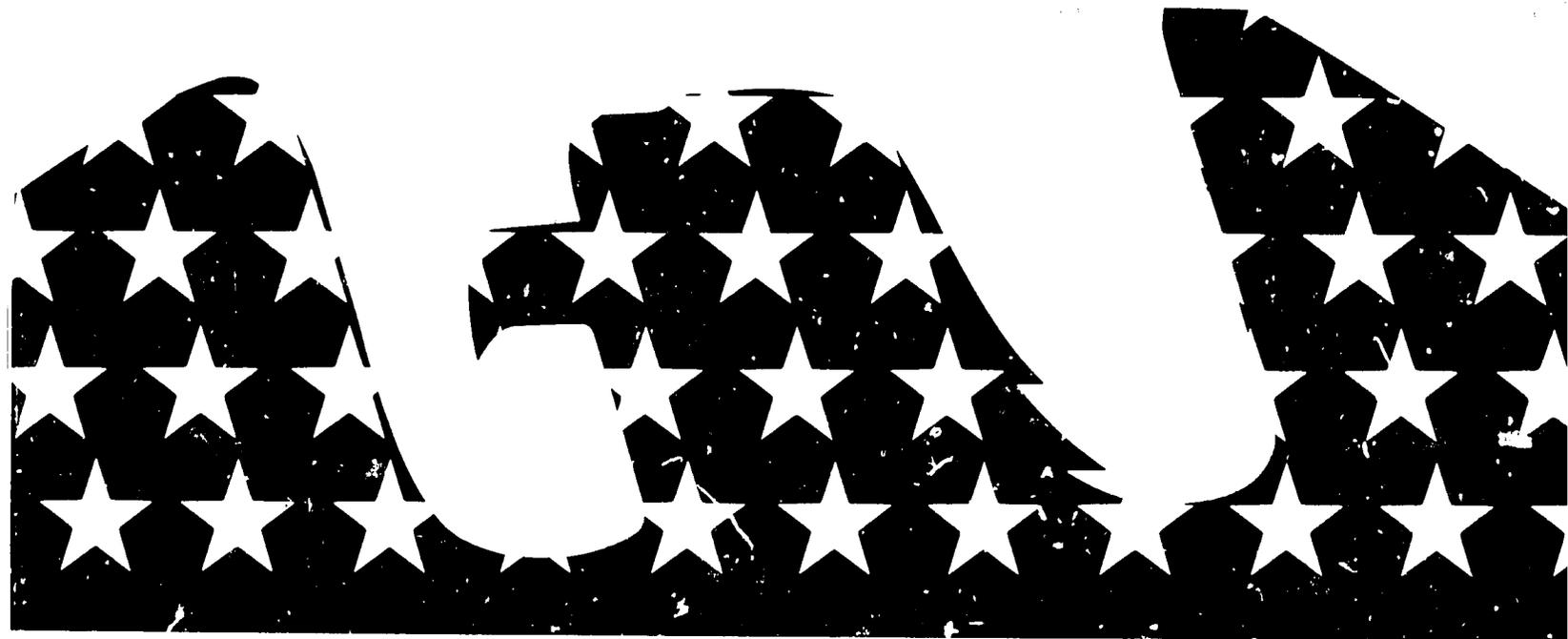


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A.I.D. Policy Paper

DOMESTIC WATER AND SANITATION



U.S. Agency for International Development
Washington, D.C. 20523

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**Bureau for Program and Policy Coordination
U.S. Agency for International Development
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Water Supply and Sanitation Policy Paper

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Summary

The combination of unsafe drinking water and inadequate sanitation facilities constitutes one of the major causes of death and disability among the poor in developing countries. Safe, convenient water supply and adequate sanitation is a fundamental component of broad-based economic growth strategies. Lowering mortality and morbidity from water and sanitation-related diseases is a goal in itself; it can also lead to increased productivity and decreased absenteeism among members of the labor force and can reduce the time and energy burden on the household, leading to more time for crop cultivation, child care, and income-generating activities, as well as more regular school attendance.

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 is not readily available and where inadequate domestic water and sanitation creates significant health problems, A.I.D. will consider funding projects for improvements in water and sanitation. The following criteria will guide A.I.D.'s investment in the area:

1. Evidence of need and effective demand: *The need for improved water and sanitation is clearly 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 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.*

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. Development Assistance funding for these programs is available from Section 104, the Health and Population Account and when part of rural development activities, from Section 103, the Agriculture, Rural Development and Nutrition Account; in addition, Economic Support Funds and the Housing Guarantee Program can support domestic water and sanitation projects, principally in urban areas.

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.

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.

Among the factors that will guide the design of A.I.D.-supported domestic water and sanitation 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 to 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 and 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 project;
- sustained educational efforts to instruct users in proper water use and hygiene;
- a demonstrated means of financing and ensuring 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 the maintenance, operation and repair of water supply and sanitation systems;
- technical assistance or training, as required, to improve the administration of water supply and sanitation systems.

In addition, A.I.D. encourages attention to other factors which may have implications for domestic 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.

I. Introduction

This paper is the first of a series designed to give more explicit guidance on major health issues, and draws on A.I.D.'s experience with domestic water and sanitation programs.¹ The paper provides suggested guidelines on how and under what conditions scarce U.S. development funds may be used cost effectively to improve health conditions through selective investments in domestic water supply and sanitation programs.

Improvements in water supply and sanitation have important ramifications in areas other than health, including education, employment, nutrition, agriculture, industry, housing, and the environment. This paper, however, concentrates primarily on the health rationale for investments in domestic water supply and sanitation, and brings together A.I.D.'s practical experience, that of other international donors, and the findings of numerous research studies.

¹ U.S. Agency for International Development, "Community Water Supply in Developing Countries, Lessons from Experience" (Draft), 1982.

This paper is concerned with both water supply for "domestic use"² and sanitation in developing countries. The discussion of sanitation deals principally with the disposal of human excreta, domestic waste water, and other household waste materials. This paper addresses water supply and sanitation policy issues pertinent to urban and periurban populations as well as to rural communities.³ This paper does not address issues arising from large-scale irrigation projects or from the use of water for primarily agricultural purposes. Nor does it deal with recent conservation or watershed management efforts which A.I.D. also finances.

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.

² As used here, this term encompasses water used for drinking; for hygiene (handwashing, bathing, cleaning the home, washing kitchenware and eating utensils, food preparation, and frequently for washing clothes as well); for watering poultry and livestock, in small numbers, near the dwelling; and, in minor amounts, for irrigation in small household gardens.

³ U.S. development assistance has long supported some rural and village water supply programs. In recent years, through the Housing Guaranty Program, through urban development projects, and through Economic Support Fund programs, A.I.D. has given increased attention to water and sanitation programs that serve the poor in rapidly growing urban centers of the developing world as well. (See Table I for trends in A.I.D. funding of water and sanitation programs.) The project criteria developed in this paper are intended as guidance for ESF and HG programs as well as for DA projects.

