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WATER, SANITATION, AND HEALTH

This report is intended as a basis for the technical discussions on the above subject. It gives the background to the problem of supplying populations with the clean water and the basic sanitation facilities that are essential to their health; outlines the present situation throughout the world, and in particular in the Eastern Mediterranean Region; traces the approach that has gradually evolved and the action taken throughout the United Nations system in recent years, leading to the declaration of the period, 1981-1990, as the International Drinking Water Supply and Sanitation Decade, and culminating in the launching of the Decade in November 1980. This paper suggests a framework for possible national action plans in Member States to advance the aims of that Decade.

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I INTRODUCTION

An adequate supply of safe water and basic sanitation is listed as one of eight essential components of primary health care required for the achievement of "Health for All by the Year 2000" (HFA/2000). Preventable diseases associated with the lack of these basic sanitary measures, which contribute to high infant mortality, morbidity, low life expectancy, and poor quality of life, comprise major health problems in many of the developing countries, irrespective of their stage of development.

It is the object of this paper to highlight the effect of these diseases; to emphasize the overall needs for basic sanitary measures in countries of the Region, with particular reference to the activities to be undertaken by Member States in relation to the International Drinking Water Supply and Sanitation Decade; pinpoint the constraints on those activities; and to suggest ways of overcoming them.

Water Uses and Requirements

It is the task of the politician, the economist and the planner to ensure optimal use of water resources for the benefit of the whole population. The basic available assets are the people (their health, knowledge and skills), along with the land and other natural resources. But in most developing countries the people are an inadequately capitalized asset because their health is too often adversely affected by their environment.

In this context water is frequently of vital importance. It is almost the only element that exists naturally as a liquid on the earth's surface and has a very wide range of uses, both consumptive and non-consumptive (domestic, agricultural/fisheries, industrial, use in drainage and in energy production; it also constitutes a recreative amenity).

The normal daily water requirement for adults is 2.5 litres (say, 5.5 lbs). Under conditions of extreme heat or physical exertion this requirement may increase. But in addition to this quantity - which is for alimentation and comes mostly from ingested food - much greater quantities are required for common human activities, domestic, industrial and agricultural. The domestic

water demand in a developed country would be a minimum of some 100 litres *per capita* per day.

While, in general, the availability of water as a resource is not a major impediment, the difficulty lies in providing the consumer with water of sufficient quality and quantity. Further, it is crucial to note that an adequate supply of safe water implies access to water within a reasonable distance.

Sanitation Requirements

Sanitation is inextricably linked with water supply and has many dimensions that affect the quality of life. The disposal of human excreta is only one of its aspects. Others include personal hygiene, the collection and disposal of solid wastes, wastewater collection, food sanitation, vector control, and household cleanliness. The linking of water supply and sanitation opens up a wide range of alternatives for improving the health conditions of the vast majority of those in the developing world. The quality of life, however, is influenced not only by quantitative and qualitative improvements but also by other factors such as convenience of location and availability of facilities.

II WATER AND HEALTH

It has been estimated that 80 per cent of all illness in the countries of the Third World is associated with water. Typhoid and cholera outbreaks often occur because water is unsafe. Water provides the breeding-place for the insect vectors of malaria, filariasis and yellow fever, and the number of people affected is very large indeed. Some 200 million people suffer from schistosomiasis. And an estimated 400 million people suffer at any one time from gastroenteritis. Diarrhoea is the major cause of sickness and death among children in the developing countries: during 1975, for example, there were approximately 500 million episodes of diarrhoea in Africa, Asia and Latin America among children below the age of five.(23)

Diarrhoea directly kills some 6 million children in the developing world every year and results in fatalities of about 18 million people; trachoma

affects almost 500 million people at any time, sometimes causing blindness; parasitic worms infect nearly one half of the entire population of the developing nations, often with serious consequences[32].

Socio-economic effects of ill-health

CARE (Cooperative for American Relief Everywhere), a non-governmental organization, concluded from their studies on a rural water supply project in Kenya that nearly one-fifth of rural households spent more than six hours each day collecting water. A third of the total work time of female members of the household was devoted to collecting water, while only 17% was spent in preparing food and 21% in economic activities such as farming, etc.[12]

Sickness can really spell disaster to any rural community, especially during the rainy season - a peak period for both agricultural activities and water-related diseases. As those unable to work lose income, levels of family nutrition drop; this in turn increases susceptibility to disease and death.

