0	1004	1196	2000	2300	2098	1450	1294
AF	Liberia	Hand Dug Wells	G 6490157	C	78	81	Pilot	HE	267	0	0	0	0	0	267	0	0	0	0	0	0	0
AF	Malawi	Rural Water	G 6120207	D	80	85	Reg.	HE	4000	0	0	0	0	0	0	0	700	1700	2040	731	0	0
AF	Mali	Rural Water Improvement	G 6880224	C	80	80	villages	SH	259	0	0	0	0	0	0	0	259	0	0	0	0	0
AF	Mali	Sahel Wells	G 6889229	D	81	84	Pilot	SH	405	0	0	0	0	0	0	0	0	405	0	0	0	0
AF	Mali	Self-Help: Doboro Wells	G 6882500	C	82	82	Village	SH	1	0	0	0	0	0	0	0	0	0	1	0	0	0
AF	Mali	Self-Help:Ana,Koro,Moyd.Wells	G 6880500	C	82	82	Village	SH	2	0	0	0	0	0	0	0	0	0	2	0	0	0
AF	Mali	Self-Help:Dalakent Wells	G 6882300	C	82	82	Village	SH	1	0	0	0	0	0	0	0	0	0	1	0	0	0
AF	Mali	Self-Help:Koursale Wells	D 6861760	C	82	82	Village	SH	1	0	0	0	0	0	0	0	0	0	1	0	0	0
AF	Mali	Self-Help:Sana and Noki Wells	G 6861200	C	82	82	Village	SH	2	0	0	0	0	0	0	0	0	0	1	0	0	0
AF	Mali	Self-Help:Iroungoombe Well	G 6882400	C	82	82	Village	SH	0	0	0	0	0	0	0	0	0	0	2	0	0	0
AF	Mali	Self-Help:Water Pumps at SAN	D 6880800	C	82	82	Village	SH	3	0	0	0	0	0	0	0	0	0	0	0	0	0
AF	Mali	Self-Help:Wena Were Well	G 6881300	C	82	82	Village	SH	1	0	0	0	0	0	0	0	0	0	3	0	0	0
AF	Mali (SH Reg)	Yelimane:Tambacara Wells(?)	D 6250937	D	81	85	Pilot	SH	155	0	0	0	0	0	0	0	0	0	1	0	0	0
AF	Rwanda	Rural Water for Public Health	G 6960127	P	85		Design	PDS	10	0	0	0	0	0	0	0	155	0	0	0	0	0
AF	Rwanda (Reg)	Gicye Water (IRT25)	G 6980407	C	81	81	Pilot	FN	60	0	0	0	0	0	0	0	0	0	0	0	0	10
AF	Somalia	Compreh. GROWTH Development	D 6490104	D	79	83	REG	HE	6554	0	0	0	0	0	0	0	0	40	0	0	0	0
AF	Somalia	Mogadiscio Water Supply	G 6490037	C	62	75	Urban	FN	970	0	0	0	0	0	0	757	2400	2200	1899	0	0	0
AF	Somalia	Mogadiscio Water Supply	L 6490037	C	62	75	Urban	DL	7150	0	0	0	0	0	0	0	0	0	0	0	0	0
AF	Sudan	GEDAREF Municipal Water Supply	G 6500065	D	83	87	Urban	FDA	7500	0	0	0	0	0	0	0	0	0	0	0	0	0
AF	Sudan	Port Sudan Water Supply	G 6500050	D	81	84	Urban	MRA	2000	0	0	0	0	0	0	0	0	0	0	7500	2400	0
AF	Sudan	Water & Sanitation Project	G 6500065	D	82	85	Urban	MRA	2000	0	0	0	0	0	0	0	0	2000	0	0	0	0
AF	Swaziland (R)	Water Filtration (IRT 17)	G 6980407	C	80	80	Pilot	FN	29	0	0	0	0	0	0	0	0	0	6000	0	0	0
AF	Tanzania	Self:Help:Maswa Water Reserv.	02-6	C	82	82	Village	SD	3	0	0	0	0	0	0	0	29	0	0	0	0	0
AF	Tanzania	Self:Help:Zanzibar Water Works	02-5	C	82	82	Regional	SD	4	0	0	0	0	0	0	0	0	0	3	0	0	0
AF	Togo	Rural Water and Sanitation	D 6930210	D	80	87	Regional	HE	11739	0	0	0	0	0	0	0	0	0	4	0	0	0
AF	Togo (R)	Spring Water (IRT 17)	G 6980407	C	81	82	PILOT	FN	75	0	0	0	0	0	0	0	1506	3240	1000	2091	2292	1608
AF	Upper Volta	Rural Water Supply	G 6860228	D	79	84	Prov.	SH	12200	0	0	0	0	0	0	0	0	61	15	0	0	0
AF	Zaire	Water Supply in Shaba	G 6400116	P	85	87	Zone	SD	2256	0	0	0	0	0	0	3500	2500	2277	4003	0	1220	0
AF	Zaire (Reg)	Kienze Water (IRT27)	G 6980407	C	82	82	Pilot	FN	25	0	0	0	0	0	0	0	0	0	0	0	0	2250
								SUBTOTAL	82451	0	0	300	500	500	1992	7520	9373	15015	17088	12750	7362	5142
AS	Indonesia	Surakarta Water Supply	L 4970262	C	77	83	Urban	HE	4000	0	0	0	0	4000	0	0	0	0	0	0	0	0
AS	Korea	Chong Gye Chun Sewage	L 4890089	C	74	74	Urban	DL	2517	0	2517	0	0	0	0	0	0	0	0	0	0	0
AS	Korea(R)	Potable Water Systems (CARE)	G 4980025	C	78	78	Towns	HE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AS	Philippines	Barangay Water I	D 4920291	C	78	79	PROJ	HE	104	0	0	0	0	0	104	0	0	0	0	0	0	0
AS	Philippines	Barangay Water I	L 4920291	C	78	82	PROJ	HE	4000	0	0	0	0	0	3000	3000	0	0	0	0	0	0
AS	Philippines	Barangay Water II	G 4920333	D	80	84	PROJ	HE	2537	0	0	0	0	0	0	0	802	750	750	0	0	0
AS	Philippines	Barangay Water II	L 4920333	D	80	84	PROJ	HE	17600	0	0	0	0	0	0	0	7500	9200	1000	1100	0	0

REG	COUNTRY	TITLE	PROJ.NO.	STATUS	BEG	END	SCOPE	APPR	LOAN	FY73	FY74	FY75	FY76	FY77	FY78	FY79	FY80	FY81	FY82	FY83	FY84	FY85
AS	Philippines	Local Water Development	G 4920309	C	78	83	Urban	HE	500	0	0	0	0	0	0	500	0	0	0	0	0	0
AS	Philippines	Local Water Development	G 4920309	C	78	79	Urban	SD	500	0	0	0	0	0	500	0	0	0	0	0	0	0
AS	Philippines	Local Water Development	L 4920309	C	78	77	Urban	HE	20000	0	0	0	20000	0	0	0	0	0	0	0	0	0
AS	Philippines	Provincial Waterworks	G 4920263	C	74	77	DIST	HE	750	0	750	0	0	0	0	0	0	0	0	0	0	0
AS	Philippines	Provincial Waterworks	L 4920263	C	74	77	DIST	HE	14000	0	0	14000	0	0	0	0	0	0	0	0	0	0
AS	Regional	Rural Water Supply	G 0790269	O	80	84	Rural	HE	400	0	0	0	0	0	0	0	0	200	200	200	0	0
AS	Sri Lanka	Market Town Water Supply	G 3830063	O	80	82	Urban	HE	2000	0	0	0	0	0	0	0	2000	0	0	0	0	0
AS	Sri Lanka	Market Town Water Supply	L 3830063	O	80	82	REG	HE	6000	0	0	0	0	0	0	0	5517	0	483	0	0	0
AS	Sri Lanka	Water Supply & Sanitation Secl	G 3830080	P	84	89	Nat/R	HE	5000	0	0	0	0	0	0	0	0	0	0	0	500	1000
AS	Sri Lanka	Water Supply & Sanitation Secl	L 3830080	P	84	87	Nat/R	HE	7500	0	0	0	0	0	0	0	0	0	0	0	2000	4100
AS	Thailand	Potable Water Project	G 4930104	C	66	73	REG	HE	2989	0	0	0	0	0	0	0	0	0	0	0	0	0
AS	Thailand	Rural Water Supply (PWWA)	L 4930331	P	84	88	Rural	HE	5700	0	0	0	0	0	0	0	0	0	0	0	5700	0
								SUBTOTAL	103177	0	3247	14000	20000	6800	3604	3500	15904	10150	3233	1300	8200	5100
LA	Belize	Increas.Prod.Thru Better Hlth.	G 5050010	P	85	89	Dist/R	HE	2041	0	0	0	0	0	0	0	0	0	0	0	0	250
LA	Bolivia	Potable Water	G 5110495	C	79	83	PROJ	HE	329	0	0	0	0	0	0	329	0	0	0	0	0	0
LA	Bolivia	Rural Sanitation	G 5110458	O	77	84	PROJ	HE	310	0	0	0	0	54	100	35	121	0	0	0	0	0
LA	Bolivia	Rural Sanitation	L 5110458	O	77	84	Provincial	HE	4000	0	0	0	0	4000	0	0	0	0	0	0	0	0
LA	Bolivia	Rural Water Systems	G 5110479	C	77	79	PROJ	HE	450	0	0	0	0	450	0	0	0	0	0	0	0	0
LA	Brazil	Urban Sanitation	L 5120291	C	71	77	Urban	HE	24991	0	0	0	0	0	0	0	0	0	0	0	0	0
LA	Brazil	Urban Water and Sewage	G 5120062	C	61	75	Urban	SD	3102	0	0	0	0	0	0	0	0	0	0	0	0	0
LA	Colombia	Environmental Sanitation	L 5140183	C	75	75	Urban	HE	7500	0	0	7500	0	0	0	0	0	0	0	0	0	0
LA	Dom.Republic	Health Sector II	L 5170120	O	79	84	NAT	HE	8000	0	0	0	0	0	0	8000	0	0	0	0	0	0
LA	E.Carib.Reg.	Antigua Water Supply	G 5380096	O	83	86	National	ES	3075	0	0	0	0	0	0	0	0	0	0	3075	0	0
LA	E.Carib.Reg.	Antigua Water Supply	L 5380098	O	83	83	National	ES	6625	0	0	0	0	0	0	0	0	0	0	6625	0	0
LA	Ecuador	Rural Potable Water	G 5180020	C	81	82	PROJ	HE	181	0	0	0	0	0	0	0	0	111	70	0	0	0
LA	El Salvador	Rural Potable Water & Sanit.	G 5190209	C	79	81	NAT	HE	390	0	0	0	0	0	0	390	0	0	0	0	0	0
LA	Guatemala	Nat'l Fed. for Rur.Wtr. (CRS)	G 5200290	P	84	84	Pilot	HE	500	0	0	0	0	0	0	0	0	0	0	0	500	0
LA	Guatemala	Rural Potable Water & Latrines	G 5200244	C	77	77	Pilot	HE	24	0	0	0	0	24	0	0	0	0	0	0	0	0
LA	Guatemala	Village Water & Latrines	G 5200231	C	75	76	NAT	HE	260	0	0	260	0	0	0	0	0	0	0	0	0	0
LA	Guyana	Water Supply	L 5040040	C	69	70	REG	AL	5000	2400	0	0	0	0	0	0	0	0	0	0	0	0
LA	Haiti	Community Water System Develop	G 5210155	P	84	88	Rural	FN	4000	0	0	0	0	0	0	0	0	0	0	0	550	1289
LA	Haiti	NGO Support II:Community Water	G 5210169	O	83	84	Rural	ES	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LA	Haiti	Potable Water II	G 5210112	C	70	70	REG	SD	101	0	0	0	0	0	101	0	0	0	0	0	0	0
LA	Haiti	Potable Water III	G 5210147	O	81	83	REG	FN	495	0	0	0	0	0	0	0	0	175	0	0	0	0
LA	Haiti	Potable Water Supply	G 5210074	C	75	76	Rural	SD	121	0	0	121	0	0	0	0	0	0	0	0	0	0
LA	Haiti	Water Resources Develop. II	G 5210101	C	70	81	REG	FN	490	0	0	0	0	0	100	0	0	240	0	0	0	0
LA	Honduras	Bay Island Development	G 5220233	O	83	84	pilot	HE	245	0	0	0	0	0	0	0	0	0	0	145	100	0
LA	Honduras	Municipal Development II	L 5220165	O	80	84	Urban	HE	3000	0	0	0	0	0	0	0	3000	0	0	0	0	0
LA	Honduras	Rural Water and Sanitation	G 5220164	O	80	85	NAT	HE	1000	0	0	0	0	0	0	0	500	0	0	0	500	0
LA	Honduras	Rural Water and Sanitation	L 5220164	O	80	86	NAT	HE	19500	0	0	0	0	0	0	0	10000	0	0	3000	0	0
LA	Honduras	Special Development Activities	G 5220073	C	70	70	Rural	SD	50	0	0	0	0	0	50	0	0	0	0	0	0	0
LA	Panama	Panama City Water Supply	L 5250130	C	68	76	Urban	HE	20000	0	0	0	0	0	0	0	0	0	0	0	0	0
LA	Panama	Sewerage Facility	L 5250134	C	67	73	Urban	HE	6400	0	0	0	0	0	0	0	0	0	0	0	0	0
LA	Peru	Rural Water & Health Services	G 5270177	C	77	80	REG	HE	450	0	0	0	0	220	230	0	0	0	0	0	0	0
LA	Peru	Rural Water System/Sierra	G 5270221	O	81	85	REG	HE	1000	0	0	0	0	0	0	0	0	150	450	200	0	200
LA	Peru	Rural Water System/Sierra	L 5270221	C	82	82	RURAL	HE	10000	0	0	0	0	0	0	0	5000	0	5000	0	0	0
								SUBTOTAL	135538	2400	0	7989	0	4740	581	8754	18621	676	5520	13845	1650	1739
NE	Afghanistan	Special Devel:Rural Water	G 3040103	C	65	73	PROJ	SD	32	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	Egypt	Alexandria Sewage I	L 2630089	O	77	84	Urban	ES	15000	0	0	0	0	15000	0	0	0	0	0	0	0	0
NE	Egypt	Alexandria Sewer Expansion II	G 2630100	O	79	86	Urban	ES	198700	0	0	0	0	0	0	87321	0	0	0	79600	31900	0
NE	Egypt	Basic Village Services(.02)	G 2630161	O	80	85	NAT	ES	145000	0	0	0	0	0	0	0	70000	45000	0	0	0	0