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.

ii. Rationale for A.I.D. Support of Water and Sanitation Programs

An important goal of U.S. development assistance—indeed, perhaps the most important goal—is to help developing countries bring about the conditions under which their citizens can look forward to full lives, sharing in the benefits of a sturdy and growing economy. As President Reagan noted recently, "In its ultimate form, development is human fulfillment—an ability of all men and women to realize freely their full potential." The challenge for development assistance agencies and LDC governments alike is to identify the most critical obstacles to guaranteeing individual freedom and initiative, and to design and implement programs that overcome these obstacles with as few negative side effects for the individuals and communities involved as possible.

Very clearly, in countries where a life of chronic, energy-sapping illness and death at an early age is likely for most people, learning potential and the options for exercising individual initiative are extremely circumscribed. A.I.D.'s health policy paper, approved in 1980, highlighted the problems which continued poor health in LDCs poses for the achievement of important personal and national aspirations. This paper investigates and provides guidance on one of the most important vehicles for improving health and living conditions in LDCs: safe water and adequate sanitation.

The combination of unsafe drinking water and inadequate sanitation facilities constitutes one of the major causes of death and disability among the poor in developing countries. The World Health Organization estimates that more than 25,000 people (most of them children) die each day from water and hygiene-related diseases.⁴ Less than one-half of the people in developing countries have reasonable access to reliable sources of safe drinking water and a satisfactory means of excreta disposal. Most of those who lack reasonable access to these sources live in rural areas.

⁴ WHO Rapid Assessment Report, 1980 (United Nations, Report of the Secretary General, International Drinking Water Supply and Sanitation Decade: Present Situation and Prospects, No. A/3567, July, 1980).

A.I.D.'s efforts to increase access⁵ to safe water supply, adequate waste disposal and sanitation in developing countries reflect U.S. interest in furthering economic growth by helping countries meet the basic needs of their populations.

Safe,⁶ convenient water supply and adequate sanitation is a fundamental component of a broad based economic growth strategy.⁷ Waterborne and sanitation-related diseases, particularly diarrheal disease and parasitic infections, are principal causes of morbidity and mortality among infants and young children in Less Developed Countries (LDCs). Lowering mortality and morbidity from water and sanitation-related diseases is, of course, a goal in itself. It can also lead to increased productivity and decreased absenteeism among members of the labor force, and is therefore an important factor in promoting economic growth.⁸

To satisfy basic needs, water must be not only safe, but also available in quantities sufficient for personal hygiene and a healthful environment.⁹ Sufficient safe water is particularly necessary for the control of certain diarrheal diseases and skin and eye infections. Trachoma, for example—the leading cause of preventable blindness in the developing world—is in large measure a result of

⁵ According to World Health Organization (WHO) definitions, "reasonable access" in urban areas denotes a public fountain or tap not more than 200 meters from a house; in rural areas "reasonable access" implies that members of a household do not have to spend a "disproportionate part of the day" obtaining water for the family ("World Health Statistical Report," World Health Organization, Vol. 29, No. 10, 1976). Access is a somewhat subjective term, varying according to the perceptions of a given society and topography (e.g., reasonable access may be defined in relation to available alternative water sources only, or the energy and time required to haul water over a distance considered close when the terrain is flat).

⁶ In this context, "safe" is a term of art, often used interchangeably with "potable," "clean," etc. to mean water of sufficient quality that it can be used, untreated, without major risk of contracting serious disease. "Safe" does not imply quantifiable standard, see pp. 8-9.

⁷ "Foreign Assistance Act of 1961, Amended." U.S. Agency for International Development, "Basic Human Needs Discussion Paper," 1977.

⁸ Evidence of the indirect links between improved water supply and overall economic growth is found in Saunders, Robert J. and Jeremy J. Warford, *Village Water Supply*, Baltimore: Johns Hopkins University Press (for the World Bank), 1976; Feacham, Richard et. al., *Water, Health, and Development*, 1978; White, Gilbert F., et. al., *Drawers of Water*, University of Chicago Press, 1972; and Feacham, Richard, et. al. (eds.), *Water, Wastes and Health in Hot Climates*, Chichester: John Willen & Sons, 1977.

⁹ It is generally agreed that 20-40 liters per capita per day is the minimum required to assure adequate supplies for consumption, sanitation, and hygiene.

poor hygiene, as is epidemic typhus, spread by human body lice.¹⁰

There has been considerable debate over the trade-off between water quantity and quality in improving health conditions. The issue appears to turn on the prevalence and mode of transmission of diarrheal and other diseases. Where these are almost entirely water-borne, or water-based, improving water quality is likely to be the most effective way to reduce disease incidence. Where diarrheal diseases are primarily "water-washed", as opposed to "water-borne", priority should be given to promoting the availability and use of water in greater quantity, and to improved domestic hygiene.¹¹

Improved access to convenient, reliable sources of safe water also has an impact on health through reducing the time and energy burden on the household. This benefit is of particular significance to women and children, who bear the principal responsibility for seeking, drawing, and carrying water in the developing world. These responsibilities are particularly burdensome for pregnant and lactating women, who are already somewhat more vulnerable to disease and poor health.

Time saved as a result of more convenient sources of water has been used in subsistence agriculture, in child care, in leisure, and in income-generating activities—all of which can contribute both to improved health and to increased income.¹² Numerous studies have documented the importance which beneficiaries

of water projects attach to these improvements in living conditions.¹³

Indirect benefits of improved domestic water supply and sanitation may be even more important than the direct benefits listed above. For instance, some have suggested that the rate at which girls drop out of school is directly linked to the burden of domestic responsibilities they bear¹⁴; carrying water competes directly with school attendance since it can take anywhere from one-half hour daily in urban areas to 4-6 hours in difficult terrain, during dry seasons, or when numerous trips and substantial waiting time are required. Getting girls into school and making sure they stay in school is important not only for them but also for their families. There is mounting evidence that mother's education is directly related to family size (educated mothers have fewer children) and to child health: mortality among children whose mothers completed more than three years of primary school tends to be significantly lower than for children born to women with less schooling, *regardless of income*.¹⁵

III. Current Situation in Developing Countries and the Role of International Donors

In recent years there has been relatively little improvement in the proportion of people in LDCs who have access to adequate supplies of safe water and basic sanitation, in large part because continued rapid population growth has outpaced the expansion of basic health-related services. Even a vigorous and well coordinated effort by LDCs and developed countries is unlikely to result in safe water and adequate sanitation for all the world's population by 1990, the goal of the International Drinking Water Supply and Sanitation Decade. The UN estimates that the cost of achieving universal access to adequate

¹⁰ Feacham, 1977 and 1978, *op. cit.*

¹¹ Feacham, et. al., 1978, *op. cit.*, p. 217. Thus both water quantity and water quality are important to health, and should be addressed in project design. The minimal quantity needed to promote health is at least 20-40 liters per capita per day. Additional quantities are desirable; however, as quantity exceeds about 100 liters per capita per day marginal health benefits decline. The most important quality parameter is microbiological purity. This is best assured by selection of nonpolluted, protected sources, and, if necessary water treatment (purification). Given the scarcity of resources in most developing countries, investments in additional improvements in quality and quantity should be weighed against providing these minimal services to a larger population.