Repercussions at the national level may be equally grave, as farmers, village craftsmen, fishermen and others often contribute quite a sizeable share of gross national product to the economies of developing countries. Data available for India, for example, show that water-borne diseases alone claim some 73 million work days every year. The cost, in terms of medical treatment and lost production, has been estimated at around US $ 600 million per year[12].

In the Eastern Mediterranean Region, it is estimated that out of eleven million children born each year approximately two million die before reaching the age of five; and of these two million deaths, about 40 per cent are due to diarrhoeal diseases alone. In Egypt (1973) these diseases were the leading cause of death in children under 3 years of age, accounting for 43 per cent of all deaths in this age group.[27] In Iran (1973) they were the second most prevalent of the diseases with an incidence of 22 per cent in the 0-5 year age group and 14 per cent in all age groups. In Jordan, Pakistan and Saudi Arabia they are the leading causes of hospitalization and deaths.

In all, the diarrhoeal diseases are responsible for between 15 per cent and 22 per cent of all mortality in the Region. There are, besides, several water-borne and water-related diseases rampant in nearly all countries of the Region.

Recent studies[24] have demonstrated that provision of safe supplies of water for drinking is not by itself sufficient to control acute diarrhoeal diseases. This is because they can be transmitted by contaminated water used for bathing, cooking, washing food, etc.; and also because such diseases as shigellosis and rotavirus infections can be transmitted through non-water-borne routes. It has been stated[3] that in India the population at risk from filariasis has increased over 15 years from about 20 million to over 125 million as a result of improved water supplies without supporting drainage systems. In addition to the supply of safe water, therefore, there must be a combination of efforts to provide means of wastewater disposal and to educate the public regarding proper personal and food hygiene practices.

WATER QUALITY

The quality of drinking-water supplies is an essential aspect of the problem. An increase in quantity alone is not sufficient; the water used by people anywhere in the world must also meet certain minimum hygiene and health requirements.

Chemical Quality of Water

Some chemical substances to be found in water have adverse effects on health; these are now of particular concern in industrial countries where infectious diseases have largely been overcome. Standards for toxic substances such as arsenic, cadmium, cyanide, lead, mercury, selenium, fluorides and nitrites have been laid down by WHO and have been adopted by many countries[22].

Hardness

In many countries of the Region, deep groundwater is being increasingly used for public water supplies. Such water usually contains a higher concentration of hardness-forming constituents as compared with water from springs,

shallow wells or even rivers. (Hardness is defined as a direct measure of the concentration of calcium and magnesium ions and is frequently expressed in equivalent amounts of calcium carbonate ($CaCO_3$); water is considered hard if the concentration of $CaCO_3$ is between 150–300 mg/l as against 75 or less for soft waters).

Recent studies have shown a negative correlation between hardness of water and mortality due to cardiovascular diseases; in other words, the harder the water, the lower the cardiovascular disease mortality rate. However, no additional decrease in that rate was observed when hardness levels progressed beyond 170 mg/l. It is not yet known which water parameters are responsible for this association, although some studies claim inverse relationship between cardiovascular diseases and magnesium content.

Trace elements

The chemical composition of the food that we eat is influenced, among other things, by the chemical composition of the water used for food preparation and cooking. Food cooked in water will of course lose minerals; and further loss occurs when it is industrially processed, refined or frozen[9]. Table 1 gives the daily requirements of adults in trace elements. It is even possible that where foods and diets are deficient in minerals, the water used for drinking and cooking purposes could make up for the deficit. The maximum contribution that drinking-water can make to the daily intake of certain essential elements is shown in Table 2.

Among the individual inorganic elements that can make the difference between health and disease are lithium (commonly prescribed for behavioural disorders); chromium, which acts as a co-factor with insulin to maintain normal glucose tolerance; fluorine which, in a proportion of 1 mg/l, is of marked benefit in protecting against dental caries; iodine, deficiency of which is associated with goitre; silicon, calcium and magnesium, the presence of which in water is reported as showing a correlation with a low incidence of cardiovascular diseases.