PAGE: 3

REG	COUNTRY	TITLE	PROJ.NO.	STATUS	BEG	END	SCOPE	APPR	LOAN	FY73	FY74	FY75	FY76	FY77	FY78	FY79	FY80	FY81	FY82	FY83	FY84	FY85
NE	Egypt	Cairo Sewage	G 2630091	O	70	06	Urban	ES	129000	0	0	0	0	0	25000	0	0	74100	0	29900	0	0
NE	Egypt	Cairo Sewerage II	G 2630173	P	04	90	Urban	ES	445000	0	0	0	0	0	0	0	0	0	0	0	70000	95000
NE	Egypt	Cairo Water System	G 2630030	O	77	05	Urban	ES	61400	0	0	0	0	30000	0	0	0	31400	0	0	0	0
NE	Egypt	Cairo Water System	L 2630037	O	77	05	Urban	ES	30000	0	0	0	0	30000	0	0	0	0	0	0	0	0
NE	Egypt	Canal Cities Water & Sanit.	G 2630040	O	79	05	Urban	ES	107000	0	0	0	0	0	0	36000	0	0	0	73000	0	0
NE	Egypt	Canal Cities Water & Sanit.	L 2630040	O	70	05	Urban	ES	60000	0	0	0	0	0	40000	0	0	0	0	0	0	0
NE	Egypt	WRS Inst.Development	G 2630174	P	85	00	National	ES	25000	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	Israel	Desalting Plant	G 2710005	O	75	05	Pilot	ES	20000	0	0	20000	0	0	0	0	0	0	0	0	5000	5000
NE	Jordan	Amman Water and Sewerage	L 2780220	O	70	04	Urban	ES	39000	0	0	0	0	0	28500	10500	0	0	0	0	0	0
NE	Jordan	Aqaba Sewerage	L 2780204	O	77	05	REG	ES	7500	0	0	0	0	0	0	7500	0	0	0	0	0	0
NE	Jordan	Irbid Water and Sewerage	G 2780233	O	80	07	Urban	ES	2500	0	0	0	0	0	0	0	2500	0	0	0	0	0
NE	Jordan	Irbid Water and Sewerage	L 2780233	O	80	05	Urban	ES	21000	0	0	0	0	0	0	0	21000	0	0	0	0	0
NE	Jordan	Water Systems and Services Mgt	G 2780259	O	03	05	Urban	ES	4000	0	0	0	0	0	0	0	0	0	0	3000	1000	0
NE	Jordan	Water Systems and Services Mgt	L 2780259	O	03	08	Urban	ES	17000	0	0	0	0	0	0	0	0	0	0	10000	7000	0
NE	Jordan	Zarqa-Ruseifa Water	G 2780234	O	03	03	Urban	ES	5000	0	0	0	0	0	0	0	0	0	0	5000	0	0
NE	Jordan	Zarqa-Ruseifa Water Supply	L 2780234	O	02	02	Urban	ES	10000	0	0	0	0	0	0	0	0	0	10000	0	0	0
NE	Lebanon	Potable Water&Envir.Sanitation	G 2480339	O	84	04	Urban	ES	22000	0	0	0	0	0	0	0	0	0	0	0	22000	4000
NE	Lebanon	Potable Water&Envir.Sanitation	G 2480339	C	83	03	Urban	IDA	2000	0	0	0	0	0	0	0	0	0	0	2750	0	0
NE	Lebanon	Rural Potable Water	G 2480306	C	70	01	INT	ES	4500	0	0	0	0	0	4500	0	0	0	0	0	0	0
NE	Portugal	Basic Sanitation I	L 1500005	C	74	74	REG	ES	0000	0	0	0	0000	0	0	0	0	0	0	0	0	0
NE	Portugal	Basic Sanitation II	L 1500010	C	77	02	Urban	ES	12000	0	0	0	0	12000	0	0	0	0	0	0	0	0
NE	Syria	Damascus Water I	L 2760000	O	75	04	Urban	NE	40000	0	0	40000	0	0	0	0	0	0	0	0	0	0
NE	Syria	Damascus Water II	L 2760010	C	74	01	Urban	ES	14500	0	0	0	14500	0	0	0	0	0	0	0	0	0
NE	Syria	Provincial Water Supply	L 2760024	C	79	03	PROV	ES	17600	0	0	0	0	0	0	17600	0	0	0	0	0	0
NE	Tunisia	Bizerte Wells (CARE)	G 6640206	C	75	76	PROV	NE	154	0	0	105	50	0	0	0	0	0	0	0	0	0
NE	Tunisia	CTRD:Kasserine(14)	G 6640312	C	80	80	PROV	NE	1050	0	0	0	0	0	0	0	1050	0	0	0	0	0
NE	Tunisia	CTRD:Potable Water (04)	G 6640312	O	79	03	PROV	NE	750	0	0	0	0	0	0	750	0	0	0	0	0	0
NE	Tunisia	CTRD:Siliana Water (05)	G 6640312	O	79	03	Rural	NE	492	0	0	0	0	0	0	492	0	0	0	0	0	0
NE	Tunisia	CTRD:Well Drilling (07)	G 6640312	O	77	04	PROV	NE	2190	0	0	0	0	0	0	1050	0	0	0	0	0	0
NE	Tunisia	Kairouan Water Facility	G 6640290	C	77	78	PROV	NE	345	0	0	0	0	220	110	0	0	0	0	0	0	0
NE	Tunisia	Lokef Potable Water	G 6640313	C	78	79	Rural	NE	344	0	0	0	0	0	344	0	0	0	0	0	0	0
NE	Tunisia	Lokef Wells Rehabilitation	G 6640288	C	74	78	PROV	NE	45	0	0	0	45	0	0	0	0	0	0	0	0	0
NE	Tunisia	Siliana Rural Centers	L 6640310	O	78	04	PROV	NE	3500	0	0	0	0	0	3500	0	0	0	0	0	0	0
NE	Tunisia	Siliana Water Project	G 6640299	C	76	77	Rural	NE	267	0	0	0	267	0	0	0	0	0	0	0	0	0
NE	Yemen	Rural Water Supply	G 2790022	C	74	79	Rural	NE	4894	0	795	1217	1725	890	210	0	0	0	0	0	0	0
NE	Yemen	Sanaa Water Supply	G 2790021	C	73	75	Urban	NE	743	300	160	283	0	0	0	0	0	0	0	0	0	0
NE	Yemen	Small Rural Water Systems	G 2790044	O	79	09	Rural	NE	7477	0	0	0	0	0	0	144	1527	650	1500	3656	3049	3000
NE	Yemen	Taiz Water & Sewer Design	G 2790027	C	76	78	Urban	NE	185	0	0	0	45	0	0	0	0	0	0	0	0	0
NE	Yemen	Taiz Water & Sewer Design	G 2790027	C	76	78	Urban	FN	1475	0	0	0	1475	0	0	0	0	0	0	0	0	0
NE	Yemen	Taiz Water and Sewage	G 2790039	O	77	03	Urban	NE	11200	0	0	0	0	10000	0	0	0	0	1200	0	0	0
NE	Yemen	Taiz Water and Sewers	L 2790039	O	81	03	Urban	NE	5000	0	0	0	0	0	0	0	0	5000	0	0	0	0
NE	Yemen	Taiz Water Rehabilitation	G 2790017	C	73	74	Urban	FN	457	330	161	0	0	0	0	0	0	0	0	0	0	0
NE	Yemen	Water Supply System Management	G 2790020	C	77	02	INT	NE	6100	0	0	0	0	420	1580	2014	706	0	1100	0	0	0
								SUBTOTAL	1522200	630	1116	67405	24127	90730	125752	163371	96063	174150	13000	206906	137949	107000
								TOTAL	1043778	3030	4303	91794	44627	110706	137989	103153	140781	201991	40441	234801	157161	121001

* This Table provided courtesy of AID/S&T/H.

CURRENT A.I.D. FUNDED WATER AND SANITATION PROJECTS*

COUNTRY	PROJECT # Grant/Loan	PROJECT TITLE	YR BEGIN	YR END	SCOPE	LIFE OF PROJECT US$ thousands
Burundi	G6950109	Community Water & Health	1983	1986	National	330
Lesotho	G6320088	Rural Water & Sanitation	1979	1987	Multiprov	12,142
Malawi	G6120207	Rural Water	1980	1985	Regional	6,000
Mali	G6880229	Sahel Wells	1981	1984	Pilot	405
Mali	G6250937	Yelimane:Tambacara Wells(9)	1981	1985	Pilot	155
Somalia	G6490104	Comprehensive GRDWTR Dev.	1979	1983	Regional	6,556
Sudan	G6500065	GEDAREF Municipal Water Supply	1983	1987	Urban	7,500
Sudan	G6500050	Port Sudan Water Supply	1981	1984	Urban	2,000
Sudan	G6500065	Water & Sanitation Project	1982	1985	Urban	6,000
Togo	G6930210	Rural Water & Sanitation	1980	1987	Regional	11,739
Burkina	G6860228	Rural Water Supply	1979	1984	Provincial	12,280
Phillipines	G4920333	Barangay Water II	1980	1984	Provincial	2,537
Phillipines	L4920333	Barangay Water II	1980	1984	Provincial	19,600
Asia Reg.	G8790269	Rural Water Supply	1980	1984	Rural	600
Sri Lanka	G3830063	Market Town Water Supply	1980	1982	Urban	2,000
Sri Lanka	L3830063	Market Town Water Supply	1980	1982	Regional	6,000
Bolivia	G5110458	Rural Sanitation	1977	1984	Provincial	310
Bolivia	L5110458	Rural Sanitation	1977	1984	Provincial	4,000
Dom. Republic	L5170120	Health Sector II	1979	1984	Provincial	8,000
E. Carib Reg.	G5380098	Antigua Water Supply	1983	1986	National	3,075
E. Carib Reg.	L5380098	Antigua Water Supply	1983	1983	National	6,625
Haiti	G5210169	NGO Support I: Community Water	1983	1984	Rural	0
Haiti	G5210147	Potable Water III	1981	1983	Regional	495
Honduras	G5220233	Bay Island Development	1983	1984	Pilot	245
Honduras	L5220165	Municipal Development II	1980	1984	Urban	3,000
Honduras	G5220166	Rural Water & Sanitation	1980	1985	National	1,000
Honduras	L5220166	Rural Water & Sanitation	1980	1986	National	19,500
Peru	G5270221	Rural Water System/Sierra	1981	1985	Regional	1,000
Egypt	L2630089	Alexandria Sewage I	1977	1984	Urban	15,000
Egypt	G2630100	Alexandria Sewer Expansion II	1979	1986	Urban	198,700
Egypt	G2630161	Basic Village Services	1980	1985	National	145,000
Egypt	G2630091	Cairo Sewage	1978	1986	Urban	129,000
Egypt	G2630038	Cairo Water System	1977	1985	Urban	61,400
Egypt	L2630038	Cairo Water System	1977	1985	Urban	30,000
Egypt	G2630048	Canal Cities Water & Sanitation	1979	1985	Urban	109,000
Egypt	L2630048	Canal Cities Water & Sanitation	1978	1985	Urban	60,000

COUNTRY	PROJECT # Grant/Loan	PROJECT TITLE	YR BEGIN	YR END	SCOPE	LIFE OF PROJECT US$ thousands
Israel	G2710005	Desalting Plant	1975	1985	Pilot	20,000
Jordan	L2780220	Amman Water & Sewerage	1978	1984	Urban	39,000
Jordan	L2780206	Aqaba Sewerage	1979	1985	Regional	7,500
Jordan	G2780233	Irbid Water & Sewerage	1980	1989	Urban	2,500
Jordan	L2780233	Irbid Water & Sewerage	1980	1985	Urban	21,000
Jordan	G2780259	Water Systems & Services Mgt.	1983	1985	Urban	4,000
Jordan	L2780259	Water Systems & Services Mgt.	1983	1988	Urban	17,000
Jordan	G2780234	Zarqa-Ruseifa Water	1983	1983	Urban	5,000
Jordan	L2780234	Zarqa-Ruseifa Water Supply	1982	1982	Urban	10,000
Lebanon	G2680330	Potable and Envir. Sanitation	1984	1984	Urban	22,000
Tunisia	G6640312	CTRD: Potable Water	1979	1983	Provincial	750
Tunisia	G6640312	CTRD: Siliana Water	1979	1983	Rural	492
Tunisia	G6640312	CTRD: Well Drilling	1979	1984	Provincial	2,190
Tunisia	L6640318	Siliana Rural Centers	1978	1984	Provincial	3,500
Yemen	G2790044	Small Rural Water Systems	1979	1989	Rural	7,477
Yemen	G2790039	Taiz Water & Sewage	1977	1983	Urban	11,200
Yemen	L2790039	Taiz Water & Sewers	1981	1983	Urban	5,000

*Updated 10/19/84 from AID/S&T/H

Table 5

A.I.D. OBLIGATIONS FOR WATER AND SANITATION PROJECTS BY REGION

DOLLAR AMOUNTS*

FISCAL YEAR	AFRICA	ASIA	LATIN AMERICA	NEAR EAST	ALL REGIONS
1973	0	0	2,400	630	3,030
1974	0	3,267	0	1,116	4,383
1975	300	14,000	7,889	69,605	91,794
1976	500	20,000	0	26,127	46,627
1977	500	6,800	4,748	98,738	110,786
1978	1,992	3,684	581	125,752	132,009
1979	7,528	3,500	8,754	163,371	183,153
1980	9,373	15,904	18,621	96,863	140,761
1981	15,015	10,150	676	176,150	201,991
1982	17,888	3,233	5,520	13,800	40,441
1983	12,750	1,300	13,845	206,906	234,801
1984	7,362	8,200	1,650	139,949	157,161
1985	5,162	5,100	1,739	109,000	121,001
Total	78,370	95,138	66,423	1,228,007	1,467,938

A.I.D. WATER AND SANITATION LIFE OF PROJECT OBLIGATIONS, 1961-1990**

LIFE OF PROJECT $	82,461	103,177	135,938	1,522,200	1,843,776
PERCENT OF LOP $	4	6	7	83	

* In thousands of dollars
** Some projects may not have been identified.
Information from A.I.D. S&T/Health

CURRENT A.I.D. FUNDED WATER AND SANITATION PROJECTS*

COUNTRY	PROJECT # Grant/Loan	PROJECT TITLE	YR BEGIN	YR END	SCOPE	LIFE OF PROJECT US$ thousands
Burundi	86950109	Community Water & Health	1983	1986	National	330
Lesotho	66320088	Rural Water & Sanitation	1979	1987	Multiprov	12,142
Malawi	66120207	Rural Water	1980	1985	Regional	6,000
Mali	66880229	Sahel Wells	1981	1984	Pilot	405
Mali	66250937	Yelimane:Tambacara Wells(9)	1981	1985	Pilot	155
Somalia	66490104	Comprehensive GRDWTR Dev.	1979	1983	Regional	6,556
Sudan	66500065	GEDAREF Municipal Water Supply	1983	1987	Urban	7,500
Sudan	66500050	Port Sudan Water Supply	1981	1984	Urban	2,000
Sudan	66500065	Water & Sanitation Project	1982	1985	Urban	6,000
Togo	66930210	Rural Water & Sanitation	1980	1987	Regional	11,739
Burkina	66860228	Rural Water Supply	1979	1984	Provincial	12,280
Phillipines	64920333	Barangay Water II	1980	1984	Provincial	2,537
Phillipines	L4920333	Barangay Water II	1980	1984	Provincial	19,600
Asia Reg.	68790269	Rural Water Supply	1980	1984	Rural	600
Sri Lanka	63830063	Market Town Water Supply	1980	1982	Urban	2,000
Sri Lanka	L3830063	Market Town Water Supply	1980	1982	Regional	6,000
Bolivia	65110458	Rural Sanitation	1977	1984	Provincial	310
Bolivia	L5110458	Rural Sanitation	1977	1984	Provincial	4,000
Dom. Republic	L5170120	Health Sector II	1979	1984	Provincial	8,000
E. Carib Reg.	65380098	Antigua Water Supply	1983	1986	National	3,075
E. Carib Reg.	L5380098	Antigua Water Supply	1983	1983	National	6,625
Haiti	65210149	NGO Support I: Community Water	1983	1984	Rural	[illegible]
Haiti	65210147	Potable Water III	1981	1983	Regional	495
Honduras	65220233	Bay Island Development	1983	1984	Pilot	245
Honduras	L5220165	Municipal Development II	1980	1984	Urban	3,000
Honduras	65220166	Rural Water & Sanitation	1980	1985	National	1,000
Honduras	L5220166	Rural Water & Sanitation	1980	1986	National	19,500
Peru	65270221	Rural Water System/Sierra	1981	1985	Regional	1,000
Egypt	L2630089	Alexandria Sewage I	1977	1984	Urban	15,000
Egypt	62630100	Alexandria Sewer Expansion II	1979	1986	Urban	198,700
Egypt	62630161	Basic Village Services	1980	1985	National	145,000
Egypt	62630091	Cairo Sewage	1978	1986	Urban	129,000
Egypt	62630038	Cairo Water System	1977	1985	Urban	61,400
Egypt	L2630038	Cairo Water System	1977	1985	Urban	30,000
Egypt	62630048	Canal Cities Water & Sanitation	1979	1985	Urban	109,000
Egypt	L2630048	Canal Cities Water & Sanitation	1978	1985	Urban	60,000

TRY	PROJECT # Grant/Loan	PROJECT TITLE	YR BEGIN	YR END	SCOPE	LIFE OF PROJECT US$ thousands
Israel	G2710005	Desalting Plant	1975	1985	Pilot	20,000
Jordan	L2780220	Amman Water & Sewerage	1978	1984	Urban	39,000
Jordan	L2780206	Aqaba Sewerage	1979	1985	Regional	7,500
Jordan	G2780233	Irbid Water & Sewerage	1980	1989	Urban	2,500
Jordan	L2780233	Irbid Water & Sewerage	1980	1985	Urban	21,000
Jordan	G2780259	Water Systems & Services Mgt.	1983	1985	Urban	4,000
Jordan	L2780259	Water Systems & Services Mgt.	1983	1988	Urban	17,000
Jordan	G2780234	Zarqa-Ruseifa Water	1983	1983	Urban	5,000
Jordan	L2780234	Zarqa-Ruseifa Water Supply	1982	1982	Urban	10,000
Lebanon	G2680330	Potable and Envir. Sanitation	1984	1984	Urban	22,000
Tunisia	G6640312	CTRD: Potable Water	1979	1983	Provincial	750
Tunisia	G6640312	CTRD: Siliana Water	1979	1983	Rural	492
Tunisia	G6640312	CTRD: Well Drilling	1979	1984	Provincial	2,190
Tunisia	L6640318	Siliana Rural Centers	1978	1984	Provincial	3,500
Yemen	G2790044	Small Rural Water Systems	1979	1989	Rural	7,477
Yemen	G2790039	Taiz Water & Sewage	1977	1983	Urban	11,200
Yemen	L2790039	Taiz Water & Sewers	1981	1983	Urban	5,000

dated 10/19/84 from AID/S&T/H

GRAPHS AND STATISTICS

Access To Potable Water: A World Overview

- In all regions of the world a greater proportion of the urban population than the rural population has access to safe water (see Figures 1 and 2).

- The percent of the urban population with access to potable water in 1975 ranged from 50 percent in the Sahel to 84 percent in Latin America (see Figure 1).

- The percent of the rural population with access to potable water in 1975 varied from 19 percent in Latin America to 64 percent in the Near East (see Figure 2).

- Between 1970 and 1975, the latest year for which there is good information, there was some increase in the percentage of both urban and rural populations with an access to potable water.

- Areas in which the population has the lowest rate of access to safe water are concentrated in West and Central Africa and in Asia. In Latin America and the Near East a greater proportion of the inhabitants has potable water (see maps).