¹² For an excellent discussion of some of the difficulties involved in quantifying the health and economic benefits of improvements in water supply and sanitation, see White, Gilbert F., et. al., 1972, *op. cit.*

¹³ Time saved in rural Thai villages where water was provided in or near the home made possible economically productive activities—such as crafts and small vegetable gardens. Villagers cited increased craft activities and more gardening and farming as the most beneficial consequences of the piped water systems. (Dworkin, D. and B.L.K. Pillsbury, "The Potable Water Project in Rural Thailand," A.I.D. Project Evaluation Report No. 3, Washington, D.C. 1980.) Findings such as these have been cited in numerous recent studies. See, for instance, White, et. al., 1972, *op. cit.*

¹⁴ Russel, Annemarie, "Report on the Situation of Women in the Target Village of the UNICEF Domestic Water Supply Project in Bahr El Ghazal Province, Sudan," Khartoum: UNICEF, 1979.

¹⁵ Cochran, Susan, *The Effects of Education on Health*, Washington, D.C. IBRD Working Paper 405, 1980.

water and sanitation will be \$300 billion over the decade. This estimate probably falls short of actual requirements, because the total cost of providing water to all rural areas, where the bulk of LDC populations live, is very high. But the estimated \$300 billion far exceeds the resources that are likely to be available over the decade for drinking water and sanitation programs.

A. The U.S. Commitment to Supporting Water and Sanitation Programs in Developing Countries

The United States has voiced strong support for water supply and sanitation programs in developing countries in numerous international fora in recent years. The U.S. has supported resolutions endorsing the provision of safe water supplies and hygienic means of waste disposal at the U.N. Conference on Human Settlements (Habitat) in 1976; at the U.N. Water Conference in 1977, which proposed that the U.N. establish the 1981-1990 International Drinking Water and Sanitation Decade; at the International Conference on Primary Health Care (Alma Ata) in 1978; at the U.N. World Health Assembly; and, most recently, at the convocation of the U.N. General Assembly inaugurating the International Drinking Water and Sanitation Decade.

B. A.I.D. and Other International Donors

A.I.D. is one of the leading international donors providing financial support and technical assistance for water supply and sanitation programs in developing countries. (See Table I). Compared with the aggregate contribution of other donors, however, the level of A.I.D. financing for such activities is small. The World Bank (including IDA), by far the largest donor in developing countries, lent nearly \$900 million for water supply and sanitation programs in 1979, primarily in urban areas. UNICEF devotes one-quarter of its budget (\$53 million in 1979) to water supply and sanitation activities. Other bilateral, multilateral, and private voluntary donors in this area include the Inter-American Development Bank, UNDP (\$698 million in 1979), the Asian Development Bank, the various Arab development banks, and the bilateral agencies of the OECD countries. While there is an impressive number of organizations involved in development assistance in this sector, it should be noted that at least 75 percent of the roughly \$10 billion expended annually on improving domestic water supply and sanitation, comes from the LDCs (both governments and consumers) themselves.

TABLE I
AID FUNDING, WATER SUPPLY AND SANITATION (1978-82)
(\$000)

	FY 1978		FY 1979		FY 1980		FY 1981		FY 1982*	
	DA ¹	ESF ²	DA	ESF	DA	ESF	DA	ESF	DA	ESF
Asia	3,684		3,500		16,104		9,400		3,033	
LAC	330		8,425		18,961		220		150	
NE	3,844	166,500	8,469	192,100	2,190	139,500	5,000	237,900	1,450	163,000
Africa	6,557		3,060		8,330		11,980		7,597	
S&T/H	545		66		2,652		2,650		2,450	
HG	45,000		55,000		70,500		42,000		46,000	
TOTALS, DA/ESF	59,960	166,500	78,529	192,100	118,737	139,500	71,250	237,900	60,680	163,000
Annual Totals	226,460		270,620		258,237		309,150		217,180	

¹ Development Assistance Funds.

² Economic Support Funds.

* 82 = Estimated

C. A.I.D.'s Role in Water Supply and Sanitation in Developing Countries

Many of the water supply and sanitation programs supported by major donors other than

A.I.D. have traditionally been urban-oriented and have generally employed relatively sophisticated levels of technology. However, the majority of LDC populations lives in rural areas and in villages and market towns, and it is in these

areas that access to safe water and sanitation is most limited.¹⁶ Another residential grouping that has largely been bypassed by traditional water and sanitation systems is the recent immigrants living in the slums, squatter settlements and fringe areas of burgeoning LDC cities. Their poverty, their illegal or squatter status, and their lack of familiarity with urban life all tend to deny them the basic services more likely to be available to other urban residents. The neediest groups in developing countries include not only rural households but also those in cities and, in particular, in high density urban slums, and it is A.I.D.'s policy to assist in providing water supply and sanitation to both.

The cost-effectiveness of alternative technologies in various settings therefore becomes of paramount concern in A.I.D.'s investment decisions. For instance, providing domestic water and sanitation to people who live in extremely isolated regions or in widely dispersed households is likely to be more costly on a per capita basis than providing the same technology and services to settlements that are somewhat more densely populated and more readily accessible. But less costly technology and related design factors can narrow considerably if not close this gap. In certain regions the minimum community size for provision of improved water supply and sanitation at a reasonable cost will be 2,000-10,000, whereas in others, as a result of less costly technologies and other factors, it may be as low as 500.¹⁷ Providing improved sanitation in rural areas does not necessarily involve a large capital investment in construction; sanitation in urban areas, on the other hand, tends to be more costly on a per capita basis, because relatively sophisticated technology is frequently required.¹⁸

In the selection of technologies for water supply and sanitation programs, planners should also pay attention to "software" components. These might include training, technical assistance, the development of host country institutions, hygiene education, the promotion of community participation, the support of complementary

¹⁶ It may be extremely costly to provide these services for the poorest, most widely dispersed groups (who are least able to pay for them), but A.I.D. is committed to the search for low-cost technologies that lower the cost of serving the poorest populations in LDCs (see pp. 21-24 below).

¹⁷ Saunders and Warford, *op. cit.* Total cost depends on the quality and quantity of the water available, the type of "hardware" selected, the related training, administrative, and other costs, and much more.

¹⁸ "Water Supply and Waste Disposal," Poverty and Basic Needs Series, The World Bank, Washington, D. C., 1980.

nutrition and health activities, and the development of national and regional water and sanitation policies and plans. A.I.D. does not and should not support water supply and sanitation programs where these essential software elements have not been adequately considered in the design of the project.

In general, A.I.D.'s increasingly scarce and limited levels of funding in many countries are not likely to be sufficient to support the capital investment costs of major urban water supply and sanitation programs.¹⁹ The Agency will finance "software" components of programs in urban and urban fringe areas. This policy is based on several considerations, not the least of which is expense. More substantial resources for major capital investments in water supply and sanitation tend to be available from other donors and lending institutions such as the World Bank; these funds are less often available for the technical assistance elements of such projects. Furthermore, in line with growing U.S. concern for assuring the long-term viability of LDC institutions, A.I.D. is placing strong and increasing emphasis on the "software" and technical assistance components mentioned above.