Demineralization

The practice of softening hard tap water for practical, economic or aesthetic reasons needs reconsideration. Many public health authorities and investigators think that a more prudent attitude should be taken to water softening, and that it might be preferable to maintain some of the mineral content that is naturally present. A WHO Working Group (Brussels, 1978) recommended that excessive softening of water should be avoided or carried out only in the case of water for industrial use; or, in the case of domestic use, only for the hot water line that goes to domestic appliances. Investigations indicate that the optimum range of water mineralization should be between 200-600 mg/l[9].

Biological Quality of Water

As mentioned above, in the developing countries many of the major communicable diseases are water-borne. These may be sub-divided according to the likely effect of changes in water and are of four categories (Table 3). Of categories I and II (water-borne diseases and those caused by polluted water) each has its own associated disease changes. Then there are infections which can multiply at the water source (category III); and, lastly, there are infections carried by vectors which depend on the water supply (category IV).

Water-borne Diseases (Category I)

The most dramatic decrease observed in the incidence of disease after improvement of the microbiological quality of urban water supplies has been in the classical water-borne infections, typhoid and cholera (Table 3). Since these diseases were a main preoccupation of municipal suppliers in temperate countries, they have come to dominate the thinking about water supply and the training of public health engineers. They are unusual infections in that the minimal infective dose of organism is so low that even after extreme dilution of the infective material, transmission still occurs. The dimension of the epidemic that may result from contaminated water largely depends upon the number of consumers. As the degree of faecal pollution of water increases it becomes possible for other microbes, with a higher minimal infective dose, to be transmitted; paratyphoid fever and possibly hepatitis

are in this category. Since such a degree of pollution is intolerable in a municipal source, these infections are likely to be water-borne only in less developed communities.

Infections from washing in polluted water (Category II)

There are many infections, especially in the tropics, which decrease markedly when the volume of water available for washing and personal hygiene is increased. Most of these are infections of the gastrointestinal tract or of the skin. Although diarrhoeal diseases may sometimes be spread in this way by polluted water, it seems clear that many of the infections in question are not water-borne in the strict sense. Studies have shown that they decrease with proximity to a water source and are relatively unaffected by its microbiological quality. Trachoma and cutaneous infections are among this group, as are skin sepsis due to bacteria and cutaneous fungal infections.

Water-based diseases (Category III)

Several parasitic worms are dependent on aquatic intermediate hosts. Eggs or larvae carried by infected persons may reach the water and infect the intermediate host and after a time large numbers of larvae infective to man will be present in the water. Schistosomiasis and guinea worm are two such water-based diseases. The schistosome larvae develop in certain aquatic snails and the infective cercariae invade man through the skin. The guinea-worm larvae escape from man by way of lesions on the leg and develop in small aquatic crustaceans. Man is reinfected by drinking water containing the intermediate hosts. Infections produced by these helminths differ from the water-borne infections of category I in their cumulative effect: the worm burden can build up, even in small communities, if the source of water is polluted.

Water-related insect vectors of disease (Category IV)

The insects involved in transmitting several major tropical diseases are associated with water in one of two ways. Mosquitoes, which carry malaria, filariasis, etc., and *Simulium* which transmits onchocerciasis, breed in water. Other insects, particularly the tsetse fly (*Glossina*) of the

palpalis group, bite near water by preference and may transmit sleeping sickness to those coming to fetch water.

CONSEQUENCES OF IMPROVING WATER SUPPLIES

It is well known that, even given ideal water supplies, few infections disappear completely, with the possible exception of guinea worm[3]. Studies suggest that half to three-quarters of the prevalence of bacillary dysentery and of round-worm (*Ascaris*) are due to inadequate water supplies. Data from American cities have shown that the provision of safe water was accompanied by a 90 per cent fall in the incidence of typhoid (Figure 1) but there was little change in the incidence of diarrhoeal diseases overall[16].

The main diseases of Category III are of two types. Most of them are infections of skin and eye and are a consequence of an insanitary environment. The number of cases increase when there is a shortage of water for washing or where there is dust pollution. They would diminish with a more accessible and greater volume of water supply even without improvement in water quality. The diarrhoeal diseases also decrease when water supplies are made more accessible. However, prevalence can vary between areas with a comparable water supply: a hot dry climate and an insanitary environment particularly favour the diarrhoeal diseases and they therefore flourish both in crowded urban and in arid rural areas.