Figure 1

PERCENT URBAN POPULATION WITH ACCESS TO POTABLE WATER

SUMMARY OF SOCIAL INDICATOR BY FY-85 CP DIVISIONS
INDICATOR=% OF POP WITH ACCESS TO SAFE WATER - URBAN

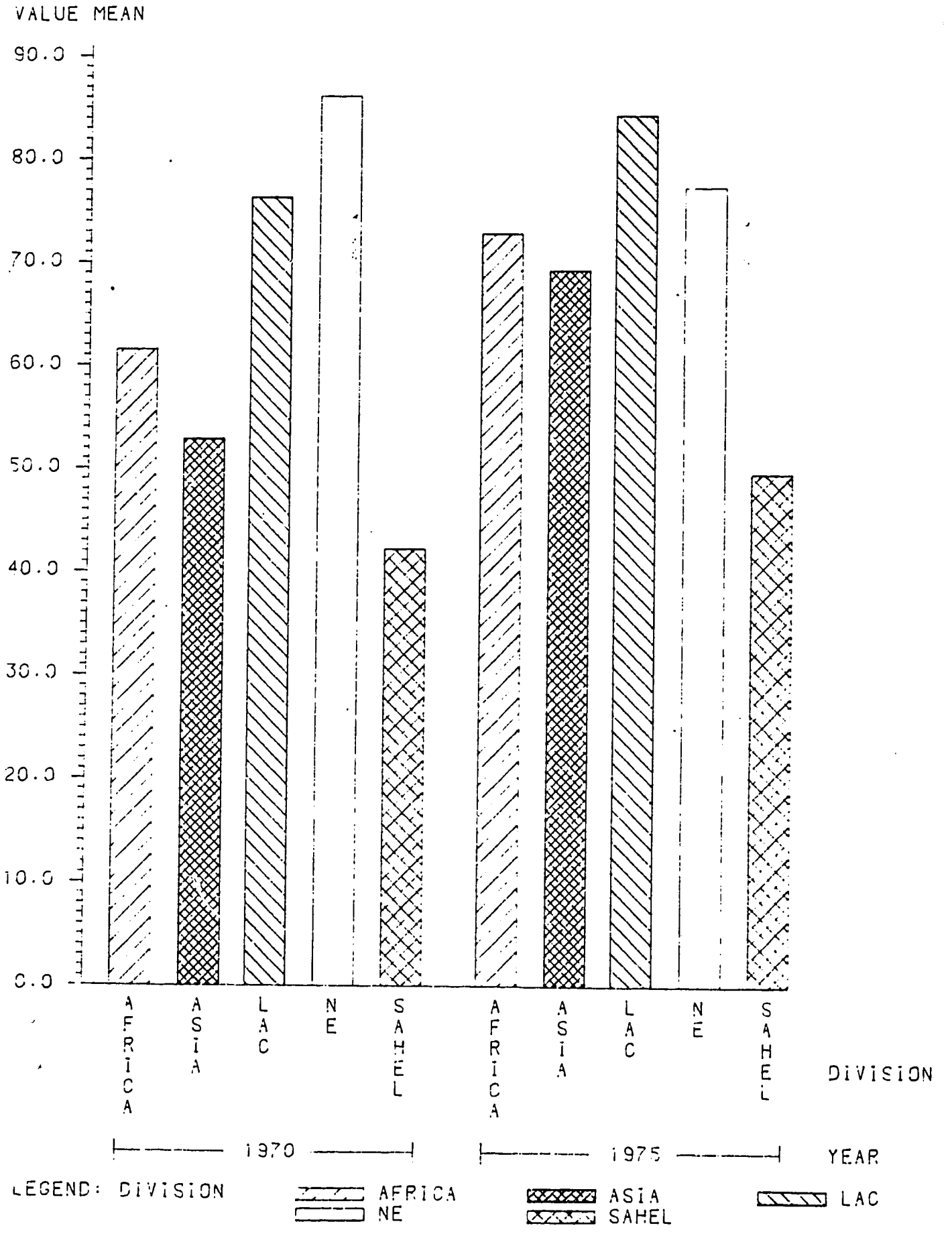
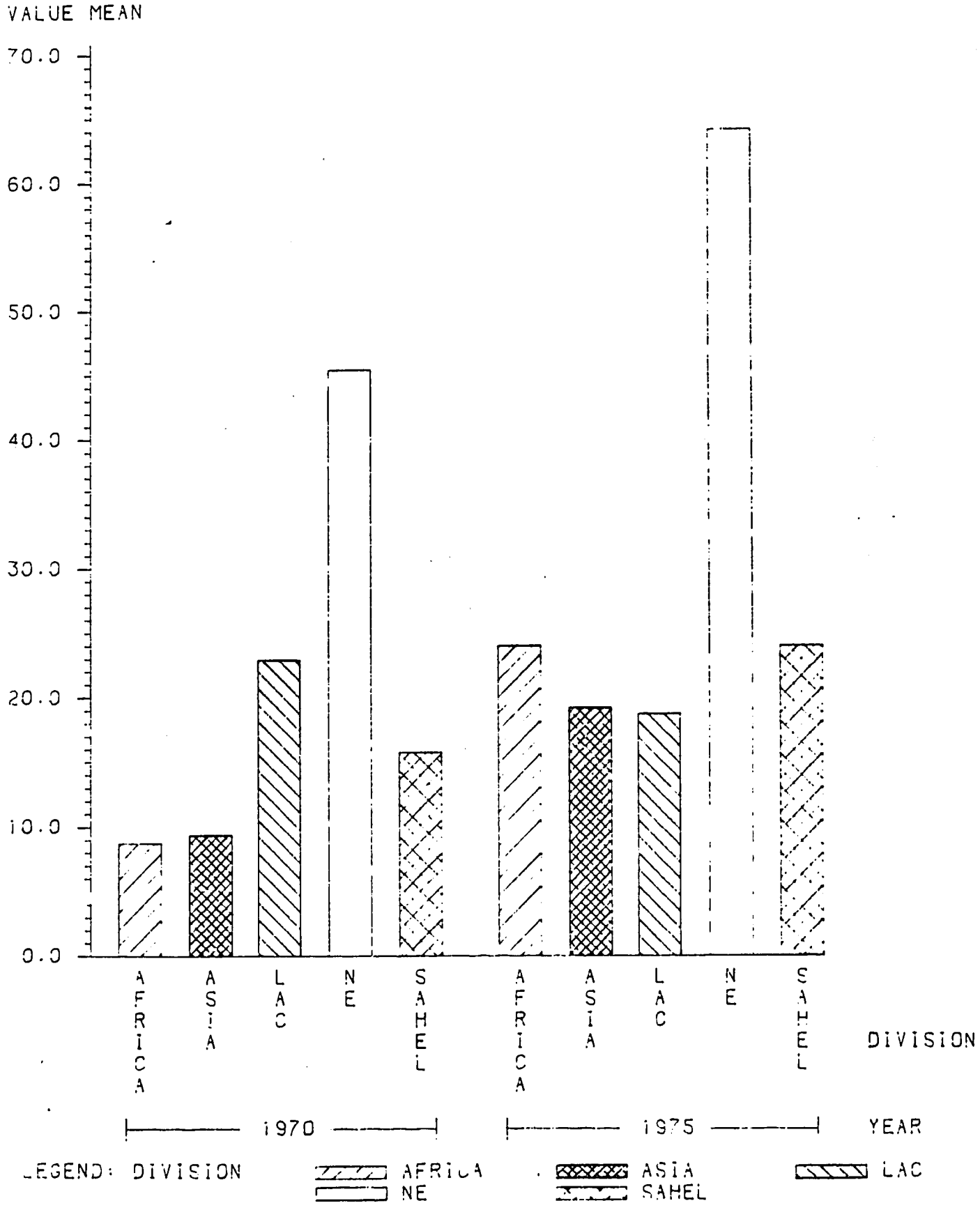