D. The Linkages Between Domestic Water Supply, Sanitation, and Health

What priority should water supply and sanitation programs have in A.I.D.'s overall health objectives? There is a strong temptation to compare health improvements that result from water and sanitation programs with those from other health activities, especially interventions such as immunizations or oral rehydration that appear to achieve comparable health objectives at lower per capita cost.

Although improvements in water supply and sanitation are generally linked to improvements in life expectancy and decreases in mortality and morbidity,²⁰ water and sanitation programs tend to be relatively costly per capita compared with other health interventions.²¹ While per capita costs of establishing and operating water and

¹⁹ Housing Guaranty and Economic Support Fund Programs which operate primarily in urban areas are exceptions.

²⁰ Barnum, Howard, *et. al.*, *A Resource Allocation Model for Child Survival*, Cambridge, Ma: Oelgeschläger, Gunn & Hain, 1980. According to this analysis of health improvements in five barrios in Colombia, at least 25% of the drop in mortality was directly attributed to improved water and sanitation programs.

²¹ See, for instance, Grosse, Robert N., "Interrelation Between Health and Population: Observations Derived from Field Experience," *Social Science and Medicine*, Vol. 14C, No. 2, pp. 99-120, 1980.

sanitation systems are important considerations, and in many cases will be the most important factor determining investment strategies in health, other factors should also be considered. For instance, water and sanitation systems, depending on the type of system, water source, storage and treatment (if any), may not require heavy involvement of highly skilled manpower. In settings where the absence of such skilled personnel is a major constraint, water and sanitation projects can be competitive alternatives to other health programs designed to combat diarrheal and other water-related diseases.²²

In addition, in any assessment of water and sanitation benefits, effects other than health must be taken into account.²³ Thus while an analysis of the relative cost-effectiveness of water programs in improving health might discourage investments in domestic water supply and sanitation programs in favor of simpler or "more direct" health interventions (immunizations, etc.), a cost-benefit analysis (of *all* benefits, not only health) might argue strongly in favor of investments in water projects.

The Agency's past experience has resulted in a fairly thorough appreciation of what is needed to keep water supply and sanitation systems functioning in the developing countries in which A.I.D. typically works. Unfortunately, there is much less certainty about the precise characteristics of water and sanitation systems that have the greatest impact on improving health. Will more convenient, reliable, and safe water supplies necessarily improve health in all communities, or must an area have achieved a certain level of socioeconomic development (whether measured in terms of educational level, level of agricultural or industrial production, or family

income) before health improvements result?²⁴ What types of health improvements can be expected in given settings and what is the best means of bringing about the behavioral changes necessary to translate improved water and sanitation into improved health?

While A.I.D. continues to support economic and social research on these important questions, it has developed some general guidelines, listed below, for its support of improved domestic water supply and sanitation programs. More 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 costs²⁵; 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.

²² Barnum, *op. cit.* p. 4.

²³ See, for instance, the studies cited in footnote 11. See also Hollister, Arthur C., Jr., et. al., "Influence of Water Availability on Shigella Prevalence in Children of Farm Labor Families," *American Journal of Public Health*, 45 (3):354-362, 1955; Moore Helen, et. al., "Diarrheal Disease Studies in Costa Rica. IV. The Influence of Sanitation Upon the Prevalence of Intestinal Infection and Diarrheal Disease." *American Journal of Epidemiology*, 82 (2): 162-184, 1965; Schliessman, D. J., et. al., "Relation of Environmental Factors to the Occurrence of Enteric Diseases in Areas of Eastern Kentucky," *Public Health Monograph No. 54* (Issued concurrently in *Public Health Reports*, 73 (11).), Washington, 1958.

Section 611(b) of the Foreign Assistance Act requires "...a computation of benefits and costs made insofar as practical in accordance with the procedures set forth in the Principles and Standards for Planning Water and Related Land Resources, dated October 25, 1973, with respect to such computations."

²⁴ Shuval, Hillel, et. al., "The Effect of Water Supply and Sanitation Investments on Health Status: A Threshold-Saturation Theory," in press, 1981.

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.

There are numerous complementary programs, in the areas of education, nutrition, primary health care, housing, irrigation, cottage industries, and rural development with which domestic water supply and sanitation programs can be combined to improve the impact of the program; such integrated approaches should be adopted wherever technically and financially feasible. For instance, where improved water supply and sanitation systems have been introduced in a community to improve health conditions, especially among young children, high priority should be given to constructing latrines and providing adequate water supplies in the local schools, and to including hygiene in the curriculum. In some settings, the school environments are so unhealthy that parents are reluctant to allow their children to attend. Furthermore, having appropriate sanitation facilities in the schools is a powerful way of reinforcing the hygiene lessons being taught in the classroom. Where provision of more convenient water in greater quantity is designed to lessen diarrheal disease, simultaneous introduction of oral rehydration (teaching women to mix solutions hygienically) can enhance the health impact of the new water supply, thus further diminishing mortality.

Among the benefits generally thought to flow from investments in water are: (1) improved health, (2) more cash income, (3) increased food production or diversification of crops, (4) more employment, and (5) more leisure.²⁶ The extent to which any one of these benefits is realized or sustained varies considerably from setting to setting.²⁷ In subsequent sections of this paper, the factors that tend to lead to sustained health improvements and ancillary benefits are discussed in greater detail. Except in unusual circumstances, A.I.D. programs will be expected to adhere to the guidance contained below.

IV. Guidance for the Development of the Drinking Water and Sanitation Programs in Developing Countries: Major Issues

The issues in water supply and sanitation programs in developing countries can be divided into three categories: technical issues; social and cultural issues; and issues concerning the implementation and administration of programs.

²⁶ Carruthers, I.D., "Impact and Economics of Community Water Supply: A Study of Rural Water Investments in Kenya" (Kent, England: Agrarian Development Studies Report No. 6), 1973, p. 30.

²⁷ Warner, Dennis, "Social and Economic Preconditions for Water and Sanitation Programs," Washington, D.C.: U.S.A.I.D., 1981.

A. Technical Issues

1. Convenience, Reliability, Quantity, and Quality

These four characteristics are key to the success of water supply programs; the first two apply to sanitation programs as well. Safe water supplies and sanitary means of excreta disposal must be both convenient (as perceived by the consumer) and reliable (in good working order throughout the year). Water should be available in at least some minimum quantity, which will vary among regions and even within countries, but should fall within the range of 20-40 liters per capita per day for the domestic uses defined above if health improvements are to be sustained.²⁸ This range may be too high for certain arid zones, where limited availability of water may dictate more modest objectives.