A good supply of water is therefore essential, but how much water is enough? Very few data are available on this aspect although it is crucial to the engineer and others. Of the studies specifically relating to the relationship between volume of water and burden of disease, one was made in parts of California where dysentery caused by *Shigella* is very prevalent. The studies[3] showed that, although any type of sanitary improvement tended to decrease the prevalence of *Shigella*, the big reduction came when water was available inside the house rather than outside, even if nearby. Additional observations made in East Africa showed that water use does not significantly increase when the distance to the water-point changes, provided that in the first place it is not more than a mile away or is not inside the house[3].

Diseases are thus affected in different ways by changes in the water supply. Some are more responsive to a change in the quality of the water, and others to an increase in the supply available. The threshold for the improvements to take effect, and the form of relationship between water quality and incidence of a disease, will vary according to the particular infection and the environment.

Improvements in water supply can be made in many ways but they do not necessarily have to be carried out all at once. Each single improvement will produce specific changes in the quantity or quality of water supplied. Figure 2 shows the annual *per capita* disease costs to the community, estimated for each habitat and improvement level, on an arbitrary scale on which 100 represents the disease cost of unimproved supplies in a semi-arid tropical area and zero represents the disease cost where there is a supply of adequate pure water.

Three general conclusions have been drawn from this. First, that not all improvements of comparable cost produce similar benefits. Secondly, that similar improvements in different habitats may have different effects on health. Thirdly, that the relation between the cost of improvements and the health benefits derived is by no means linear[(3)]. Where resources are limited and the long-term goal of ample safe water cannot be achieved in the near future, there is a wide range of partial improvements that can be undertaken and will bring consequential advantages and benefits to health.

HEALTH ASPECTS OF WATER RESOURCE DEVELOPMENT PROJECTS

Water, which is indispensable to the survival of man, sustains the life of other organisms as well. Some of these organisms can be harmful and their presence in water comes from the interference of man, e.g., its pollution by defaecation or by disposal of sewage, an interference that favours the propagation of both vectors and hosts of disease. The water-related, vector-borne diseases include malaria, schistosomiasis, yellow fever, and many others. The major diseases prevalent in the Eastern Mediterranean Region, due mainly to water resources development without due attention to proper drainage and wastewater disposal, are briefly discussed below.

Malaria

Over the past 30 years, the countries of the Region have undertaken important water development schemes for irrigation, energy, production, and other purposes. While much benefit has been derived in the form of higher food production and better socio-economic conditions, the environmental changes brought about by such schemes have favoured the spread and multiplication of malaria vectors and have often produced a dramatic increase in the prevalence of this disease.

In the Gezira irrigation scheme area of Sudan, malaria cases have risen to epidemic level. In 1975, similar effects were reported from Pakistan after the development of the Indus Basin Canal irrigation schemes; the cost of malaria control measures for Pakistan now amounts to some $ 20 million per annum. Egypt, after construction of the Aswan High Dam, is experiencing similar problems. Almost identical situations can be cited for the Khuzistan irrigation projects in Iran, the Mussayels area project in Iraq, the Ghab Valley and Euphrates Dam and related projects in Syria, the North Jordan Valley irrigation works, the Abijan cotton plantation project in Democratic Yemen and the Johar sugar plantation project in Somalia. Obviously the campaign against malaria calls for control measures to eliminate or reduce breeding-places, through construction of drainage and wastewater disposal systems[2].

Schistosomiasis

Schistosomiasis is one of the world's longest known and documented diseases. It plagued the ancient Egyptians for centuries, parasite eggs having been found in Egyptian mummies dating back to the XXth Dynasty (1250-1000 BC). The Nile provided suitable ecological conditions.[28] Also in ancient times, it was an established disease in Iraq (Mesopotamia) along the Tigris and Euphrates rivers. It is now widespread in tropical and sub-tropical zones in Africa, Japan, the Philippines, Thailand, other parts of Asia and the Middle East, the West Indies, and parts of South America, altogether in a total of approximately seventy countries.[5, 32] Currently it affects over 200 million people and many more are liable to infection, since in recent years many water development projects have been undertaken, and the connection between water/irrigation development and the disease is beyond question.