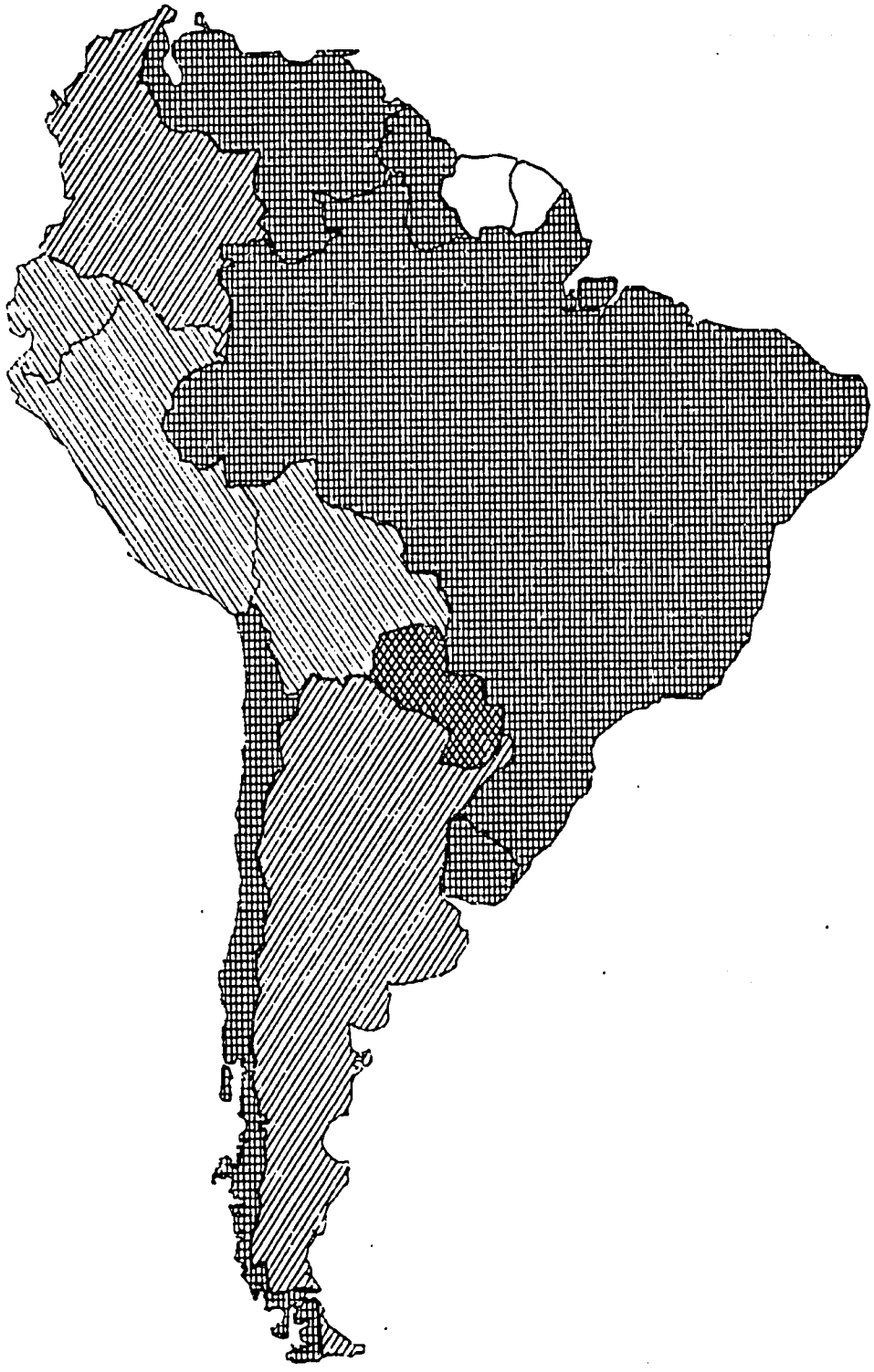
Figure 2

PERCENT RURAL POPULATION WITH ACCESS TO POTABLE WATER

SUMMARY OF SOCIAL INDICATOR BY FY-85 CP DIVISIONS
INDICATOR=% OF POP WITH ACCESS TO SAFE WATER - RURAL



POPULATION WITH ACCESS TO SAFE WATER



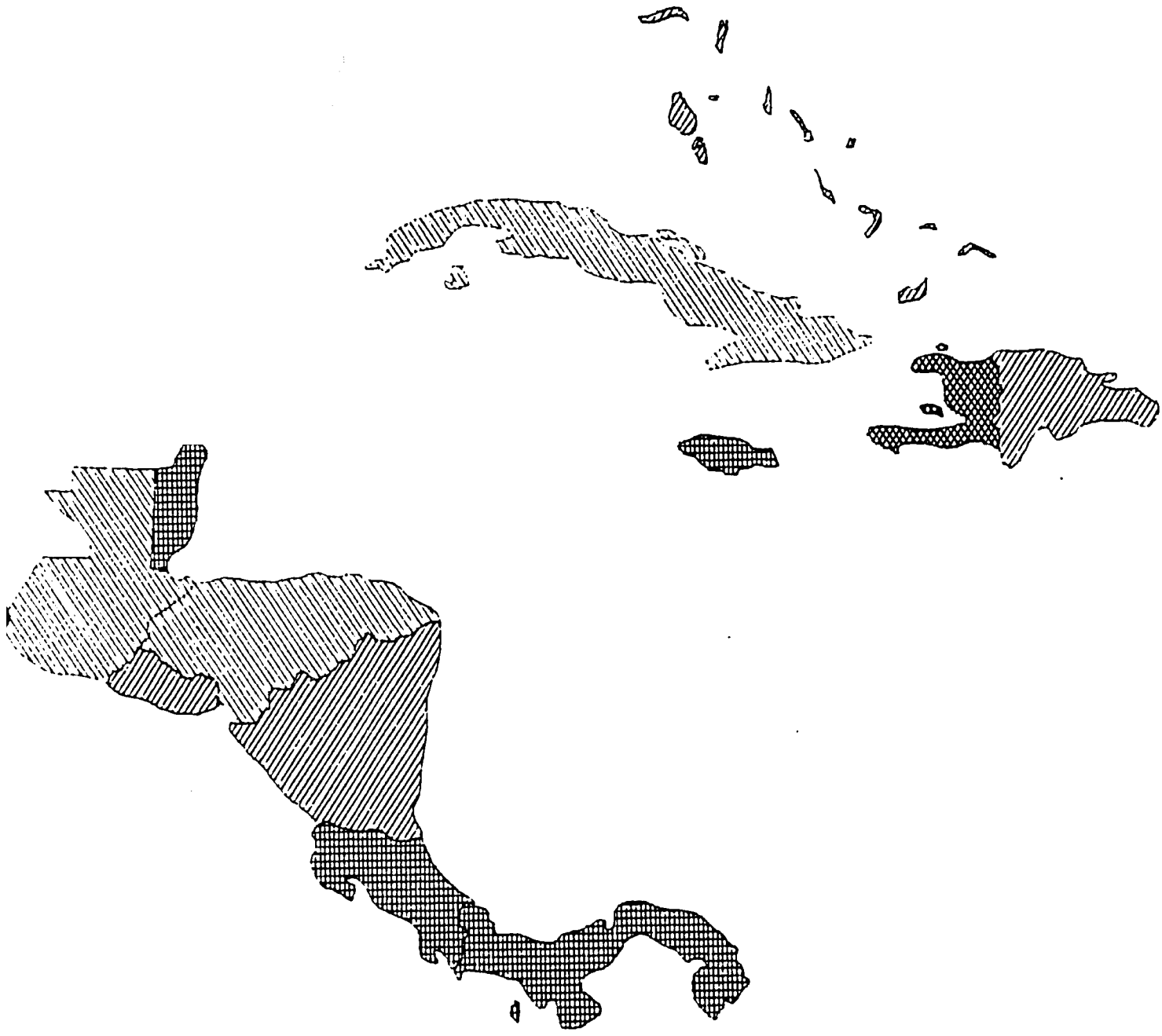
PERCENT

LESS THAN 25%
25% TO 49%
50% TO 75%
75% TO 100%

BLANKS INDICATE NO DATA

SOURCE: CDIE'S ECONOMIC AND SOCIAL DATA BASE
MOST CURRENT DATA

POPULATION WITH ACCESS TO SAFE WATER



PERCENT

LESS THAN 25%

25%

BLANKS INDICATE NO DATA

SOURCE: CDIE'S ECONOMIC AND SOCIAL DATA BASE
MOST CURRENT DATA

POPULATION WITH ACCESS TO SAFE WATER

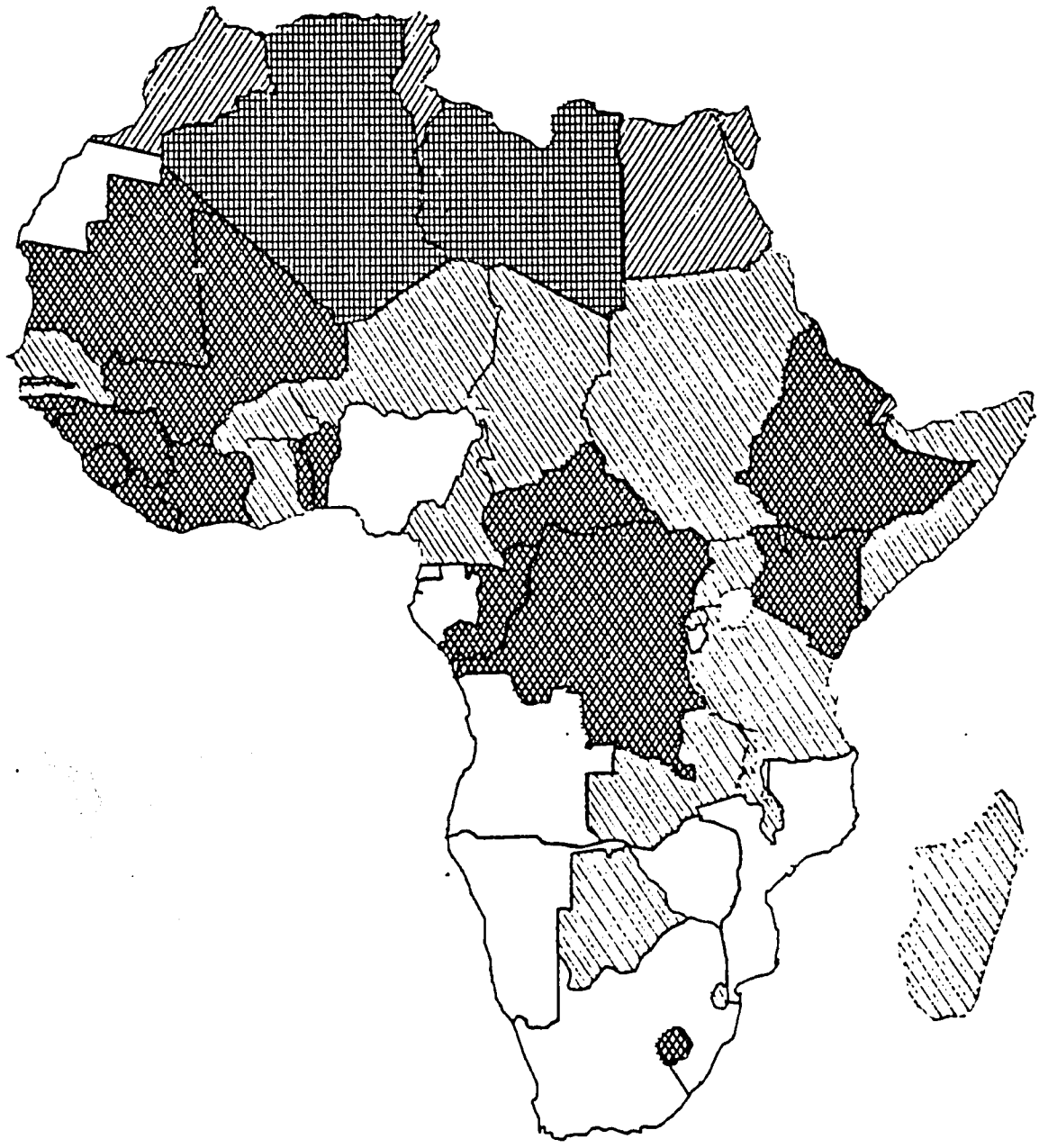
PERCENT

LESS THAN 25%
25% TO 50%
50% TO 75%
75% TO 100%

BLANKS INDICATE NO DATA

SOURCE: CDIE'S ECONOMIC AND SOCIAL DATA BASE
MOST CURRENT DATA

ACCESS TO SAFE WATER



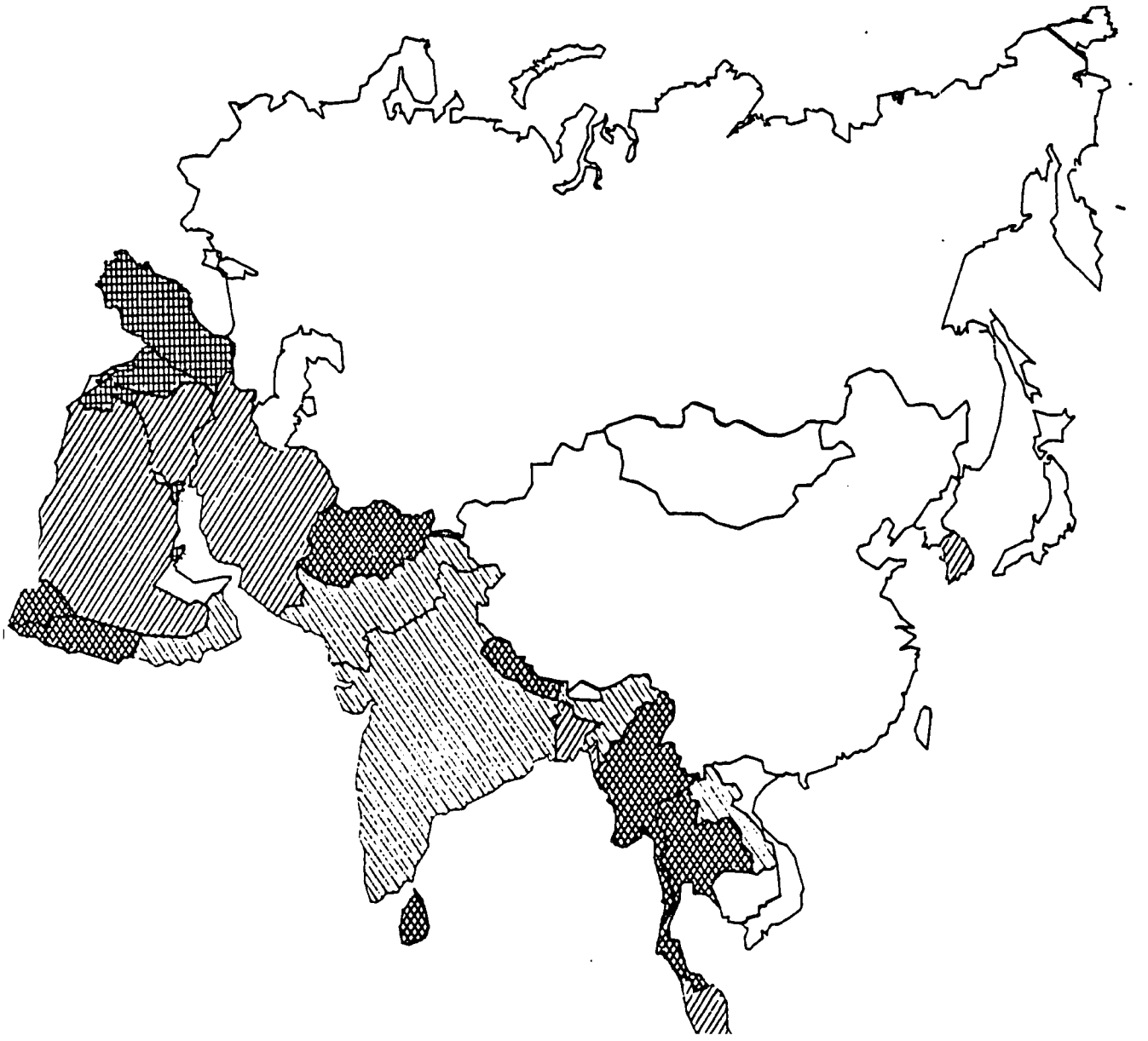
PERCENT

LESS THAN 25%
25% TO 49%
50% TO 75%
75% TO 100%

BLANKS INDICATE NO DATA

SOURCE: CDIE'S ECONOMIC AND SOCIAL DATA BASE
MOST CURRENT DATA

PERCENT POPULATION WITH ACCESS TO SAFE WATER



PERCENT

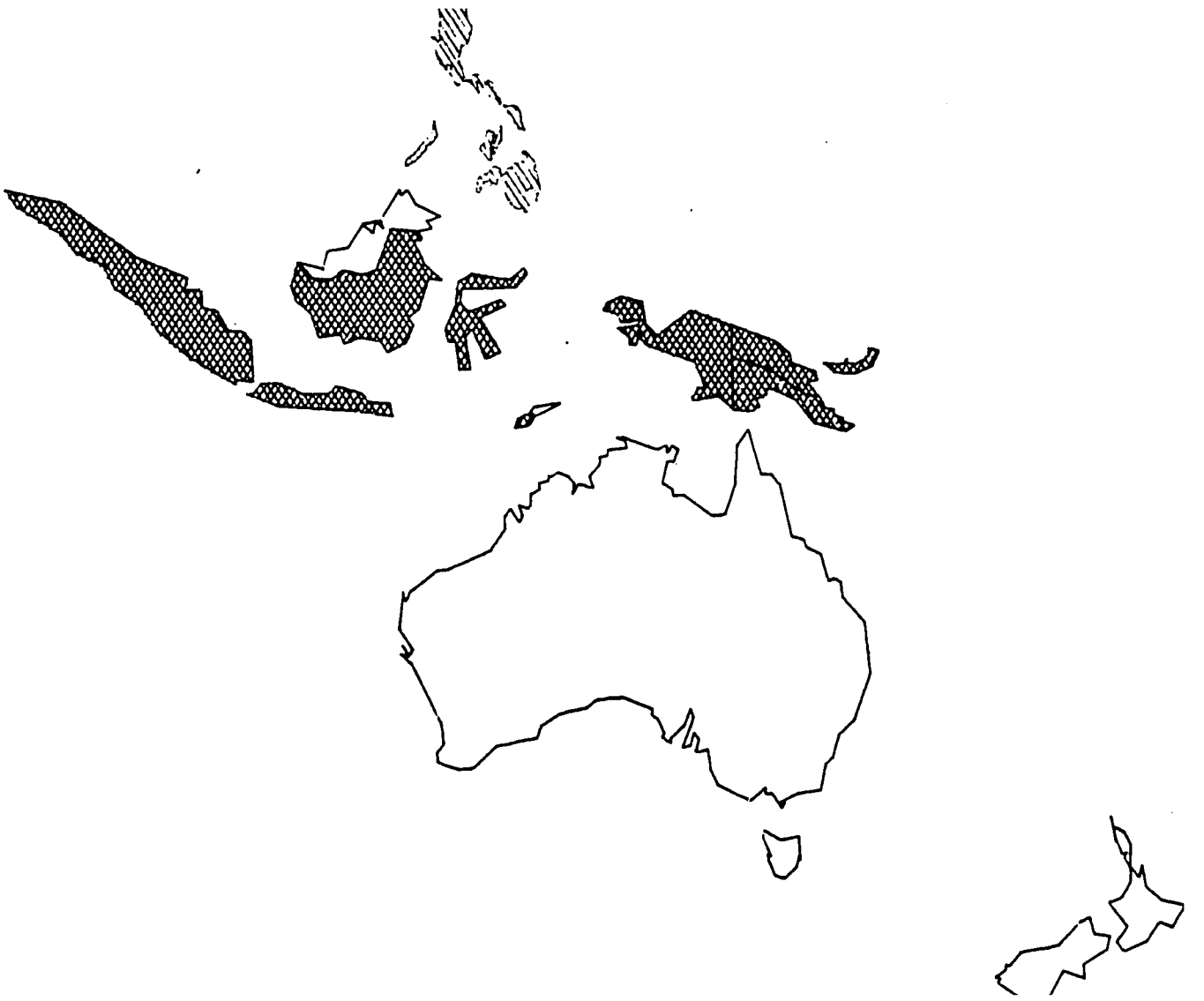
LESS THAN 25%
50% TO 75%

25% TO 49%
75% TO 100%

BLANKS INDICATE NO DATA

SOURCE: CDIE'S ECONOMIC AND SOCIAL DATA BASE
MOST CURRENT DATA

POPULATION WITH ACCESS TO SAFE WATER



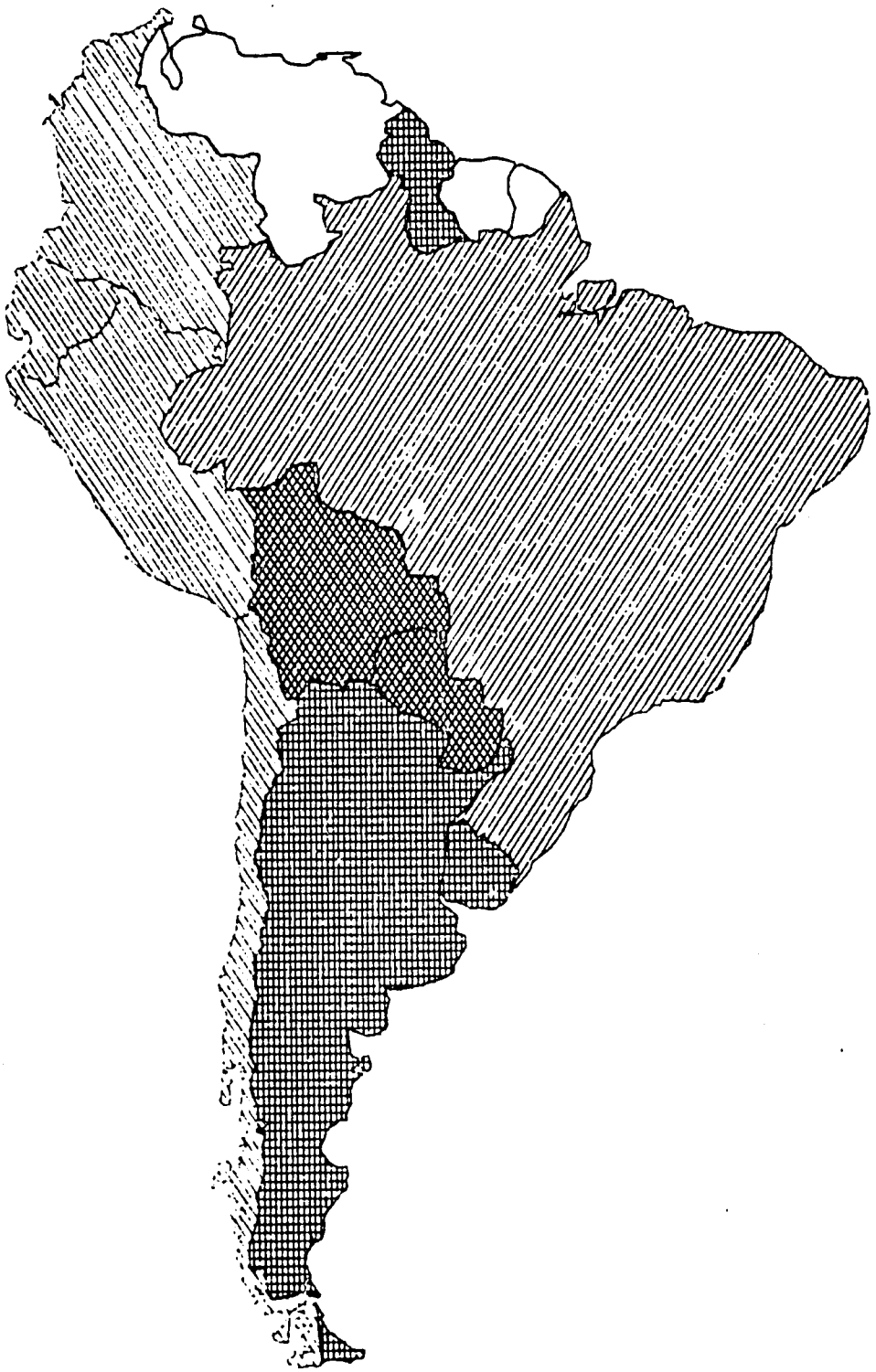
PERCENT

LESS THAN 25%
25% TO 50%
50% TO 75%
75% TO 100%

BLANKS INDICATE NO DATA

SOURCE: CDIE'S ECONOMIC AND SOCIAL DATA BASE
MOST CURRENT DATA

POPULATION WITH ACCESS TO SANITATION



PERCENT

LESS THAN 25%
50% TO 75%
25% TO 50%
75% TO 100%

BLANKS INDICATE NO DATA

SOURCE: CDIE'S ECONOMIC AND SOCIAL DATA BASE
MOST CURRENT DATA

POPULATION WITH ACCESS TO SANITATION

PERCENT 25% TO 50% 50% TO 75% 75% TO 100%

BLANKS INDICATE NO DATA

SOURCE: CDIE'S ECONOMIC AND SOCIAL DATA BASE
MOST CURRENT DATA

POPULATION WITH ACCESS TO SANITATION

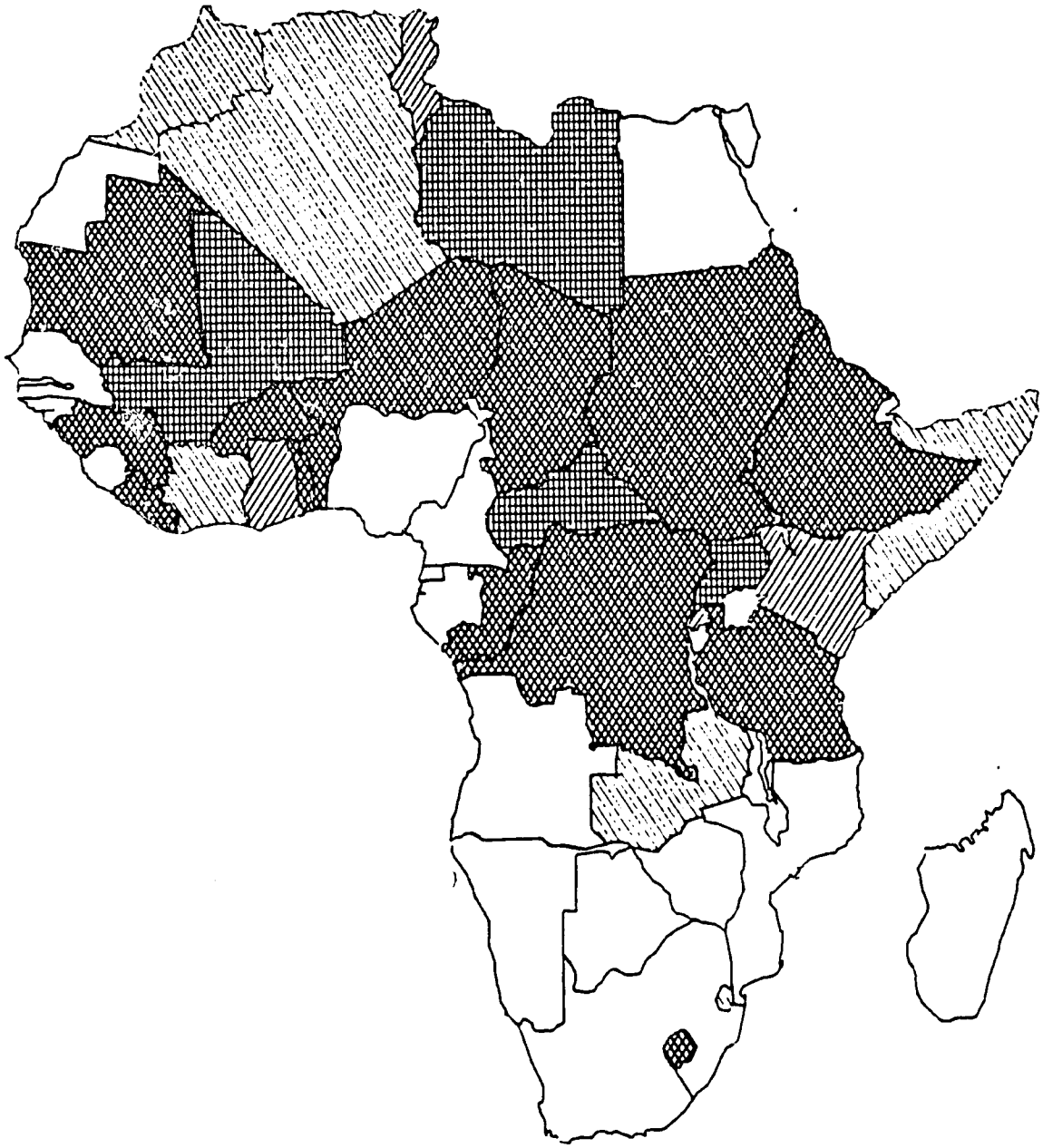
PERCENT

LESS THAN 25%
25% TO 50%
50% TO 75%
75% TO 100%

BLANKS INDICATE NO DATA

SOURCE: CDIE'S ECONOMIC AND SOCIAL DATA BASE
MOST CURRENT DATA

PERCENT POPULATION WITH ACCESS TO SANITATION



PERCENT

LESS THAN 25

25% TO 49%

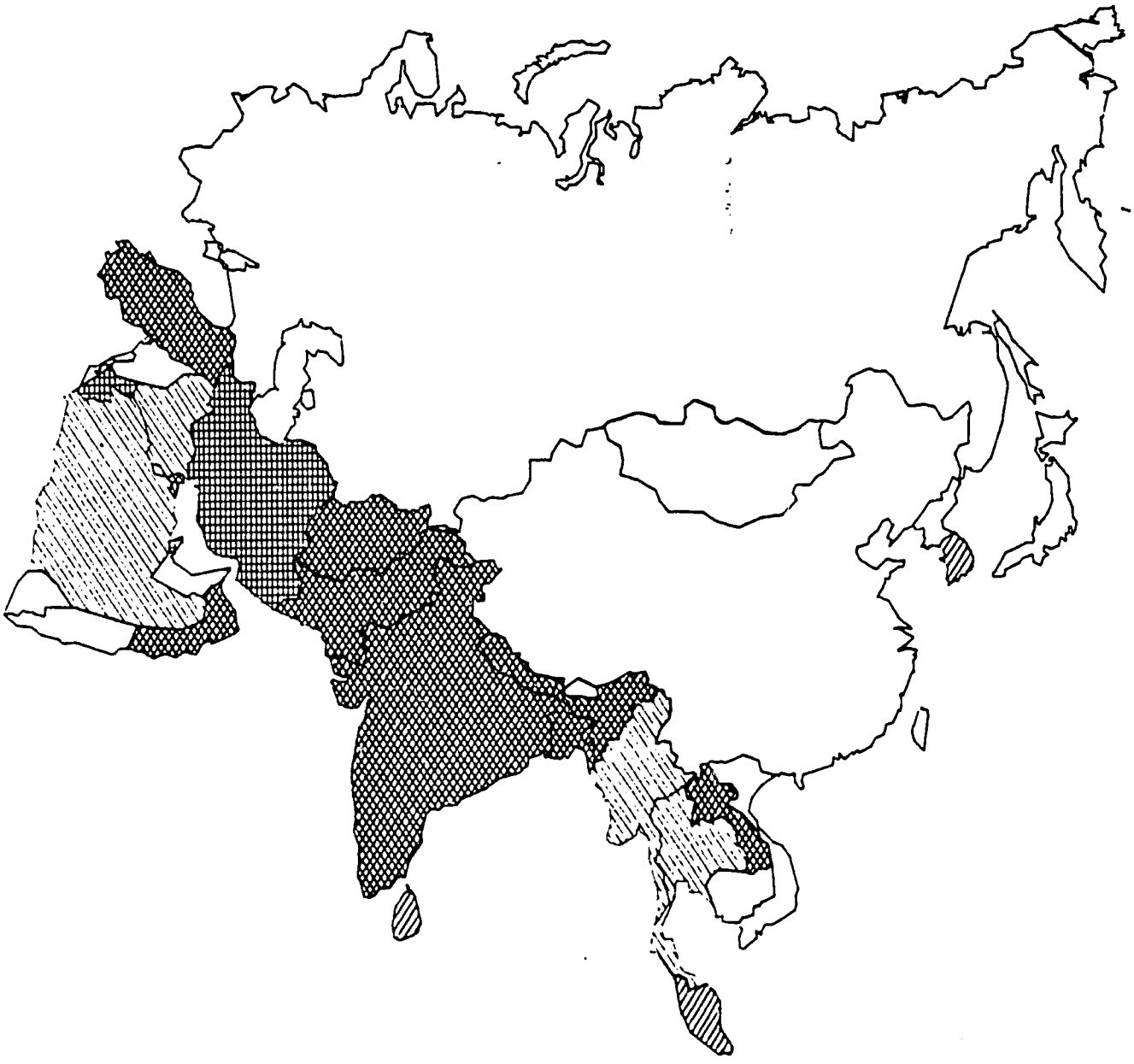
50% TO 75%

75% TO 100%

BLANKS INDICATE NO DATA

SOURCE: CDIE'S ECONOMIC AND SOCIAL DATA BASE
MOST CURRENT DATA

POPULATION WITH ACCESS TO SANITATION



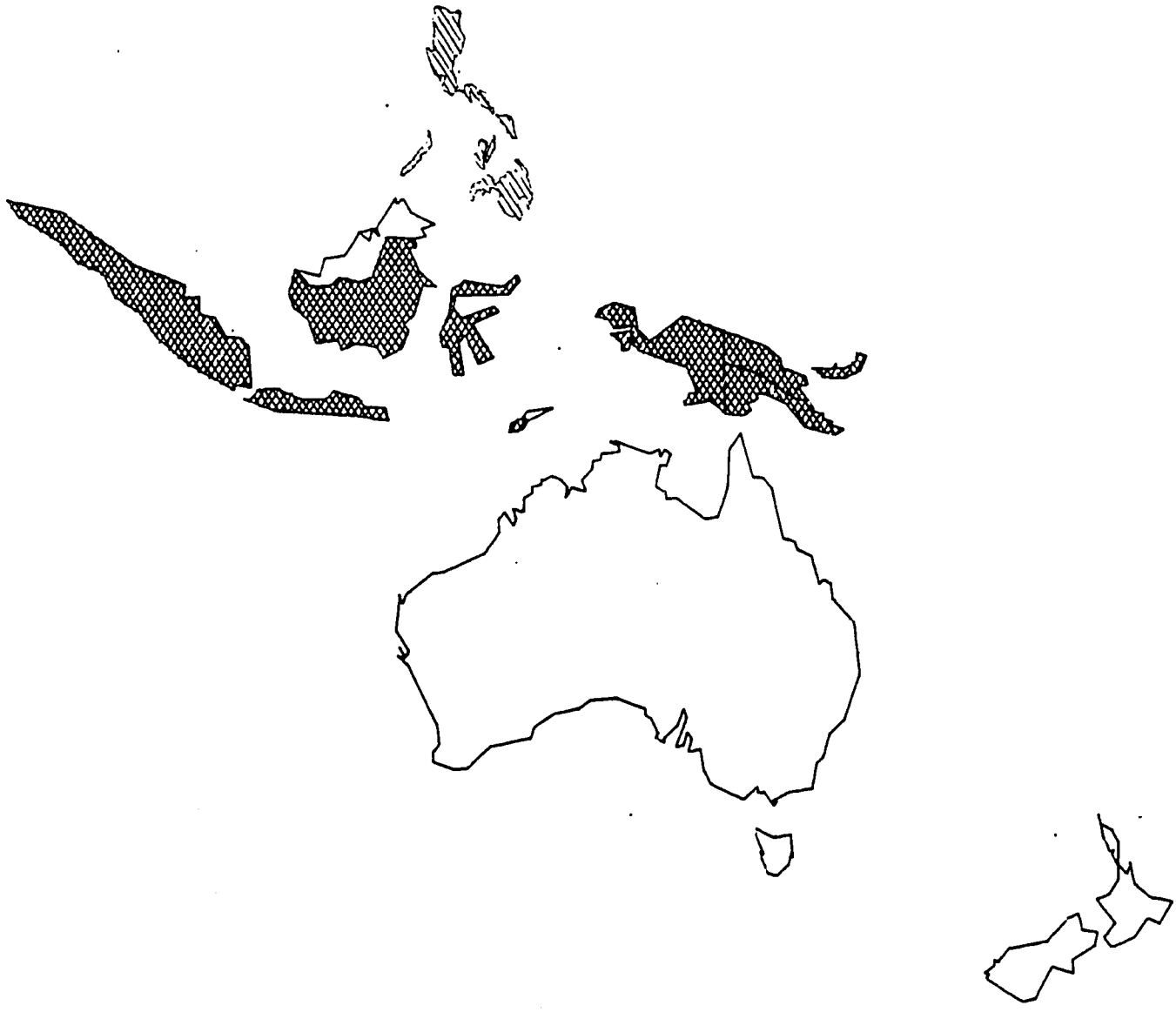
PERCENT

LESS THAN 25%
25% TO 50%
50% TO 75%
75% TO 100%

BLANKS INDICATE NO DATA

SOURCE: CDIE'S ECONOMIC AND SOCIAL DATA BASE
MOST CURRENT DATA

POPULATION WITH ACCESS TO SANITATION



PERCENT

LESS THAN 25%

75% TO 100%

50% TO 75%

BLANKS INDICATE NO DATA

SOURCE: CDIE'S ECONOMIC AND SOCIAL DATA BASE
MOST CURRENT DATA

URBAN AND RURAL POPULATION WITH ACCESS TO SAFE WATER AND SANITATION

YEAR=1970

COUNTRY NAME	TOTAL POPU-LATION*	URBAN POPU-LATION*	RURAL POPU-LATION*	PERCENT TOTAL WITH SAFE WATER	PERCENT URBAN WITH SAFE WATER	PERCENT RURAL WITH SAFE WATER	PERCENT TOTAL WITH SANITATION	PERCENT URBAN WITH SANITATION	PERCENT RURAL WITH SANITATION
BANGLADESH	68,117	5,183	62,934	45.0	13.0	47.0	6.0	.	.
BELIZE	120	61	59	80.0	.	.	.	.	.
BENIN	2,657	335	2,322	.	.	.	14.0	83.0	1.0
BOLIVIA	4,325	1,760	2,565	33.0	92.0	2.0	12.0	25.0	4.0
BOTSWANA	577	55	522	29.0	71.0	26.0	.	.	.
BRAZIL	95,847	53,483	42,364	55.0	78.0	28.0	58.0	85.0	24.0
BURKINA FASO (UPPER VOLTA)	5,071	345	4,726	12.0	35.0	10.0	4.0	49.0	.
BURMA	27,000	6,166	20,834	18.0	35.0	13.0	35.0	45.0	32.0
BURUNDI	3,350	74	3,276	.	77.0	.	.	96.0	.
CAMEROON	6,506	1,321	5,185	.	.	.	.	.	.
CAPE VERDE	269	.	.	.	.	.	.	.	.
CENTRAL AFRICAN REPUBLIC	1,879	584	1,295	.	.	.	72.0	64.0	96.0
CHAD	3,643	414	3,229	27.0	47.0	24.0	1.0	7.0	.
COMOROS	270	38	232	.	.	.	.	.	.
CONGO	1,208	463	745	27.0	63.0	6.0	6.0	8.0	6.0
COSTA RICA	1,727	685	1,042	74.0	98.0	59.0	52.0	66.0	43.0
CYPRUS	615	251	364	95.0	100	92.0	95.0	100	92.0
DJIBOUTI	160	.	.	.	.	.	.	.	.
DOMINICAN REPUBLIC	4,006	1,615	2,391	37.0	72.0	14.0	58.0	63.0	54.0
ECUADOR	5,864	2,316	3,548	34.0	76.0	7.0	22.4	.	.
EGYPT	33,053	13,948	19,105	93.0	94.0	93.0	.	.	.