The importance of water quality must be weighed not only against the diseases prevalent in the region but also against other factors such as cost, quantity, and reliability (e.g., the ability of a system to operate continuously, during reasonable periods every day, throughout the year).²⁹

Water quantity: Domestic water should be available in adequate quantity to satisfy minimal requirements for drinking, cooking, and food preparation as the highest priority. Ten liters per capita per day is the minimum estimated for these requirements. Second in priority is sufficient water for bathing, personal hygiene, and washing utensils, for which 10-15 liters per capita per day is the minimum. Third, if feasible, domestic water should be available for washing clothes, and for watering small garden plots and/or small numbers of livestock or poultry.³⁰

Water quality: Water treatment should be introduced where needed to improve water quality, especially for drinking, cooking, and food

²⁸ White et. al., *op. cit.* (See also page 18).

²⁹ The WHO's International Drinking Water Standards, are currently being reformulated. See also: Chamberlain, Charles E., et. al., *Wholesome and Palatable Drinking Water: A Background Paper on Water Quality Aspects of Water Supply*, Washington, D.C., 1979; Wolman, Abel, et. al., "A Panel Report to U.S. Agency for International Development on Sanitary Services During 1980-1983," Washington, D.C.: U.S.A.I.D., 1979.

This issue was thoroughly reviewed by A.I.D. during 1979 by an external panel of experts. Guidelines on water quality are based on the findings in their report, which is available from A.I.D.'s Office of Health. (Chamberlin, et. al., *op. cit.*)

³⁰ Donaldson, David, "Sanitation and Health: An Overview," in *The Impact of Interventions in Water Supply and Sanitation in Developing Countries*, U.S.A.I.D., April 1981.

preparation. Water treatment to improve the quality of water for bathing, personal hygiene, clothes washing, or garden plots should only be introduced where treatment does not prejudice the reliability of the water supply and where water quality can be improved at a reasonable cost. Simple household treatment may be sufficient to assure adequate quality for domestic use. Education (particularly for mothers and school-age children) can help ensure maintenance of the water's quality during its storage and transportation from point of collection to point of use (see pp. 11-13 below).

Where these minimum standards of quantity and quality cannot be assured, investments in water supply are not likely to achieve completely their desired health impact.

2. Site Selection and Source Development

In selecting the site and the appropriate method of developing and providing the water for domestic uses, attention should be given to potential future demands on the system, which should be designed with a view of possible future expansion if population growth or other conditions require it. These considerations lead to several guidelines:

— **Water and sanitation surveys** should be conducted to aid project designers and the community in selecting the most appropriate water sources among available alternatives and to identify feasible, efficient and appropriate methods of waste disposal.

— **Social and cultural factors** should be taken into account in site selection and source development (e.g., location of communal washing areas; identification of cultural norms pertaining to the tasks of fetching water, cleaning, etc.; and consideration of water laws and current patterns of ownership, allocation and access to water). Where feasible the beneficiaries themselves should be actively consulted and involved in the development of the project activity.

— In most cases, *groundwater should be the first possible source of water considered*, since it is often the least costly and most reliable source that is relatively free of bacteria and does not normally require treatment. However, where surface water can be easily treated, and where sufficient quantities are available year round, surface water may be the least-costly and most reliable source for systems that require large quantities of water. Gravity-fed systems that require no pumping are less costly and less susceptible to mechanical failure than alternative methods.

— When surface water is used, its variable quality requires monitoring throughout the year. It should be treated when necessary to meet minimum standards of safety for purposes of drinking, cooking, and food preparation.

3. Selection of a Suitable Technology

Experience in many developing countries has shown that the selection and adaptation of technologies suitable to the local setting is crucial in finding a balance among desirable characteristics of water and sanitation systems: convenience, reliability, costs and, in water systems, quantity and quality. There is some evidence that utilizing LDC private sector enterprise for the manufacture and installation of water and sanitation systems is not only cost-effective, but also stimulates the private sector and promotes employment.

There are now a large number of alternatives to Western style water and sanitation systems, including pit latrines and water-sealed latrines (pour-flush commodes).³¹ Selection of a suitable technology should take into consideration local preferences as well as social and cultural factors, the repair and maintenance support systems, availability of labor and management, appropriate institutional structures, the level of investment and recurrent cost implied, and the willingness and ability of beneficiaries to cover the expected costs. Although the selection process is not an easy one, the factors discussed in this section should serve as a guide.

The local manufacture of parts and equipment can significantly ease the operation and repair of the system, and often with substantial cost savings. A simple well screen that would cost \$10-30 per foot to manufacture in the United States may cost only \$2-3 per foot in many developing countries, because of lower production costs. A hand

³¹ In many arid regions, traditional societies developed water supply and excreta disposal systems which were designed to fit within the constraints imposed by the environment. For example, in the Near East, huge cisterns were built to store rain water for the dry season. Dry toilets built within the homes provided an ecologically sound means of human waste disposal. Excreta deposited in an isolated chamber was readily available as a soil additive or fuel supplement. Planners should consider modifying time-tested traditional approaches such as these, rather than automatically replacing them with modern methods that may waste resources already in short supply. New technologies, such as pumps and self-closing valves that curtail water waste, should also be considered. See Winblad, Uno and Wen Kilama, *Sanitation Without Water*, Stockholm: SIDA, 1980; Kalbermaten, John M, et. al., *Appropriate Technology for Water Supply and Sanitation, Technical and Economic Options*, Washington: World Bank, 1980.

pump costing \$300 to produce in the United States may be manufactured for \$40-\$60 in a country like Indonesia. In estimating potential cost savings through local manufacture of parts and equipment, however, it is necessary to assure that locally manufactured equipment is of sufficient reliability and durability, and is as easy to install properly and maintain as the more expensive foreign equipment, or else the cost differential may involve no savings at all.

A.I.D. has been active in the development and testing of technologies suitable for local manufacture (e.g., improved handpumps and well screens) and has also sponsored comparative reviews of other locally producible equipment and machinery (e.g., non-sewered excreta disposal devices, desalinization devices, small diameter pipe, and well-drilling equipment). The Agency's guidelines for the promotion of appropriate technologies for water and sanitation projects include the following:

— A.I.D. supported water supply and sanitation programs should encourage LDCs to use efficient technologies that can be maintained and operated easily and are acceptable within the local culture.³²

— A.I.D. should investigate the potential of private firms in LDCs to develop and operate efficient water and sanitation systems.

— A.I.D. should stimulate local manufacture and field testing of simple equipment. In specific instances (where local capacity is not adequate or where a small market is involved), manufacture on a regional level may be preferable.

— Instead of introducing a new system, A.I.D. should support the improvement of traditional systems, where local preferences or cost considerations indicate system upgrading is the most desirable approach.

— A.I.D. recognizes that success of water and sanitation programs depends in large measure on the ability and commitment of people to use, operate, and maintain the system properly. Thus, A.I.D. should also support programs to train maintenance and other personnel and to educate current and potential users of the services.