It is difficult to quantify accurately the economic losses due to schistosomiasis. It was stated by Obeng[2] that such losses in the Philippines were about $ 6.5 million per year. She based this 1963 estimate both on the cost of medical care and on the decrease in productivity of those suffering from the disease. She also estimated the economic loss to Egypt to be about $ 560 million per year. Obviously the economic loss for 1980 would be much higher. But the example serves to highlight the significance of the disease and the need to control it.

Control measures include both environmental management and engineering methods, e.g., the reduction of snails through habitat management; the prevention of access of schistosome eggs to snail habitats by construction of excreta disposal systems; the reduction of human contact with water, through provision of safe water; and health education of the community.

III SANITATION AND HEALTH

PUBLIC HEALTH IMPORTANCE OF SANITATION

The need for adequate sanitation is as great as the need for safe water. In fact, water supply and sanitation measures are truly efficient only if they complement each other.

Human excreta constitute the principal vehicle for the transmission and spread of a wide range of communicable diseases. Some of these diseases rank among the chief causes of sickness and death in societies where poverty and malnutrition are ubiquitous: diarrhoeas, for instance are - together with malnutrition, respiratory diseases and endemic malaria - the main causes of death among small children and infants in developing countries. Cholera, whether endemic or epidemic in form, is responsible for numerous deaths in all age groups, although under endemic conditions it is the children who suffer the most fatalities. Other diseases, such as hookworm infections and schistosomiasis, produce chronic debilitating conditions which impair the quality of life and make individuals more vulnerable to superimposed acute infections.

These diseases, and many others, begin their journey from an infected individual to a new victim when the causative agent is passed on in the excreta. The collection, transportation, treatment and efficient disposal of human excreta are of much importance in the protection of the health of any community; they are particularly important in those societies which make use of human excreta in agriculture, aquaculture or gas production and which therefore re-use, rather than dispose of, the raw and treated wastes. Such re-use systems have a positive role in supporting economic activity and food production and are often cheaper than alternative methods of disposal. However, they present a challenge for designing and developing technologies that will not pose unacceptable risks to health.

A good example of the effect of sanitary excreta disposal on the incidence of typhoid and paratyphoid is given by Fair and Geyer[1] in a study made in West Virginia, USA, where a privy construction programme was undertaken: the death-rate attributable to these diseases was cut by two-thirds and eventually reduced to nil (Figure 3). It is stated however that improvements in other sanitary conditions probably occurred at the same time.

SANITATION AND DISEASE TRANSMISSION

In the transmission of sanitation-related diseases from the sick or the disease-carrier to the healthy, the chain of events (Figure 4A) is similar to that of many other communicable diseases. In order to transmit disease, the following factors are necessary:

- a causative or aetiological agent;
- a reservoir or source of infection of the causative agent;
- a mode of transmission from the reservoir to the potential new host;
- a mode of entry into the new host; and
- a susceptible host.

The control of any one of these five conditions makes the spread of the disease impossible.

There are many ways in which the causative agent of an enteric disease reaches a new host. In different parts of the world, different modes of transmission may assume different degrees of importance: in some areas,

water, food and milk may be the more important; in others, flies or other insects; and in others direct contact may play a major role. The objective of sanitary excreta disposal is therefore to isolate human wastes so that the infectious agents they contain cannot possibly get into a new host. Figure 4B shows the points at which sanitation can intervene by erecting a barrier to check the chain of disease transmission from excreta.

EXTENT OF THE PROBLEM

Of the total population of the developing countries, which constitutes some 2 000 million, 70 per cent live in rural areas. A vast majority of that population at one time or other suffers from typhoid fever, diarrhoeal, enteric, helminthic and other diseases. Of the helminthic infestations, a former member of WHO's Executive Board, Dr Van Zile Hyde, once said:

> "The dire effect of all this upon a rural nation was clearly brought home to me by a statement that the worms infesting the people of the country metabolize more of the produce of that country than do the inhabitants. Half the work of a sick peasantry, therefore, goes into the cultivation of food for the worms that make them sick".(10)

In most cases in rural and small communities, almost all the elements of sanitation are absent and indiscriminate fouling of the soil with human excrement is common. Such conditions are also often found in rural areas near towns and aggravate the urban situation. The economic losses that result from such lack of sanitation often reach high proportions.