EL SALVADOR	3,582	1,411	2,171	40.0	71.0	20.0	37.0	66.0	18.0
EQUATORIAL GUINEA	288	112	176	.	.	.	.	.	.
GAMBIA, THE	465	70	395	12.0	97.0	3.0	.	.	.
GHANA	8,614	2,507	6,107	35.0	86.0	14.0	55.0	92.0	40.0
GRENADA	94	.	.	60.0	100	47.0	.	.	95.0
GUATEMALA	5,353	1,909	3,444	38.0	88.0	12.0	.	.	11.0
GUINEA	4,490	624	3,866	.	68.0	.	13.0	70.0	2.0
GUINEA-BISSAU	526	95	431	.	.	.	.	.	.
GUYANA	709	209	500	72.0	100	63.0	93.0	95.0	92.0
HAITI	4,235	839	3,396	.	.	.	.	.	1.0
HONDURAS	2,639	763	1,876	34.0	99.0	10.0	24.0	64.0	9.0
INDIA	547,569	108,638	438,931	17.0	60.0	6.0	18.0	85.0	1.0
INDONESIA	116,201	19,837	96,364	3.0	10.0	1.0	15.0	19.0	14.0
ISRAEL	2,974	2,504	470	.	.	.	.	.	.
ITALY	53,661	34,583	19,078	.	.	.	.	.	.
JAMAICA	1,877	781	1,096	62.0	100	48.0	94.0	100	92.0
JORDAN	2,299	1,161	1,138	.	.	.	.	.	.
KENYA	11,253	1,146	10,107	15.0	100	2.0	50.0	85.0	45.0
LEBANON	2,469	1,467	1,002	92.0	95.0	85.0	.	.	.
LESOTHO	1,061	28	1,033	3.0	100	1.0	11.0	44.0	10.0
LIBERIA	1,335	350	985	.	.	.	.	.	.
MADAGASCAR	6,785	957	5,828	11.0	67.0	1.0	.	88.0	.
MALAWI	4,513	289	4,224	.	.	.	.	.	.
MALI	5,162	769	4,393	.	29.0	.	8.0	63.0	.
MAURITANIA	1,214	155	1,059	17.0	98.0	10.0	7.0	100	.
MAURITIUS	829	348	481	61.0	100	29.0	77.0	51.0	99.0
MOROCCO	14,968	5,181	9,787	51.0	92.0	28.0	29.0	75.0	4.0
MOZAMBIQUE	8,078	459	7,619	.	.	.	.	.	.
NEPAL	11,350	443	10,907	2.0	53.0	.	1.0	14.0	.
NICARAGUA	1,836	867	969	35.0	58.0	16.0	.	.	8.0
NIG[illegible]	4,008	336	3,672	20.0	37.0	19.0	1.0	10.0	.

URBAN AND RURAL POPULATION WITH ACCESS TO SAFE WATER AND SANITATION

YEAR=1970

COUNTRY NAME	TOTAL POPU-LATION*	URBAN POPU-LATION*	RURAL POPU-LATION*	PERCENT TOTAL WITH SAFE WATER	PERCENT URBAN WITH SAFE WATER	PERCENT RURAL WITH SAFE WATER	PERCENT TOTAL WITH SANITATION	PERCENT URBAN WITH SANITATION	PERCENT RURAL WITH SANITATION
OMAN	654	33	621	.	.	.	.	100	.
PAKISTAN	60,449	15,045	45,404	21.0	77.0	4.0	3.0	1.0	.
PANAMA	1,464	697	767	69.0	100	41.0	78.0	87.0	69.0
PARAGUAY	2,290	849	1,441	11.0	22.0	5.0	6.0	16.0	.
PERU	12,867	7,386	5,481	35.0	58.0	8.0	36.0	52.0	16.0
PHILIPPINES	36,848	12,138	24,710	36.0	.	.	57.0	.	.
POLAND	32,526	16,953	15,573	47.3	75.2	12.1	.	.	.
PORTUGAL	9,044	2,371	6,673	34.5	.	.	.	.	.
RWANDA	3,695	118	3,577	.	.	.	53.0	83.0	52.0
SAO TOME AND PRINCIPE	74	18	56	.	.	.	.	.	.
SENEGAL	4,391	1,317	3,074	.	.	.	.	.	.
SEYCHELLES	53	14	39	.	.	.	.	.	.
SIERRA LEONE	2,508	454	2,054	12.0	75.0	1.0	.	.	.
SOMALIA	3,238	748	2,490	15.0	17.0	14.0	.	.	.
SPAIN	33,779	22,307	11,472	.	.	.	.	.	.
SRI LANKA	12,516	2,737	9,779	21.0	46.0	14.0	64.0	76.0	61.0
SUDAN	13,859	2,270	11,589	19.0	61.0	13.0	16.0	.	.
SURINAME	372	171	201	.	.	.	.	.	.
SWAZILAND	452	34	418	.	.	.	.	.	.
SYRIA	6,258	2,712	3,546	71.0	98.0	50.0	.	.	.
TANZANIA, UNITED REPUBLIC	13,300	922	12,378	13.0	61.0	9.0	.	.	.
THAILAND	36,370	4,807	31,563	17.0	60.0	10.0	17.0	65.0	8.0
TOGO	2,020	264	1,756	17.0	.	5.0	1.0	4.0	1.0
TUNISIA	5,127	2,229	2,898	49.0	92.0	17.0	62.0	100	34.0
TURKEY	35,321	.	.	52.0	51.0	53.0	.	.	.
UGANDA	9,758	779	8,979	22.0	88.0	17.0	76.0	84.0	76.0
YEMEN (SANAA) (NORTH)	5,258	394	4,864	4.0	45.0	2.0	.	.	.
ZAIRE	21,638	4,674	16,964	11.0	33.0	4.0	5.0	5.0	5.0
ZAMBIA	4,159	1,248	2,911	37.0	70.0	22.0	16.0	12.0	18.0
ZIMBABWE	5,241	887	4,354	.	.	.	.	.	.

YEAR=1975

COUNTRY NAME	TOTAL POPU-LATION*	URBAN POPU-LATION*	RURAL POPU-LATION*	PERCENT TOTAL WITH SAFE WATER	PERCENT URBAN WITH SAFE WATER	PERCENT RURAL WITH SAFE WATER	PERCENT TOTAL WITH SANITATION	PERCENT URBAN WITH SANITATION	PERCENT RURAL WITH SANITATION
BANGLADESH	79,877	7,178	71,699	56.0	22.0	61.0	5.0	40.0	.
BELIZE	131	65	66	.	.	.	.	.	.
BENIN	3,029	403	2,626	.	.	.	.	.	.
BOLIVIA	4,894	2,031	2,863	34.0	81.0	6.0	.	.	9.0
BOTSWANA	711	100	611	45.0	95.0	39.0	.	.	.
BRAZIL	108,032	66,785	41,247	.	87.0	.	.	.	.
BURKINA FASO (UPPER VOLTA)	5,596	509	5,087	25.0	50.0	23.0	4.0	47.0	.
BURMA	29,800	7,388	22,412	17.0	31.0	14.0	32.0	38.0	32.0
BURUNDI	3,720	82	3,638	.	.	.	.	.	.
CAMEROON	7,439	1,986	5,453	.	.	.	.	.	.
CAPE VERDE	282	.	.	.	.	.	.	.	.
CENTRAL AFRICAN REPUBLIC	2,034	702	1,332	.	.	.	100	100	100
CHAD	4,030	579	3,451	26.0	43.0	23.0	1.0	9.0	1.0
COMOROS	306	51	255	.	.	.	.	.	.