³² The level of technology that is appropriate in a given situation should not be underestimated. The evaluation of A.I.D.'s potable water project in rural Thailand demonstrated that the best technology was not necessarily that which appeared to be the most capital saving technology. Villages perceived piped water systems with household connections as preferable to traditional sources of hand-pumps. They were therefore willing to finance and maintain the piped systems, while few of the handpumps have remained in operation. Dworkin, D. and B. L. K. Pillsbury, 1980, *op. cit.*

— A.I.D. should promote standardization of water and sanitation equipment and parts, even while seeking technologies in which hardware can be produced efficiently on a small scale. A.I.D.'s efforts to eliminate wastage and maintenance failure currently caused by a proliferation of mechanical designs and specifications will necessitate closer coordination among donors and local private investors, and may on occasion require a procurement waiver.

4. Water Conservation and Reuse

In most LDCs, potable water is neither cheap nor abundant, and with continued rapid population growth, water shortages may affect significant proportions of LDC populations. Certain areas of the world (e.g., the Sahel) have already experienced grave water crises. Water conservation is playing an increasingly important role in development planning, not only because water is recognized as a scarce resource but also because wastage of water contributes to health problems: pools of water that collect around taps present health hazards, and saturation of the soil with waste water (such as has been observed in rural Egypt) can contaminate the aquifer.³³ Water metering in urban areas, safe restricted flow measures, increasing block rates,³⁴ reduction of leakage by proper installation and regular repair and maintenance, and reuse of waste water for agricultural and industrial purposes are among the means that can contribute to water conservation.

B. Social and Cultural Issues

Water and sanitation programs are most likely to succeed when they respond to the needs of the community. Those needs — and how they are perceived by the community — will differ greatly depending on the country, whether the setting is rural or urban, the current availability and adequacy of water and sanitation, and other factors. A thorough understanding of social, cultural and institutional factors and relationships is therefore a basis for developing and implementing effective water and sanitation programs.

1. Community Participation

Recent project impact evaluations and other project reviews of A.I.D.'s experience have

³³ Varisco, Daniel and Max Kroeschel, "Rural Sanitation in the Arab Republic of Egypt," Washington, D.C.: Metametrics (for U.S.A.I.D.), 1981.

Pools of waste water may promote mosquito breeding (especially of *Culex fatigans* and *Aedes aegypti*, vectors of filariasis and yellow fever) and may create soil conditions favorable to transmission of geohelminthic diseases, e.g., hookworm and ascariasis.

³⁴ Increasing block rates refers to the pricing structure where the first units of water are provided at low prices, with cost per unit increasing with the volume of water consumed.

documented the importance of community participation to effective water supply and sanitation programs in developing countries.³⁵ Local residents must have a strong interest in keeping the system functioning. They must use the system, and be able to support the bulk of the costs of operating and maintaining the system,³⁶ whether in the form of cash, labor, or in-kind contributions. It is their contribution that can help ensure commitment to maintaining the system over the long-term.³⁷

Participation of the community is for these reasons often crucial in rural areas, small communities and low-income urban areas served by communal facilities such as standpipes. A.I.D.-funded programs intended for such areas should adhere to the following guidelines. These guidelines may need to be modified or relaxed in the case of higher income urban residential or commercial areas served by building-to-building connections where a high degree of community participation is not practical. However, even in such situations some indication of community interest is desirable.

— A.I.D. should require a request by community leaders or by a representative community group, or some other formal evidence of community support, and the community should be involved in the program from the outset. Communities where support is lacking will be bypassed unless a compelling public health need exists.

— Wherever possible, the community must be fully aware of the costs and benefits of alternative systems, and should help select the site, level of service, and technology employed. Communities must understand and agree to water rates and other fees at the outset. They must be consistent with the beneficiaries' ability to pay.

— The project should where feasible include a plan to train community workers in the construction, operation, and maintenance of systems. Women as well as men should be trained. (See p. 13.)

³⁵ Observations of Rural Water Supply and Sanitation Programs in Eight Developing Countries. IBRD, Report No. PUN 42, 1978; Self, George, "Social Analysis of Rural Potable Water Programs," A.I.D., 1979. UNICEF/WHO Joint Study on Water Supply and Sanitation Components of Primary Health Care, IC 22/UNICEF-WHO/79.3.

³⁶ Larger and more complex systems will require full-time staff and supervision. Even when systems can be operated and maintained by the users, access to the expertise of a central water authority will occasionally be necessary.

³⁷ Social and Behavioral Aspects of Project Work in Water Supply and Waste Disposal, IBRD, Transportation, Water and Telecommunications Department Public Utilities Notes, 1980.

— Wherever possible, the project will use the existing indigenous organizations to assure community participation and to institutionalize maintenance, management and administration of the system.

Social analysis, especially at the initial stage of project design, is essential to determine whether or not these conditions have been or can be met.

2. User Education

The provision of basic sanitation and a reliable supply of safe, convenient water is not sufficient to guarantee improved health. A variety of social and cultural attitudes affect the pattern of usage of water and sanitation facilities: people must use facilities and use them properly to discourage environmental contamination (particularly with fecal material) and disease transmission. In some areas, for instance, children are not encouraged to use the latrines, which are dark and distant from the home, because children's feces are considered harmless. In other areas, men and women prefer not to share the same latrines, which tends to limit use of household latrines to female members of the family. As a recent study noted: "Decisions about drinking water are often based on sensory perception — color, taste or smell — rather than technical purity."³⁸

Water supply and sanitation interventions can be most effective in improving health when they are coordinated with other primary health care activities, especially health and hygiene education, and maternal and child health services. Examples of user education which seem obvious but which are often overlooked include: advice on the protection of stored household water from microbial contamination and mosquito breeding; promotion of handwashing (particularly by food handlers); promotion of hygienic food preparation, including the proper use of water for cleaning utensils; promotion of breastfeeding, especially during the first six months of life; promotion of safe excreta disposal by all family members; and instruction on preparing water for use in oral rehydration therapy, infant formula, where used, and weaning foods.

Consumers must be encouraged to transport water in clean containers, and store it under sanitary conditions. They must know how to wash their hands and bathe properly to break the fecal-oral cycle of many diarrheal diseases.

³⁸ Elmendorf, M. L., and R. B. Iseley. "The Role of Women as Participants and Beneficiaries in Water Supply and Sanitation Programs," Washington: Mimeographed draft, 1981, p. 4.

Hygiene education can be provided in a variety of ways: by community-based, primary health care workers or other health personnel; by "promoters" working with a water agency through primary schools; or by extension workers in other sectors. Evidence from evaluations of development projects suggests that sporadic information and education campaigns do not result in real behavioral changes. Therefore hygiene education associated with water and sanitation programs must be incorporated in continuous education program efforts.

— Effective hygiene education is almost always a necessary complement to the provision of safe water supplies and adequate sanitation in A.I.D.-sponsored programs.

— Whenever possible, proper hygiene should be taught in primary schools, and water and latrines should be provided in schools and their use encouraged so that children may begin to practice the normative hygiene behavior they are taught.

— Mothers should be a main target of hygiene education programs, since they are primarily responsible for the health and training of their children; and women will be included among those employed to carry out the promotional and hygiene education activities associated with AID-supported programs.