Atkin,(1) analyzing data available for several countries, found that infant mortality from typhoid fever, diarrhoea, and enteritis were in inverse proportion to *per capita* income. The cost of these diseases (Table 5) and the *per capita* cost of rural water supplies and latrines (Table 6) were estimated. It was concluded that in each of the countries considered, it would be possible within a period of five years to amortize the cost of rural sanitation facilities from the savings that would accrue from the reduction in typhoid fever, diarrhoea and enteritis. Further advantages would accrue from the control and reduction in incidence of cholera, the dysenteries, ascariasis, guinea worm, hookworm and other enteric and

parasitic diseases, not to mention the indirect benefits from the facilities, such as the convenience and saving of time.

IV PROVISION OF BASIC MEASURES FOR WATER SUPPLY AND SANITATION

EVOLUTION OF APPROACH TO THE PROBLEM

The problem of providing safe drinking water and adequate sanitation are not new to the governments of the Region, nor indeed to the developing world as a whole. For many decades attempts have been made in various ways to bring these basic amenities to their populations. Progress has, however, been slow, for a variety of reasons.

In the 1950s, pilot and demonstration projects were started in a number of countries to discover how water supply and sanitary waste disposal could be brought to people at a cost they could afford. The emphasis was on finding simple technologies. Mainly with assistance from UNDP and the International Bank for Reconstruction and Development (IBRD), pre-investment surveys and sector studies were carried out in a number of countries; they were mainly in urban communities.

In the mid-seventies the previous approach of concentrating first on viable urban communities and then proceeding to the poorer sections was modified: governments, individually and collectively, declared their intent to reorient their plans, policies and programmes so as to serve directly the poorest sections of the community.

In 1972, the United Nations Conference on the Environment (Stockholm) gave international expression to governments' concern. This was reiterated in 1976 at the Conference on Human Settlements (Habitat) in Vancouver, Canada. At that Conference, the target of providing clean water to <u>all</u> people by 1990 and a major thrust to provide adequate sanitation were adopted; it was recommended that the target should be considered by the imminent United Nations Water Conference.

The Water Conference (Mar del Plata, Argentina, March 1977) adopted the targets and a Plan of Action, and declared the Third United Nations Development Decade (1981-1990) to be the International Drinking Water Supply and

Sanitation Decade, during which these targets were to be achieved (Annex I). The period up to the commencement of the Decade was considered a preparatory phase, during which governments were requested to assess their needs and resources and reorient their programmes, through appropriate strategies, towards achieving the goals of the Decade.

The Conference on Primary Health Care (Alma Ata, USSR, September 1978) stated in no uncertain terms that safe drinking water and sanitation are basic elements of primary health care - which is the approach for all countries to reach the goal of "Health for All by the Year 2000". This approach was approved by the United Nations General Assembly at its Thirty-second Session (Annex II). WHO was designated as the Executing Agency.(23)

GLOBAL SITUATION

The task facing those who aim to fulfil the Decade's target (safe water and sanitation for all by 1990) is formidable. As may be seen from Tables 7 and 8 approximately three out of five persons in the developing countries do not have access to safe drinking water; only about one in four has any kind of sanitary facility, be it only a pit latrine. The urban areas are somewhat better served, 75% of the population having some form of water supply through house connections or standpipes, and 53% having "adequate" sanitation. In rural areas only 29% have equivalent water supply and 13% have sanitation. Coverage improved between 1975 and 1980 for water - though much less between 1970 and 1975 - but for sanitation it seems to have declined. Drinking water and sanitation for all by 1990 means providing an estimated 3 000 million people with new or improved services at a cost of between US $ 300 billion and 600 billion (1978 rates) depending on the technology chosen. The annual investment rate works out to be between five and ten times the estimated level in 1979.(31)

The above global averages do not reflect the considerable differences existing between regions and from country to country. Moreover, it must be emphasized that many urban water supply systems are overloaded to the extent that intermittent supply has to be resorted to, so as to ensure water to all areas: in 1970, as much as 54 per cent of the population served by public

piped water received it only on an intermittent basis. A considerable quantity of water is also "unaccounted for" (undetected leakage, unauthorized use, unmetered supply, etc.); while no firm data are available, the approximately loss is put at between 20 per cent and 50 per cent of the treated water leaving the waterworks.(23)

STATUS OF SERVICES IN THE EASTERN MEDITERRANEAN REGION

The Region, consisting of twenty-three developing countries, has a population of more than 256 million (1980 figures) out of which more than 160 million live in rural areas.