URBAN AND RURAL POPULATION WITH ACCESS TO SAFE WATER AND SANITATION

YEAR=1975

COUNTRY NAME	TOTAL POPU-LATION*	URBAN POPU-LATION*	RURAL POPU-LATION*	PERCENT TOTAL WITH SAFE WATER	PERCENT URBAN WITH SAFE WATER	PERCENT RURAL WITH SAFE WATER	PERCENT TOTAL WITH SANITATION	PERCENT URBAN WITH SANITATION	PERCENT RURAL WITH SANITATION
CONGO	1,376	572	804	38.0	81.0	9.0	9.0	10.0	9.0
COSTA RICA	1,965	811	1,154	72.0	100	56.0	93.0	94.0	93.0
CYPRUS	609	264	345	95.0	94.0	96.0	95.0	94.0	95.0
DJIBOUTI	214	.	.	.	.	.	.	.	.
DOMINICAN REPUBLIC	4,697	2,128	2,569	55.0	88.0	27.0	42.0	74.0	16.0
ECUADOR	6,689	2,803	3,886	36.0	67.0	8.0	.	.	7.0
EGYPT	36,997	16,108	20,889	.	.	.	.	.	.
EL SALVADOR	4,143	1,653	2,490	53.0	89.0	28.0	39.0	71.0	17.0
EQUATORIAL GUINEA	313	146	167	.	.	.	.	.	.
GAMBIA, THE	536	89	447	.	.	.	.	.	.
GHANA	9,990	3,231	6,759	35.0	86.0	14.0	56.0	95.0	40.0
GRENADA	105	.	.	83.0	100	77.0	.	36.0	100
GUATEMALA	6,243	2,311	3,932	39.0	85.0	14.0	25.0	.	16.0
GUINEA	4,925	802	4,123	10.0	69.0	.	.	.	.
GUINEA-BISSAU	628	131	497	.	.	.	.	.	.
GUYANA	762	226	536	80.5	100	75	96.0	99.0	94.0
HAITI	4,584	1,013	3,571	12.0	46.0	3.0	.	.	.
HONDURAS	3,093	999	2,094	41.0	99.0	13.0	26.0	53.0	13.0
INDIA	613,459	127,906	485,553	31.0	80.0	18.0	20.0	87.0	2.0
INDONESIA	130,192	25,257	104,935	11.0	41.0	4.0	15.0	60.0	5.0
ISRAEL	3,455	3,006	449	.	.	.	.	.	.
ITALY	54,897	36,724	18,173	.	.	.	.	.	.
JAMAICA	2,043	934	1,109	86.0	100	79.0	94.0	100	91.0
JORDAN	2,600	1,440	1,160	.	.	.	.	.	.
KENYA	13,685	1,645	12,040	17.0	100	4.0	55.0	95.0	48.0
LEBANON	2,767	1,898	869	.	.	.	.	.	.
LESOTHO	1,192	42	1,150	17.0	65.0	14.0	13.0	51.0	12.0
LIBERIA	1,577	464	1,113	.	.	.	.	.	.
MADAGASCAR	7,603	1,223	6,380	25.0	76.0	14.0	.	.	9.0
MALAWI	5,204	416	4,788	.	.	.	.	.	.
MALI	5,873	987	4,886	.	.	.	98.0	100	93.0
MAURITANIA	1,359	314	1,045	.	.	.	.	.	.
MAURITIUS	883	417	466	60.0	100	22.0	82.0	63.0	100
MOROCCO	16,955	6,346	10,609	.	.	.	.	.	.
MOZAMBIQUE	9,130	644	8,486	.	.	.	.	.	.
NEPAL	12,841	565	12,276	8.0	85.0	5.0	1.0	14.0	.
NICARAGUA	2,204	1,106	1,098	56.0	100	14.0	.	.	24.0
NIGER	4,720	485	4,235	27.0	36.0	26.0	3.0	30.0	1.0
OMAN	766	84	682	52.0	100	48.0	12.0	100	5.0
PAKISTAN	70,876	18,711	52,165	25.0	75.0	5.0	6.0	21.0	.
PANAMA	1,639	801	838	77.0	100	54.0	77.0	78.0	76.0
PARAGUAY	2,633	998	1,635	13.0	25.0	5.0	10.0	28.0	.
PERU	14,822	9,101	5,721	47.0	72.0	15.0	.	.	.
PHILIPPINES	42,015	14,957	27,058	43.0	66.0	33.0	56.0	76.0	44.0
POLAND	34,022	18,448	15,574	.	.	.	.	.	.
PORTUGAL	9,391	2,649	6,742	.	.	.	.	.	.
RWANDA	4,358	160	4,198	68.0	84.0	68.0	57.0	87.0	56.0
SAO TOME AND PRINCIPE	87	24	62	.	.	.	.	.	.
SENEGAL	4,977	1,593	3,384	.	56.0	.	.	.	.
SEYCHELLES	59	.	.	.	.	.	.	.	.
SIERRA LEONE	2,736	585	2,181	.	.	.	.	.	.
SOMALIA	3,722	986	2,736	38.0	77.0	22.0	47.0	77.0	35.0

URBAN AND RURAL POPULATION WITH ACCESS TO SAFE WATER AND SANITATION

YEAR=1975

COUNTRY NAME	TOTAL POPU-LATION*	URBAN POPU-LATION*	RURAL POPU-LATION*	PERCENT TOTAL WITH SAFE WATER	PERCENT URBAN WITH SAFE WATER	PERCENT RURAL WITH SAFE WATER	PERCENT TOTAL WITH SANITATION	PERCENT URBAN WITH SANITATION	PERCENT RURAL WITH SANITATION
SPAIN	35,596	25,093	10,503	.	.	.	.	.	.
SRI LANKA	13,496	2,975	10,521	19.0	36.0	13.0	59.0	68.0	55.0
SUDAN	16,203	2,868	13,335	50.0	96.0	43.0	22.0	100	10.0
SURINAME	367	164	203	.	.	.	.	.	.
SWAZILAND	517	42	475	37.0	83.0	29.0	36.0	99.0	25.0
SYRIA	7,438	3,377	4,061	.	.	.	.	.	.
TANZANIA, UNITED REPUBLIC	15,751	1,442	14,309	39.0	98.0	36.0	17.0	88.0	14.0
THAILAND	41,388	6,746	34,642	25.0	69.0	16.0	40.0	58.0	36.0
TOGO	2,282	377	1,905	16.0	49.0	10.0	15.0	36.0	12.0
TUNISIA	5,611	2,794	2,817	.	93.0	.	.	.	.
TURKEY	40,078	15,029	25,049	68.0	74.0	64.0	8.0	13.0	5.0
UGANDA	11,102	1,087	10,015	35.0	100	29.0	94.0	82.0	95.0
YEMEN (SANAA) (NORTH)	6,075	668	5,407	.	.	.	.	.	.
ZAIRE	24,965	6,940	18,025	19.0	38.0	12.0	22.0	65.0	6.0
ZAMBIA	4,846	1,643	3,203	42.0	86.0	16.0	42.0	87.0	16.0
ZIMBABWE	5,895	1,165	4,730	.	.	.	.	.	.

*population in thousands

Table 5

DEFINITION OF INDICATORS*

Access to Safe Water (% of Population) -- Percentage of people with reasonable access to safe water. Safe water supply includes treated surface water or untreated but uncontaminated water such as that from protected boreholes, springs, and sanitary wells.

Access to Excreta Disposal (% of Population) -- Number of people served by excreta disposal facilities as percentage of total population. Excreta disposal may include the collection and disposal, with or without treatment, of human excreta and wastewater by water-borne systems, or the use of pit privies and similar installations.

Rural -- Villages or clearly rural areas with a large percentage of population engaged in agriculture are usually classified as rural. Comparability of rural population between various countries is often affected by the lack of uniform definitions and varying concepts of rural areas.

Urban --The designation of areas as urban is usually based on the concentration of clearly urban population. The wide variation in the definition of the concept of "urban" used by individual countries limit international comparability of data.

*Source of Definitions from World Bank.

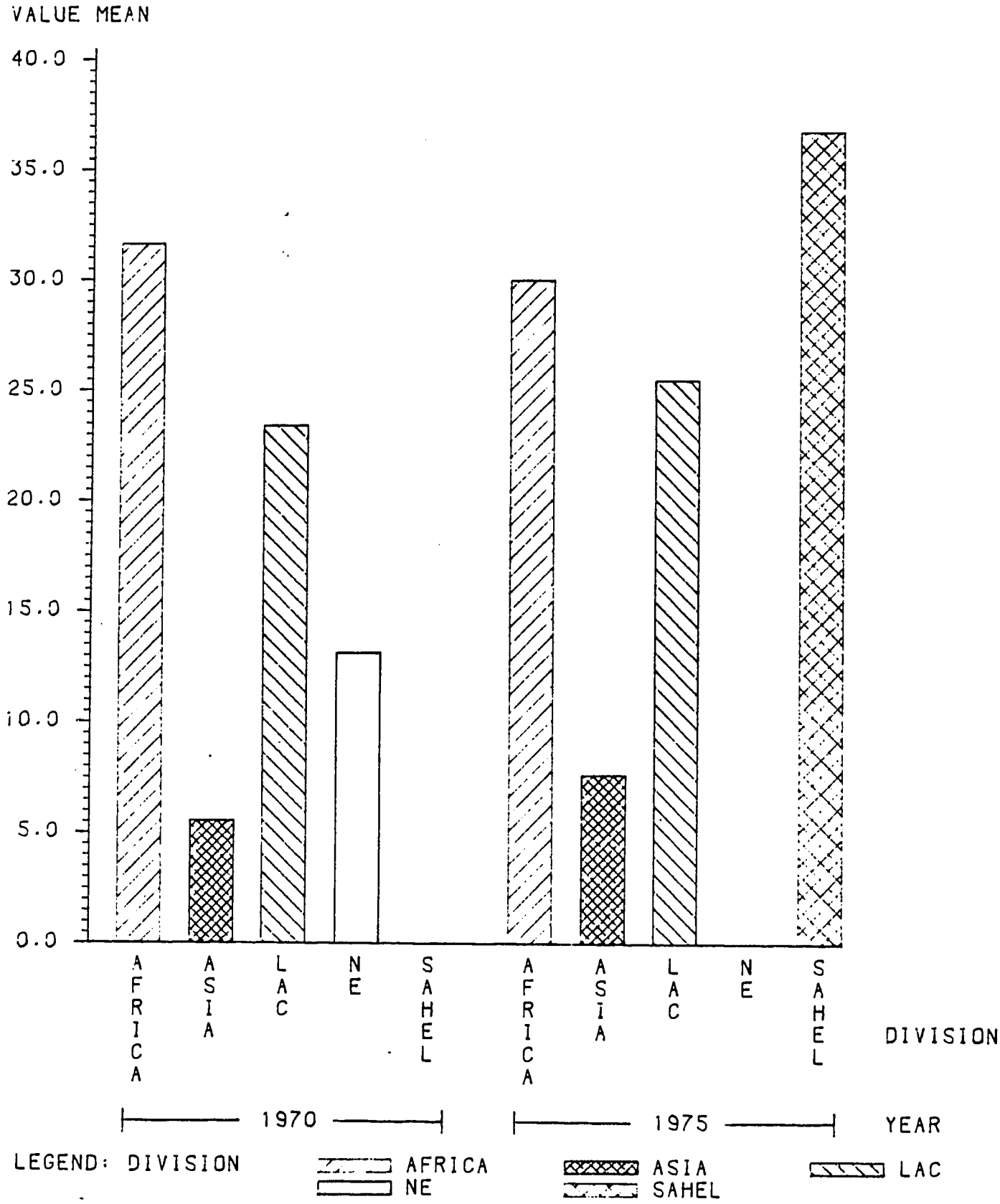
Access to Sanitation Facilities: A World Overview

- In every region urban populations have greater access to excreta facilities than do rural populations.
- Between 1970 and 1975 there was only a slight positive or negative change in the percentage of urban and rural populations with access to sanitation.
- World wide fewer people have access to excreta facilities than to safe water. Areas with the greatest need for sanitation include Central Africa, Asia, parts of the Near East and Western South America. Countries with the best access to sanitary facilities include parts of the Near East and Latin America (see maps).

RURAL POPULATION WITH ACCESS TO SANITATION

CP COUNTRIES

SUMMARY OF SOCIAL INDICATOR BY FY-86 CP DIVISIONS
INDICATOR=% OF POP WITH ACCESS TO EXCRETA DISPOSAL - RURAL



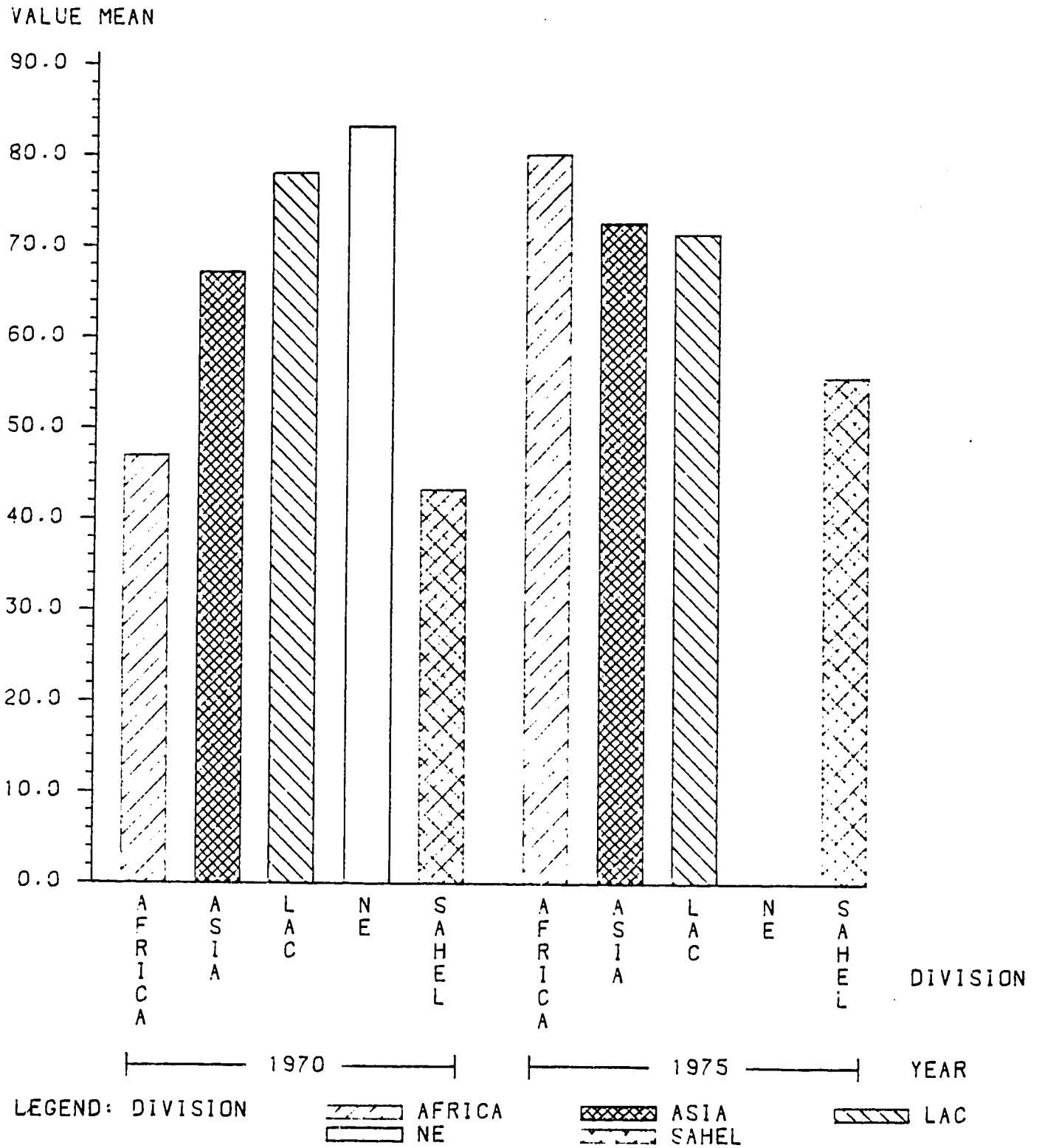
SOURCE: ECONOMIC AND SOCIAL DATA BASE
NOTE: POLAND, SPAIN, PORTUGAL, AND ITALY NOT INCLUDED

185

URBAN POPULATION WITH ACCESS TO SANITATION

CP COUNTRIES

SUMMARY OF SOCIAL INDICATOR BY FY-86 CP DIVISIONS
INDICATOR=% OF POP WITH ACCESS TO EXCRETA DISPOSAL - URBAN



SOURCE: ECONOMIC AND SOCIAL DATA BASE
NOTE: POLAND, SPAIN, PORTUGAL, AND ITALY NOT INCLUDED

ADDITIONAL INFORMATION

BIBLIOGRAPHY

World Bank

1) World Bank Research in Water Supply and Sanitation - Summary of Selected Publications. The Johns Hopkins University Press, 1980. Stock # BK9185 (free).

2) Laboratory Evaluation of Hand-Operated Pumps for Use in Developing Countries. Consumers' Assoc. Testing and Research Laboratory. Technical Paper #6, 1983. Stock # BK0133. $3.00.

3) Meeting the Needs of the Poor for Water Supply and Waste Disposal. Fredrick L. Golladay. Technical Paper #9, 1983. Stock # BK0238. $3.00.

4) A Model for the Development of a Self-Help Water Supply Program. Colin Glennie. Technical Paper #2, 1982. Stock # BK0077. $3.00.

5) Notes on the Design and Operation of Waste Stabilization Ponds in Warm Climates of Developing Countries. J.P. Arthur. Technical Paper #7, 1983. Stock # BK0137. $5.00.

6) Ventilated Improved Pit Latrines: Recent Developments in Zimbabwe. D.D. Mara and Peter Morgan. Technical Paper #3, 1983. Stock # BK0078. $3.00.