C. Issues of Implementation and Administration

1. Costs and Financing of Water Supply and Sanitation Systems

The long-term financing of water supply and sanitation systems is a matter of critical concern for developing countries and donor agencies. Per capita cost of water systems vary according to the country, characteristics and distance of the water source, and kind of technology used (e.g., communal standpipes or household connections).³⁹ Most estimates of long-term operation and maintenance costs ignore indirect costs, including such factors as the cost of running regional and national offices and training middle management personnel, and therefore seriously underestimate the costs of water systems.

Initial investment costs for water systems have been estimated to range from approximately \$25

³⁹ The World Bank has recommended that (1) "minimum" water service be available to all and (2) the charge not exceed 5-6 percent of the income of the poorest household to be served. Unfortunately, the high costs of reaching isolated groups may make total coverage of populations in developing countries an "impractical and perhaps unattainable objective. See The World Bank "Water Supply and Waste Disposal," *op. cit.*

per capita for household connections in both urban and rural areas. The annual cost of installing and maintaining an adequate sanitation system also varies enormously, from about \$20 per household per year (capital and recurrent costs) for single pour-flush toilets, to \$400 per household per year for sewerage systems.⁴⁰

Where water and sanitation systems are provided through household connections, consumers must be charged fees which at least cover operating expenses, and preferably the full cost, possibly through loan arrangements. Where services are provided as public goods and no consumer can be excluded, as in the case of water standpipes or public sanitation services, their costs must be recovered through some other mechanisms such as increasing the price of water for house connections and raising the per unit cost of water as the volume used rises (increasing block rates). Other means of financing include the use of community funds or assessment of consumers based on ability or willingness to pay criteria.⁴¹

Whether in urban or rural settings, water and sanitation tariffs must be structured so that users can afford them. Charges for initial hook-ups and policies that compel all new users to purchase a tank or other equipment at a uniform price may effectively exclude poor households from the system. Such devices as a loan fund, long-term credit arrangements, or charges pegged to income can help ensure more broad-based participation in the system. Where charges do not cover the costs of at least maintaining the system, and where the difference cannot be guaranteed through general tax revenues, A.I.D. will not, in general, support a major investment in domestic water supply.

While most people in developing countries may be prepared to pay a significant portion of their income for improved water supply, in many areas they are less persuaded or even unaware of

⁴⁰ Kalbermatten, John M., et. al., *op. cit.* Precise figures for recurrent costs of alternative water systems are unavailable, and estimates vary widely. The World Bank, "Water Supply and Waste Disposal," *op. cit.*

In some unusual settings, such as Bangladesh (which has an alluvial delta, high water table, and high population density), the cost of shallow wells with handpumps may be as low as \$3 per capita (F. Eugene McJunkin, personal communication).

⁴¹ Building on established community financing mechanisms is a useful starting point for developing financial schemes. In some instances leasing standposts or similar public sources of water to private entrepreneurs can improve operation and maintenance and simultaneously ensure the system's financial viability. However, problems encountered in the use of private vendors have included price fixing, failure to maintain water quality, and the use of inefficient technologies.

the need for improved sanitation facilities, especially when they do not understand or believe the importance of these improvements for health. Thus an education program to highlight the benefits of improved sanitation may have to be coupled with initial subsidization of sewerage systems or, in urban areas at any rate, sewerage charges may have to be subsidized by water users who have water piped to their household.

— The economic analysis of all water supply and sanitation projects will explicitly demonstrate a feasible means of financing the program over the long-term.

— A.I.D. will not support water supply and sanitation programs whose operation and maintenance costs cannot be paid by the users through fees, taxes and/or contributed labor.

— Where possible, each user household should bear primary responsibility for covering all costs, and certainly recurrent costs, except in areas with extremely poor households where some level and combination of cross subsidy and/or allocation of general tax revenues may be required. A.I.D. encourages adoption of methods, such as cross subsidies, which do not exclude the poorest members of the community.

2. Operation and Maintenance

Too frequently the success of a water and sanitation project has been measured in terms of the total number of wells, handpumps, or latrines constructed, with little attention to actual operation, maintenance, or usage. Long-term success of these systems depends on the availability of supplies, parts, equipment, and the trained people needed to monitor, maintain, and repair the systems.

— In general, A.I.D. will give preference to water supply and sanitation systems that are appropriate to the setting, inexpensive, and simple to install, operate, and maintain.

— In rural and village water and sanitation systems, revenues for operation and maintenance should be generated and controlled by the local community, which has a vested interest in maintaining the system, so that they are readily available when breakdowns occur.

— A.I.D.-supported programs for water and sanitation systems should include training for regional and national level personnel in the operation, maintenance and repair of water supply and sanitation systems, and for community members when community participation is a major feature of a program. Special emphasis will be placed on training women, since they are the

major users of the systems. Emphasis will be placed on short-term, in-service training of village-level personnel.

3. Management and Logistics: The Administration of Water Supply and Sanitation Programs

Effective institutional support for water supply and sanitation programs is essential. However, in many LDCs, the administration of water supply and sanitation programs is divided among numerous ministries and coordination among them is often deficient. In some LDC settings, there may be no clearly demonstrated capacity anywhere in the public sector to initiate and support water and sanitation programs.

The participation of the private sector in both the construction and operation of water and sanitation systems can increase the efficiency of such efforts, especially where water and sanitation services are provided directly to households willing to pay for services. However, where the services are not provided directly to households but are "public goods" in the form of standpipes or other communal facilities, special private sector incentives or public sector involvement may be necessary to ensure broad access to water.⁴²

Given the fact that utilities such as water supply tend to be natural monopolies, some public sector oversight is required to set service standards and tariff structures, to endorse operation and maintenance procedures and schedules, and billing and collection activities, and, most important, to plan for efficient and equitable water use. Relatively small, individual communities can generally take direct responsibility for management of water systems, but larger jurisdictions normally require a local or national water agency (either public or private), and where private firms are involved, public oversight is necessary.

— A thorough analysis of existing and potential institutions, including private sector entities, should be part of any project analysis for water supply and sanitation projects.

— A.I.D.-supported water supply and sanitation programs should include technical assistance and/or training to improve the efficiency and effectiveness of program administration by government institutions and private firms.

— An established, national or regional level unit responsible for domestic water supply and

⁴² For example, where the private sector is encouraged to provide public goods (for example, sanitation), incentives such as higher water fees could be allowed by the water authority to cover costs of sanitation services.

sanitation programs is a prerequisite for substantial A.I.D. assistance for domestic water supply programs. The public water authority can be governmental or parastatal, but must be responsible for assessing long term water and sanitation needs, planning for effective utilization of national local water resources, assessing and monitoring environmental hazards, rate setting, the establishment of standards, and, where applicable, oversight of private sector activities in water and sanitation. In terms of implementation of the other aspects of water supply and sanitation systems, the governmental agency and/or private firms must have responsibility for at least the following:

- administering national/local water and sanitation systems;
- establishing technical requirements for water supply and sanitation;
- ensuring operation and maintenance of the system, including procurement and distribution of equipment and supplies;
- assessing manpower needs, and providing appropriate training for operations and maintenance.