7) Village Water Supply. World Bank Paper, 1976. Stock # BK9099. $5.00.

8) Village Water Supply: Economics and Policy in the Developing World. Robert J. Saunders and Jeremy J. Warford. The Johns Hopkins University Press, 1976. Stock #JH1876, $22.50.

Water Supply and Sanitation Project Preparation Handbook
(3 volume set: $25.00)

9) Volume I: Guidelines. Brian Grover. Technical Paper #12, 1983. Stock # BK0230. $5.00.

10) Volume II: Case Studies - Identification Report for Port City, Immediate Improvement Project for Port City, Prefeasibility Report for Port City. Brian Grover, et al. Technical Paper #13, 1983. Stock # BK0231. $15.00.

11) Volume III: Case Study - Feasibility Report for Port City. Brian Grover, et al. Technical Paper #14, 1983. Stock # BK0232. $15.00.

World Bank Studies In Water Supply and Sanitation

12) Number 1: Appropriate Sanitation Alternatives: A Technical and Economic Appraisal. John M. Kalbermatten, et al. The Johns Hopkins University Press, 1982. Stock # JH2578. $12.95.

13) Number 2: Appropriate Sanitation Alternatives: A Planning and Design Manual.
John M. Kalbermatten, et al. The Johns Hopkins University Press, 1982.
Stock # JH2584. $15.00.

14) Number 3: Sanitation and Disease: Health Aspects of Wastewater Management.
Richard C. Feachem, et al. John Wiley & Sons, 1983. Stock # IB0558. $39.50.

Appropriate Technology for Water Supply and Sanitation

15) Volume 1: Technical and Economic Options.
John M. Kalbermatten, et al. 1980. Stock # BK9186. $5.00.

16) Volume 1a: A Summary of Technical and Economic Options.
John M. Kalbermatten, et al. 1980. Stock # BK0049. $3.00.

17) Volume 1b: Sanitation Alternative for Low-Income Communities - A Brief Introduction.
D. Duncan Mara. 1982. Stock # BK9189. $3.00.

18) Volume 3: Health Aspects of Excreta and Sullage Management: A State-of-the-Art Review.
Richard G. Feachem, et al. 1980. Stock # BK 9187. $15.00.

Copies of the above publications can be obtained by contacting:

World Bank Publications
P.O. Box 37525
Washington, D.C. 20013
USA

BIBLIOGRAPHY

Overseas Development Administration (ODA)

1) Domestic Water Supply Development in Mauritius.
J. White, 1972. EV206.

2) Domestic Rural Water Supplies: Eight Selected Schemes.
A. Cronin, 1974. EV213.

3) Lesotho Village Water Supplies: Administrative Aspects.
Ross Institute of Tropical Hygiene, 1976. EV164.

4) Lesotho Village Water Supplies
Ross Institute of Tropical Hygiene, 1977. EV6.

5) Botswana Small Villages Water Supply Project.
J. Carstairs, 1978. EV112.

6) Swaziland Rural Water Supplies Baseline Study.
ODM Team, 1978. EV99.

7) Water Quality Evaluation - Swaziland.
W.J. Lewis, 1979. EV67.

Copies of the above evaluations can be obtained by contacting:

Overseas Development Administration
Eland House
Evaluation Unit Room E346
Stag Place
London SW1

LIST OF WASH PUBLICATIONS: TECHNICAL AND FIELD REPORTS

TECHNICAL REPORTS

1. WASH Technical Report 1. Triocide Questions and Answers. November, 1980 by Peter Kolsky.

2. WASH Technical Report 2. Possible Disinfection of Oral Rehydration Solutions. Notes from November 13, 1980 meeting with Richard Cash and Lincoln Chen, by Raymond B. Isely.

3. WASH Technical Report 3. Training of Rural Community Development Workers in Health Education, with Special Reference to Water Supply Protection and Use Maintenance of Sanitation Facilities. March, 1981. Prepared for Mandara Mountains Water Resource Project, USAID Mission, Yaounde Cameroon by Guy Steuart and Carla Rull. C-Task No. 49.

4. WASH Technical Report 4. Evaluation Methods for Community Rural Water Supply and Sanitation Projects in Developing Countries: A Synthesis of Available Information. March 31, 1981. Prepared for the USAID Mission, Malawi, by Robert Struba. C-Task No. 47.

5. WASH Technical Report 5. The Choice of Health Status Indicators to Evaluate Water and Sanitation Projects in North Cameroon: A Synthesis of Available Information. April 9, 1981. Prepared for Mandara Mountains Water Resource Project, USAID Mission to the United Republic of Cameroon, by Robert S. Struba and Raymond B. Isely. C-Task #49. (Also available in French.)

6. WASH Technical Report 6. Women, Water and the Decade. Presented at the International Affairs Session of the American Water Works Association, St. Louis, Missouri, June 9, 1981 by Mary Elmendorf. OTD #35.

7. WASH Technical Report 7. Facilitation of Community Organization: An Approach to Water and Sanitation Programs in Developing Countries. June 17, 1981. Prepared by Raymond B. Isely. C-Task #94.

8. WASH Technical Report 8. Integration de L'Approvisionnement en Eau et de L'Assainissement du Milieu dans les Programmes de Soin Primaires. Presented in Sousse, Tunisia, August 31, 1981 by Raymond B. Isely. OTD #52.

9. WASH Technical Report 9. Toward an Asia Bureau Water and Sanitation Policy Statement. September, 1981. Prepared for the Office of Health, Population and Nutrition of the Asia Bureau, USAID by James Thomson. C-Task #98.

10. WASH Technical Report 10. Social and Economic Preconditions for Water Supply and Sanitation Programs. Prepared for AID/PPC by Dennis B. Warner, September, 1981.

11. WASH Technical Report 11. The Role of Women as Participants and Beneficiaries in Water Supply and Sanitation Programs. December, 1981. Prepared for the Office of Health by Mary L. Elmendorf and Raymond B. Isely. C-Task #51. (Also available in French and Spanish.)

12. WASH Technical Report 12. Measuring and Evaluating Diarrhea and Malabsorption in Association with Village Water Supply and Sanitation. A Review of the Food Wastage/ Sanitation Cost Benefit Methodology Project (Guatemala), Contract AID/csd-2959, by an External Panel of Experts. Prepared for the Office of Health by Branko Cvjetanovic, Lincoln Chen, Richard Kronmal, Charles Rohde, Robert Suskind, Robert Struba and Kenneth McElroy. December, 1981. OTD #19.

13. WASH Technical Report 13. Participants Manual for Sessions on Water Supply and Sanitation: USAID Workshop on Primary Health Care in Africa, November 15-20, 1981. Lome, Togo. February, 1982. Prepared for the Africa Bureau, USAID by Raymond B. Isely, Craig R. Hafner, Daniel A. Okun, Morris A. Shiffman, Thomas Talbert and Marjorie L. Kupper. OTD #53. (Also available in French.)

14. WASH Technical Report 14. Water Supply and Sanitation in Rural Development: Proceedings of a Conference for Private and Voluntary Organizations, December 1-4, 1981. Sponsored by the National Council for International Health and the WASH Project. OTD #57.

15. WASH Technical Report 15. Application of Health Education to Water Supply and Sanitation Projects in Africa. October, 1982. Prepared by Raymond B. Isely and Kathleen A. Parker. C-Task #176.

16. WASH Technical Report 16. Relating Improvements in Water Supply and Sanitation to Nutritional Status. October 1982. Prepared by Raymond B. Isely. C-Task #309.

17. WASH Technical Report 17. Water and Sanitation-Related Health Constraints of Women's Contributions to the Economic Development of Communities. October 1982. Prepared by Mary Elmendorf and Raymond B. Isely. C-Task #310.

18. WASH Technical Report 18. Community Participation and Women's Role in Water Supply and Sanitation in Developing Countries: A Three-Part Bibliography by Author, Subject and Country. November 1982. Prepared by Ellen Kendall. C-Task #235.

19. WASH Technical Report 19. Africa Bureau Domestic Water and Sanitation Strategy Statement. January, 1983. Prepared by James Thomson. OTD #107.

20. WASH Technical Report 20. Guidelines for Human Resource Development Planning in the Water Supply and Sanitation Sector. October, 1983. Prepared by J.E.S. Lawrence and J.B. Tomaro. C-Task #265.

21. WASH Technical Report 21. Women's Roles in Water Supply and Sanitation in Developing Countries: A Four-Part Bibliography by Author, Subject, Phase of Development, and Country. February 1984. By Alice J. Smith. C-Task #8410.

22. WASH Technical Report 22. Human Resource Development: A Selected and Annotated Bibliography for Use in the Water Supply and Sanitation

FIELD REPORTS

1. WASH Field Report 1. Socio-Cultural and Economic Characteristics of Conditions in Ancash and La Libertad, Peru with Special Emphasis on the Callejones de Huaylas and Conchucos: Questions to be Considered in an Evaluation of CARE-Sponsored Water, Sewage and Health Projects. November, 1980. Prepared by Charlotte D. Miller. OTD #6.

2. WASH Field Report 2. Review of AID Rural Potable Water Programs - Haiti. November 16-29, 1980. Prepared by James Arbuthnot. OTD #9.

3. WASH Field Report 3. Feasibility of Local Manufacture of the AID Hand-Operated Water Pump, and other Technology Appropriate for Rural Water Supply Programs in the Philippines. Prepared for USAID by Phillip W. Potts, Robert Knight and Yaron M. Sternberg. April, 1979. OTD #11.

4. WASH Field Report 4. Tunisia, Aspects of Well Drilling Rural Potable Water Project - Report on a Field Trip, December 20-27, 1980. Prepared for USAID by Michael Glaze. OTD #15.

5. WASH Field Report 5. Dominican Republic Consultations on the Health Sector Loan II. Report of a Field Trip, January 26-30, 1981. Prepared by Dennis B. Warner. OTD #21.

6. WASH Field Report 6. Report on the Peru Rural Water Systems and Environmental Sanitation Project. January 31, 1981. Prepared for USAID by Harold Shipman. OTD #18.

7. WASH Field Report 7. Tanzania - A National Environmental Sanitation Education Master Plan, A Preliminary Review. February 22-March 13, 1981. Prepared for USAID by Dennis B. Warner and Kenneth Woolf. OTD #26.

8. WASH Field Report 8. Tanzania - Health and Environmental Monitoring Project (HEMP): Recommendations for Project Paper Design Team. February 22-March 13, 1981. Prepared for USAID by Dennis B. Warner and Kenneth Woolf. OTD #26.

9. WASH Field Report 9. Contaminacion Ambiental en Ecuador. Prepared for USAID Mission, Ecuador by Paul C. Dreyer. OTD #14.

10. WASH Field Report 10. Lebanon - Technical Recommendations for Wastewater Treatment Demonstration (Pilot) Plants for Lebanon. March, 1981. Prepared for USAID Mission, Lebanon, by A.A. Kalinske. OTD #20.

11. WASH Field Report 11. Mauritania - Public Health Assessment of Proposed Dams, Water-Related Diseases and Community Water Supplies. March, 1981. Prepared for USAID by Emil Malek and David Goff. OTD #16.

12. WASH Field Report 12. Ecuador - Institutional Development for IEOS: Instituto Ecuadoriano de Obras Sanitarias. March, 1981. Prepared for USAID by Charles S. Pineo, Henry Tan and Guillermo Orozco. OTD #14.

13. WASH Field Report 13. Projecto de Sistema de Entrega de Salud Rural Integrado - Saneaminento Rural. March, 1981. Prepared for USAID Mission, Ecuador, by Gonzalo Medina. OTD #24.

14. WASH Field Report 14. Targets of Opportunity for WASH: Report of a Reconnaissance Visit to India and Bangladesh, February 20-March 7, 1981. Prepared for USAID by Raymond B. Isely. OTD #28.

15. WASH Field Report 15. Guatemala - XIII Central American Congress of AIDIS, Guatemala City, March 15-20, 1981. Prepared for USAID by Charles S. Pineo, March, 1981. OTD #30.

16. WASH Field Report 16. Indonesia - Rural Sanitation and Manpower Devlopment Project (RSMD). The Development of Appropriate Technology and the Improvement of Curricula for Training of Sanitarians. March, 1981. Prepared for the USAID Mission, Indonesia, by Clarence E. Calbert and Robert A. Gearheart. OTD #25.

17. WASH Field Report 17. Jordan - Recommended Wastewater Treatment Guidelines for the Hashemite Kingdom of Jordan. April, 1981. Prepared for the USAID Mission, Jordan, by Harris F. Seidel. OTD #31.

18. WASH Field Report 18. Coordination of WASH Information Activities and Exchange with International Information Centers, Holland and England. April 5-17, 1981. Prepared for USAID Washington by James E. Beverly. OTD #32.

19. WASH Field Report 19. Village Water Supply and Sanitation in Northeastern Thailand. July, 1981. Prepared for the USAID Mission, Thailand, by James Arbuthnot and Robert H. Thomas. OTD #38.

20. WASH Field Report 20. Technical Assistance in the Manufacture and Quality Control of the AID/Battelle Handpump in the Dominican Republic. June, 1981. Prepared for the USAID Mission, Dominican Republic, by Robert Knight. OTD #1.

21. WASH Field Report 21. Plan for a Health Education Component for the Health Sector II Bilateral Assistance Project in the Dominican Republic. July, 1981. Prepared for the USAID Mission, Dominican Republic, by Charles Llewellyn. OTD #21.

22. WASH Field Report 22. Evaluation of Yemen Water Supply Systems Management Project. August, 1981. Prepared for the USAID Mission, Yemen Arab Republic, by Martin Lang and Clarence Calbert. OTD #39.

23. WASH Field Report 23. Plan for the Health Impact Evaluation of the Health Sector II Bilateral Assistance Project in the Dominican Republic. August, 1981. Prepared for the USAID Mission, Dominican Republic, by Paul Howard and Robert J. Struba. OTD #21.

24. WASH Field Report 24. Community Water Supply and Sanitation in Burundi: Report of an Evaluation Team. October, 1981. Prepared for the USAID Mission, Burundi, by Raymond Isely, David R. Goff and Herbert Blank. OTD #36.

25. WASH Field Report 25. Water and Sanitation Alternatives for Southern Italy Disaster Relief. December, 1980. Prepared for USAID Washington by David R. Goff and Michael A. Kostur. OTD #13.

26. WASH Field Report 26. Appropriate Technology for Rural Water Supply and Sanitation in El Salvador: A Brief Review and Bibliography. September, 1981. Prepared for the USAID Mission, El Salvador, by Charles S. Pineo. OTD #17.

27. WASH Field Report 27. Strategy for Implementation and Evaluation of the Togo Rural Wells and Sanitation Project. October, 1981. Prepared for the USAID Mission, Togo, by Felix Awantang. OTD #45.

28. WASH Field Report 28. Rural Sanitation and Manpower Development Project: Appropriate Technology and Information Dissemination. October, 1981. Prepared for the USAID Mission, Indonesia, by Robert A. Gearheart. OTD #44.

29. WASH Field Report 29. Participation in a Workshop on Primary Health Care, August 31-September 3, 1981, Sousse, Tunisia. October, 1981. Prepared for Bureau of the Near East, USAID, by Raymond B. Isely. OTD #52.

30. WASH Field Report 30. UNICEF/PAHO Joint Workshop on Drinking Water and Sanitation in Rural and Urban Slum Areas - Lima, Peru, November 17-22, 1980. December, 1981. Report of Emil T. Chanlett. OTD #5.

31. WASH Field Report 31. Intensive Session on Water Sanitation and Health Education: A Workshop Held at UNICEF Headquarters, New York, April 22-23, 1981. December, 1981. Prepared by Raymond B. Isely. OTD #37.

32. WASH Field Report 32. Hydrogeological Reconnaissance of the Yelimare-Tambacara Area of Mali with Reference to the Village Wells Project. February, 1982. Prepared by George Taylor. OTD #64.

33. WASH Field Report 33. Environmental Health in Egypt: A Sectoral Assessment and Recommendations. April, 1982. Prepared by Dennis B. Warner and David Donaldson. OTD #62.

34. WASH Field Report 34. A Proposed Action Plan for a National Training Program in the Water Sector for the Hashemite Kingdom of Jordan. September, 1982. Ken Woolf, John Austin, Walter Pinto-Costa. OTD #55.

35. WASH Field Report 35. Scope of Work for the Health Outcome Evaluation of the Health Sector II Project in the Dominican Republic. February, 1982. Prepared by Kenneth McLeroy. OTD #58.

36. WASH Field Report 36. Municipal Water Conservation in Jordan: Report of a Seminar. February, 1982. Prepared by James L. Ogilvie. OTD #59.

37. WASH Field Report 37. Community Water Supply and Sanitation in Sudan. April, 1982. Prepared for the USAID Mission to the Democratic Republic of Sudan by Charles G. Chandler, Frank P. Araujo and Eddy K.C. Lo. OTD #60.

38. WASH Field Report 38. Recommendations for the Rural Water and Environmental Sanitation Project in Peru. April, 1982. Prepared for the USAID Mission, Peru by David Donaldson and Charles S. Pineo. OTD #74.

39. WASH Field Report 39. Integration of Health Education in the CARE Water and Sanitation Project in Indonesia. April, 1982. Prepared for the USAID Mission to the Republic of Indonesia by David Drucker. OTD #73.

40. WASH Field Report 40. Para Village Water Supply: Pre-Feasibility Report. April, 1982. Prepared for the Social Development Attache, U.S. Embassy, Brazil, by William M. Turner. OTD #66.

41. WASH Field Report 41. Testing of the Portable Water Purification and Disinfection Units of the Office of Foreign Disaster Assistance (OFDA). April, 1982. Prepared for the Office of Health, AID, by the WASH Project. OTD #83. (Limited Distribution)

42. WASH Field Report 42. Water Supply and Sanitation and Diarrheal Disease Control in the Comprehensive Health Imorovement Project -- Province Specific (CHIPPS) in Indonesia. April, 1982. Prepared for the USAID Mission to the Republic of Indonesia by James Thomson. OTD #79.