4. Role of the Private Sector

A.I.D. endorses the role of private enterprise in water supply and sanitation activities, particularly with respect to operations and management. Where private entrepreneurs are interested, franchises can be auctioned by the public sector for building and/or operating urban water systems. The public water and sanitation authority would then set rates based on acceptable rate of return criteria and ensure that where necessary public goods (standposts and, where relevant, sanitation systems) are financed through some combination of innovative community financing, common central government revenues, or cross-subsidies. Opportunities for private businesses to operate and maintain water supply systems and waste disposal (including cartage) exist, and A.I.D. should fully explore the feasibility of expanding and improving these activities. However A.I.D. recognizes that, given the high cost and modest returns as well as the uncertainty and risk associated with such investments in LDCs, the private sector is generally reluctant to finance establishment of water and sanitation systems.

5. Program Evaluation and Applied Research

Careful evaluation of water supply and sanitation programs is needed to ascertain which types of water supply and sanitation systems work best under particular field conditions. To date,

A.I.D.-supported applied research has stressed the development of technical and engineering aspects of water supply and sanitation programs. In the future, A.I.D. will give much more attention to social, economic, and administrative considerations, and will evaluate regularly the water and sanitation programs it supports. Programs that involve major innovations — either a new technology or a new combination of interventions — will have a built-in evaluation component. A.I.D. will also continue to support applied research studies.

V. Water in the Context of General Economic Development

Development programs do not operate in a vacuum, and there are, of course, a variety of other factors and considerations that have a bearing on the nature and extent of A.I.D. support for water and sanitation programs. More specifically, the need and demand for improved water supply and sanitation services can both affect and be affected by changes in other development sectors. Four such intersectoral linkages are highlighted below to illustrate the contextual issues that surround water and sanitation programs in developing countries.

A. Water, Sanitation and Natural Resources

The exploitation of natural resources may unintentionally diminish the availability and quality of water for domestic use. For instance, dam and irrigation projects may divert water supplies that would otherwise be available for domestic use.⁴³

Domestic water supplies may be contaminated by municipal sewage, agricultural chemicals, or industrial wastes. The availability and quality of water can also be compromised by such development activities as irrigation, pesticide spraying, and vector-borne disease control programs.

The reverse is also true: water supply and sanitation practices can have a detrimental effect on the natural environment. The increased use of water that generally follows the provision of more convenient water sources can lead to the discharge of large volumes of potentially contaminated, untreated waste water which may create health and environmental problems. Environmentally sound and cost-effective wastewater and excreta disposal procedures must be a part of A.I.D.-supported water supply programs.

⁴³ The environmental assessment required by the Agency for all such projects under the provisions of 22 CFR 26, "A.I.D. Environmental Procedures", should address this issue directly.

B. Water, Sanitation, and Primary Health Care

Sound primary health care programs must incorporate a mix of activities, since neither improved water supply nor any other single health-promoting activity can by itself fully meet the health objectives of LDCs in any reasonable time frame. Although for many poorer countries water and sanitation programs may not be included in the initial primary health care services provided (because of cost, logistics, and other factors), improvements over time in water supply and sanitation are a necessary part of a comprehensive primary health care program.⁴⁴

Some aspects of water supply and sanitation can be incorporated readily into primary health care programs. Village health workers can be taught to recognize diseases that are caused by inadequate or poor water and sanitation and can learn to provide hygiene education as part of their preventive health activities. Community-level personnel can be trained to carry out simplified sanitary surveys and to provide encouragement and advice to communities for the construction of water supply and simple excreta disposal systems.

C. Water Supply, Sanitation, and Agriculture

Rural development activities can have both beneficial and detrimental effects on water supply and sanitation in developing countries. Programs to increase agricultural production and increase farm family income can enable rural families to pay for improved water and sanitation systems, and irrigation activities themselves may make greater quantities of water available for domestic use.

Irrigation programs can also have a directly detrimental effect on the quality of water available for domestic use: in many countries, large-scale irrigation programs have resulted in chemical contamination of domestic water supplies and in the spread of communicable disease. Careful local and regional planning which gives particular attention to possible environmental degradation is therefore essential.

D. Water Supply, Sanitation, and Urban Development

Rapid urbanization, a result of natural population increase and of rural- to urban-migration, has strained the already limited capacity of existing water supply and sanitation and other public service systems. In addition to the health sector programs cited earlier, A.I.D. funds

water supply and sanitation programs in urban areas through its shelter sector program.⁴⁵ Sites and services programs provide utilities, including domestic water and sanitation; the construction of core housing generally includes water and sanitation facilities; slum upgrading projects often include improved water supplies, excreta disposal, and sewage treatment; and home improvement loans offered to property owners are frequently used to finance better domestic water supply and sanitation systems. Through its shelter program, A.I.D. can help developing countries devise innovative and effective responses to the massive water supply and sanitation needs of third world cities.

Among the topics currently being addressed in A.I.D.'s research and development program in urban development that bear on water supply and sanitation are: improving the financial and managerial capacity of local government to provide essential services (including water supply and sanitation) efficiently and equitably; demonstrating the feasibility and economic viability of safe disposal, recycling, and production of useful byproducts from the wastes generated in secondary cities; and field testing a strategy to help cities increase efficiency in the consumption of important scarce resources (e.g., land, water, and energy).

E. Future Strategy Considerations

A number of strategy questions emerge for priority consideration by A.I.D. For instance, the development of local financing systems for domestic water and sanitation programs is clearly an extremely important area for attention of economists and other development planners. Under what conditions is a user's fee preferable to a local tax to assuring continued operation of a common water system? Under what conditions should the government be prepared to contribute to the ongoing costs of water and sanitation programs, and what sort of government support is most effective? How reliable are government supported programs? Answers to these questions are critical to the maintenance and expansion of basic water systems in the developing world over the next several years.

Other topics on the Agency's strategy agenda include questions of program integration (e.g., under what conditions should water and sanitation activities accompany or precede other development interventions); community participation (e.g., what are the most practical ways of

⁴⁴ *Primary Health Care: Report of the International Conference on Primary Health Care, Alma Ata, USSR, 6-12 September, 1978*, Geneva: World Health Organization, 1978.

⁴⁵ "Urbanization and the Urban Poor," U.S. Agency for International Development, *Policy Determination 67, Supplement, Handbook 1, 1976*.

assuring meaningful community involvement in water programs); and suitable technology (e.g., what practical information is available to guide program planners in the selection among and adaptation of alternative small-scale technologies in the water and sanitation field). Work on these strategy questions will continue, as will efforts to collect and disseminate information that will allow the Agency to do a better job of,

targetting its water and sanitation programs to the most appropriate groups. Underlying all this effort and continuing attention is the recognition that water is not only a basic requirement of life but also contributes to overall economic growth and development. It is for both these reasons that A.I.D. has supported and will continue to support the efforts of LDCs to assure basic water and sanitation services for their populations.