43. WASH Field Report 43. Technical Training of Peace Corps Volunteers in Rural Water Supply Systems in Morocco. May, 1982. Prepared for the USAID Mission to the Kingdom of Morocco by Keith Sherer. OTD #61.

44. WASH Field Report 44. Evaluation of Practical Training of Sanitation Agents: Sine-Saloum, Senegal Primary Health Care Project. June, 1982. Prepared for USAID Mission Senegal, by Thomas C. Leonhardt and Felix Awantang. OTD #78.

45. WASH Field Report 45. Training of Trainers Workshoo for Technical Training in Water Supply and Sanitation. June, 1982. Prepared for the Office of Health, by James Carney and Louise McCoy. OTD #80.

46. WASH Field Report 46. Proposed Measures for Reducing Costs in Infrastructure and Urbanization Projects for Low Income Housing in Honduras. June, 1982. Prepared for the Regional Housing Office in Central America, USAID Mission, Honduras, by Octavio Cordon. OTD #94.

46. WASH Informe de Campo 46. Medidas Propuestas para Reducir Costos en Proyectos de Infrastructura y Urbanizaciones de Vivienda Minima. Junio, 1982. Preparado para de la Oficina Regional de Vivienda en Centro America y la Mision USAID, Honduras, Octavio Cordon. OTD #94.

47. WASH Field Report 47. Reprogramming of the Rural Sanitation Project in Bolivia. August, 1982. Prepared by Charles Stevens for the USAID Mission to the Republic of Bolivia. OTD #93.

48. WASH Field Report 48. Coordination of WASH Information Activities and Exchange with International Information Centers. (PAHO/CEPIS-Peru) Trip Report #2. July, 1982. Prepared for USAID Office of Health, Bureau for Science and Technology, by James Beverly. OTD #32.

49. WASH Field Report 49. An Assessment of the Method of Training Promotors of the Ecuadorian Institute of Sanitary Works Ambato, Ecuador, May 17 to June 4, 1982. July, 1982. Prepared for USAID Mission, Ecuador, by Hortense Dicker. OTD #96.

50. WASH Field Report 50. Well Drilling Assistance for the Health Sector Loan II Project in the Dominican Republic. July, 1982. Prepared for USAID Mission, Dominican Republic, by William M. Turner. OTD #97.

51. WASH Field Report 51. A Rural Water Supply and Sanitation Training Course for Peace Corps Volunteers in Togo. July, 1982. Prepared for USAID Mission, Republic of Togo, by Yolande Mosseau-Gershman. OTD #45.

52. WASH Field Report 52. Implementation Plan for Unsewered Areas Demonstration Project in Greater Cairo. September, 1982. Prepared for USAID Mission, Republic of Egypt, by Dennis Warner, Leo St. Michael, Richard Sullivan and James Arbuthnot. OTD #77.

53. WASH Field Report 53. Recommendations for Initial Water and Sanitation Decade Planning Activities in the Central African Republic. September, 1982. Prepared by Dennis Warner. OTD #106. (Also available in French.)

54. WASH Field Report 54. Philippine Handpump Program. August, 1982. Prepared for the USAID Mission, Philippines, by P. Alan Pashkevitch and Tyler E. Gass. OTD #40.

55. WASH Field Report 55. Night Soil Disposal and Effluent Reuse in Maseru. September, 1982. Prepared for USAID Mission, Lesotho, by Daniel A. Okun and John Briscoe. OTD #88.

56. WASH Field Report 56. Selection of Alternatives to Gravity Flow Systems for Rural Communities: A Workshop to Train Guatemalan Engineers in Pumping Technology. September, 1982. Prepared for the USAID Mission, Republic of Guatemala, by Daniel A. Edwards. OTD #76.

57. WASH Field Report 57. Evaluation of Level III-A Pilot Water Systems in the Philippines. September, 1982. Prepared for the USAID Mission, Philippines, by Emmett F. Lowry. OTD #43.

58. WASH Field Report 58. Environmental Sanitation Master Plan for Training and Education in Tanzania. September, 1982. Prepared for the USAID Mission, Tanzania, by Robert Gearheart, John Briscoe and Eugenia Eng. OTD #75.

59. WASH Field Report 59. Implementacion al Proyecto. Santa Elena Meals for Millions Ecuador. November, 1982. Prepared by Victor E. Aguayo. OTD #102.

60. WASH Field Report 60. Second Training of Trainers Workshop for Technology Transfer in Water Supply and Sanitation. November, 1982. Prepared by Fred Rosensweig and James Carney. OTD #90.

61. WASH Field Report 61. In-Service Technical Training and Program Review of Peace Corps Volunteers in Rural Water Supply Systems in Morocco. November, 1982. Prepared by Keith Sherer. OTD #111.

62. WASH Field Report 62. Training of Trainers for SANRU-86 Health Project, Kinshasa, Zaire, July 13 - August 13, 1982. Prepared by Jocelyn Carlson. OTD #100.

63. WASH Field Report 63. A Workshop for the Design of Low Cost Water Systems in Ecuador. November, 1982. Prepared by Donald T. Lauria. OTD #105.

64. WASH Field Report 64. Coordination of WASH Information Activities and Exchange with International Information Centers, Trip Report #3, Asia. December, 1982. Prepared by James E. Beverly. OTD #32.

65. WASH Field Report 65. Feasibility of Rural Groundwater Development in Honduras. December, 1982. Prepared by William M. Turner. OTD #115.

66. WASH Field Report 66. Water and Waste Needs of Metropolitan Beirut and Surrounding Areas. December, 1982. Prepared by Robert H. Thomas, Robert J. Kachinsky and Max S. Clark, III. OTD #124.

67. WASH Field Report 67. Organization of a Colloquium on Rural Water Supply and Sanitation, Kasserine, Tunisia, November 23-26, 1982. Prepared by Fred Rosensweig and Raymond B. Isely. January, 1983. OTD #92.

68. WASH Field Report 68. A Workshop for the Provincial Waterworks Authority of Thailand: Team Building for Management, November 1-5, 1982. January, 1983. Prepared by Daniel B. Edwards. OTD #123.

69. WASH Field Report 69. Diagnosis and Recommendations for Rural Water and Sanitation Systems in Honduras. January, 1983. Prepared by Charles S. Pineo and Henry Van. OTD #101.

70. WASH Field Report 70. Training of Indian Health Service Engineers and Sanitarians as Trainers for the Peace Corps: Workshop Report and Trainer Guidelines. February, 1983. Prepared by Wilma Gormley. OTD #121.

71. WASH Field Report 71. Evaluation of Foster Parents Plan's Water Supply and Sanitation Projects in Yogyakarta, Indonesia. May, 1983. Prepared by Shirley Buzzard and Robert A. Gearheart. OTD #117.

72. WASH Field Report 72. Formulation of National Water Supply and Sanitation Strategies in the Central African Republic. Prepared by Rifat Barokas, Pierre R. Leger and Dennis B. Warner. April, 1983. OTD#106. (Also available in French)

73. WASH Field Report 73. Training in Spring Capping for Field Agents in Zaire. March, 1983. Prepared by David Goff. OTD #100.

74. WASH Field Report 74. Emergency Water Supply Assistance During Floods in Ecuador, December 1982 - January 1983. March, 1983. Prepared by Fred Reiff. OTD #42. (Draft)

75. WASH Field Report 75. Formulation of the CARE Multi-Year Plan for Water Supply and Sanitation in Cameroon. March, 1983. Prepared by John Tomaro and Elizabeth Heilman. OTD #118.

76. WASH Field Report 76. A Technical Managerial Review of AID Handpump Programs Including Those in Sri Lanka, the Philippines, the Dominican Republic and Honduras. March, 1983. Prepared by David Donaldson. OTD #113.

77. WASH Field Report 77. Seminar on Rural Water Supply and Sanitation for Private and Voluntary Agencies in Haiti. May, 1983. Prepared by David Yahalem. OTD #129.

78. WASH Field Report 78. Burundi Community Water Supply and Sanitation Project. March, 1983. Prepared by Felix Awantang. OTD #137.

79. WASH Field Report 79. Development of a Short-term Plan for Solid Waste Management in Greater Beirut. March, 1983. Prepared by Max S. Clark. OTD #134.

80. WASH Field Report 80. Comparative Costs of the AID Type Pump Fabricated in the Dominican Republic and the U.S. Manufactured Moyno-Pump. April, 1983. Prepared by Justin H. Whipple. OTD #130.

81. WASH Field Report 81. Diagnostico y Plan de Trabajo Para La Construccion de Pozos E Instalacion de Bombas Manuales Para Agua en Honduras. April, 1983. Prepared by Henry Van. OTD #85.

82. WASH Field Report 82. Evaluation of the Togo Rural Water Supply Project: Observations of a WASH Participant. May, 1983. Prepared by Raymond B. Isely. OTD #145.

83. WASH Field Report 83. Evaluation of CARE/Indonesia Water Supply Projects. May, 1983. Prepared by Robert A. Gearneart. OTD #136.

84. WASH Field Report 84. Evaluation of Health and Social Benefit of Springs Capped for Irrigation, Further Adapted for Domestic Use in Central Tunisia. May, 1983. Prepared by Raymond B. Isely. OTD #120.

85. WASH Field Report 85. Technical Assistance to Manufacturers of AID Handpumps and Roboscreens in Honduras: Phase I. May, 1983. Prepared by Ben E. James, Jr. OTD #29.

86. WASH Field Report 86. An Assessment of the Water and Sanitation Sector in the Peace Corps Program: Role of the Office of Program Development. May, 1983. Prepared by John R. Tomaro. OTD #109.

87. WASH Field Report 87. Testing Training Manuals for Rainwater Roof Catchment and Spring Capping Systems in Workshop for Togolese Development Agents. June, 1983. Prepared by Henry L. Jennings. OTD #116.

88. WASH Field Report 88. Preliminary Planning for Rural Water Supply Alternatives in Zaire. June, 1983. Prepared by David Goff. OTD #141.

89. WASH Field Report 89. Evaluation of the Feasibility of Manufacturing and Marketing the AID-Design Handpump and Roboscreen in Peru. June, 1983. Prepared by the WASH Project. OTD #114.

90. WASH Field Report 90. The Minyambou Community Development Water Project and Water Supply in Irian Jaya. June, 1983. Prepared by Scott Faiia. OTD #133.

91. WASH Field Report 91. A Workshop on Sanitation in Bakel, Senegal, April 20 - May 4, 1983 and an Assessment of Environmental Health Conditions. June, 1983. Prepared by Fred Rosensweig and Thomas Talbot. OTD #147.

92. WASH Field Report 92. Public Health Education for Low-Cost Sanitation in Tanzania. June, 1983. Prepared by John W. Hatch. OTD #142.

93. WASH Field Report 93. Latrine Construction Workshops, Las Matas de Forfan, Dominican Republic, April 4-15, 1983, April 25 - May 6, 1983. June, 1983. Prepared by Winanne Kreger and Henry Van. OTD #143.

94. WASH Field Report 94. A Workshop for the National Water Supply and Drainage Board of Sri Lanka, June 6-10, 1983. August, 1983. Prepared by Daniel B. Edwards. OTD #138.

95. WASH Field Report 95. Sanitation Feasibility for Kanye Village, Bostwana. July, 1983. Prepared by Joseph Gadek and Hildegard M. Vanlankveld. OTD #95.

96. WASH Field Report 96. Water Supply Program of Foster Parents Plan in Haiti. July, 1983. Prepared by Donald T. Lauria. OTD #140.

97. WASH Field Report 97. A Seminar on Water Supply and Sanitation Strategies in the Central African Republic. July, 1983. Prepared by Thomas C. Leonhardt. OTD #106. (Also available in French).

98. WASH Field Report 98. Status of AID Type Handpumps in the Dominican Republic. July, 1983. Prepared by Fernando Pareja-Gil and Henry Van. OTD #143.

99. WASH Field Report 99. Training in Health Education and Sanitation Promotion for Rural Water Projects in Malawi. August, 1983. Prepared by Louise McCoy. OTD #144.

100. WASH Field Report 100. USAID Handpump Program in Tunisia. September, 1983. Prepared by Phillip W. Potts. OTD #63. (Also available in French).

101. WASH Field Report 101. Technical Assistance for Handpump Component of the Health Sector Loan II Project in the Dominican Republic. August 1983. Prepared by Paul F. Howard and Robert Knight. OTD #48.

102. WASH Field Report 102. Endurance Tests of Robovalves. September, 1983. Prepared by Yaron M. Sternberg and Robert Knight. OTD #71.

103. WASH Field Report 103. Evaluation of Locally Available Handpumps in Honduras. October, 1983. Prepared by Terrence L. Moy. OTD #85.

104. WASH Field Report 104. Assessment of the Environmental Sanitation Construction Component: Integrated Health and System Project in Guatemala. November 1983. Prepared by Henry Van. OTD #150.

105. WASH Field Report 105. Malawi Self-Help Rural Water Supply Program: A Mid-Term Evaluation of the USAID Financed Project. November 1983. Prepared by Dennis Warner, Raymond Isely and John Briscoe. OTD #149.

106. WASH Field Report 106. Evaluation of the CARE Water Supply Program in Kenya. February 1984. By David Donaldson. OTD #157.

107. WASH Field Report 107. Evaluation of the Technical and Community Participation Approach of CARE-Assisted Rural Water Supply Project in Indonesia. February 1984. By Robert A. Gearheart and Subiarto Martono. OTD #155.

108. WASH Field Report 108. Strengthening the Management of the Public Health Inspectorate of Swaziland. December 1983. By Harry Phillips and Eva Salber. OTD #131.

109. WASH Field Report 109. An Assessment of the Office of Nationale de l'Assainissement (ONAS) Thirty Cities and Greater Tunis Complimentary Project. February 1984. By John B. Tomaro, John H. Topik, and Thomas M. Zalla. OTD #158.

110. WASH Field Report 110. A Workshop on Handpump Installation and Maintenance in Riobamba, Ecuador, October 17-27, 1983. January 1984. By Andrea Jones and Alan Paskevitch. OTD 82.

111. WASH Field Report 111. Health Information System Development in the Dominican Republic. January 1984. By Kenneth R. McLeroy and Michael C. Connelly. OTD #99 & #103.

112. WASH Field Report 112. The Effect of Drought Conditions upon Village Water Supply and Public Health in Mauritania. January 1984. By Ralph E. Preble. OTD #172.

113. WASH Field Report 113. Evaluation of the Third Housing Guaranty Project in the Ivory Coast. February 1984. By Joseph Haratani and Harvel Sebastian. OTD #164.

114. WASH Field Report 114. Latrine Construction Workshop, Gerihun, Sierra Leone, 28 November-9 December 1983. January 1984. By Vernon Razak and Max Kroschel. OTD #166.

115. WASH Field Report 115. Training in Rainwater Catchment for SANRU-86 Village Health Workers and Peace Corps Volunteers. March 1984. By

116. WASH Field Report 116. Evaluation of Well Drilling Equipment for Bolivia Rural Water Supply and Sanitation Program. March 1984. By William Turner. OTD #173.

117. WASH Field Report 117. Training in Water and Wastewater Institutional Programs: Long-Term, Short-Term and Study Tours. March 1984. By Wilma Gormley, Donna Anthony and Daniel Edwards. OTD #160.

118. WASH Field Report 118. Training in Water and Wastewater Operations and Maintenance: Sources of Training Materials. March 1984. By Wilma Gormley, Donna Anthony and Daniel Edwards. OTD #160.

119. WASH Field Report 119. Review of Institutions in the Water and Sanitation Sector in the Near East. 1984. By David Laredo and James A. McCaffery. OTD #159.

120. WASH Field Report 120. Swaziland Rural Waterborne Disease Control Project: A Mid-Term Evaluation. March 1984. By Jacques Faigenblum, Dennis Long and DeWolfe Miller. OTD #168.

121. WASH Field Report 121. A Study of the Community Promotion Component of the Rural Sanitation Project in Bolivia. March 1984. By Josepn Haratani. OTD #173.

122. WASH Field Report 122. Training of Trainers Workshop for Handpump Installation and Maintenance in Sri Lanka, February 12-26, 1984. April 1984. Wilma Gormley and Alan Pashkevich. OTD #138.

COMPUTERIZED DATA

The following is a list of commercial databases that deal primarily with water on both domestic and international levels. These databases can be accessed through CDIE/DI. When requesting a literature search, DI recommends that the request be as specific as possible (all of the below databases have a minimum of 25,000 entries for 'water'.)

AQUACULTURE:

This database provides access to information on the growing of marine, brackish, and freshwater organisms. Subject coverage includes disease, economics, engineering, food and nutrition, growth requirements, and legal aspects of water organisms.

AQUALINE:

Aqualine provides access to information on every aspect of water, waste water, and the aquatic environment. Coverage includes water resources development and management, drinking water quality, water treatment, sewage systems, sludge disposal, groundwater pollution, river management, tidal waters, quality monitoring, and environmental protection.

AQUATIC SCIENCES ABSTRACTS:

This is a comprehensive database on life sciences of the seas and inland waters as well as related legal, political, and social topics. It includes information on oceanography, fisheries, aquatic biology, and water pollution.

COMPENDEX:

The Compendex database provides abstracted information on engineering and technological literature. There are more than 107,000 citations in this database for 'water'.

FLUIDEX:

This database provides indexing and abstracting of every abstract of fluid engineering, including theoretical research and the latest technologies and applications. Subject coverage includes aerodynamics, wind energy, coastal and inland fluid engineering works, offshore technology, multi-phase flow, mixing/separation, flow measurement and instrumentation, fluid power, pumps and pump technology, etc.

WATER RESOURCES ABSTRACTS:

This file covers a wide range of water resource topics including water resource economics, ground and surface water hydrology, metropolitan water resources planning and management, and water planning, water cycle, and water quality.

WATERNET:

Emphasis is on technical reports and studies from water utilities, regulatory agencies, and research groups in the U.S., Canada, Latin America, Mexico, Europe and Asia.