The level of social development that has been reached differs from country to country and the range of their economic development is quite wide. Within the group lie some of the richest countries in the world, measured in terms of gross national product *per capita*; while alongside are some of the poorest countries, engaged in a continuing struggle for self-improvement.

As regards water supply and sanitation services in the Region's Member States, these range from 20 per cent to 100 per cent for urban water supplies, from 6 per cent to 100 per cent for rural water supplies, from 20 per cent to 100 per cent for urban sewerage, and from very low services indeed in rural areas to total sanitation provision. It may be of interest to note that the recorded infant mortality rate ranges from 160 per 1 000 live births to 22; the literacy figures vary from 12 per cent to 60 per cent; and the lowest life expectancy index is 42 years, and the highest 59. The quality of life index (QLI)*, which is based on an assumed relationship between infant mortality, life expectancy, and literacy, ranges in countries of the Region from 11 to 85, on a total scale of 100.(26)

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*The quality of life index (QLI) measures data for infant mortality (i), life expectancy (l), and literacy (Lt) on a scale of 1 to 100, within which countries are ranked according to their performance. For infant mortality, for example, the most favourable figure achieved (8 per 1 000 live births) is rated 100 and the poorest (163 per 1 000) is rated 1. The same procedure is used for life expectancy at birth (75 years = 100), versus 39 years = 1. Literacy figures range from 5 per cent = 1 to 100 per cent in various developed countries. By using the formula Index for Country (X) = i (x) + l(x) + Lt(x) ÷ 3, the QLI for each country can be calculated.

An overall picture, for each of the Region's Member States, with respect to their achievements, constraints and tasks required to be performed for attaining water supply and sanitation decade targets is presented in Table 11.[26] Taking the Region as a whole it can be stated that the proportion of rural population having adequate supplies has remained static at about 20 per cent since 1970, while the urban population has marginally increased from 77 per cent to 80 per cent in spite of the fact that urban population growth has been much higher (about 7 per cent compared to under 2 per cent in rural areas).

According to recent statistics (1980, Table 10), as much as 75% of the population in nine out of the twenty-three Member States in the EMR have relatively easy access to safe water supplies (Figure 5). Six countries lie in the 50-75% range, while in eight countries more than 50% of the population still have to be provided with this basic need (Table 10). To the latter group belong Afghanistan, Democratic Yemen, Oman, Pakistan, Saudi Arabia, Somalia, Sudan and Yemen Arab Republic. Seven of these countries, which must depend heavily on bilateral and international assistance for accelerating sector development, constitute nearly 50% of the total population of the Region (Figures 6 and 7).

As regards sanitation, no reliable data exist; available figures however show that not more than 29% of the population in EMR benefits from facilities for sanitary disposal of excreta and domestic liquid wastes (Figure 7).

It would further be seen that most of the growth in provision of safe water has occurred in urban areas which are comparatively easier to serve. This is so because the consumers are generally more affluent; there are unit cost advantages because of high population densities, technicians are easier to locate and employ, and so on.

Development

A reliable prognosis of the development in the field of water and sanitation might not be possible at this stage. Data evaluated for those Member States which have prepared long-term sectoral plans indicate that full coverage of their entire population might be more feasible by the year 2000

(Figures 6 and 7). In terms of Decade targets this implies that the level of access to safe water can be raised from the present 50% to more than 75% by the end of 1990. Taking into account a population growth of 2.6% per annum, this increase would represent an additional population served totalling 130 million. The difference of 25% between 1990 "served" and "total" population represents almost the same amount by which the total population is expected to grow between 1980 and 1990 (76 million).

The cost of providing water supply facilities would be of the order of US $ 8 000 million based on an assumed rate of US $ 60 *per capita*. As the Decade approach calls for complementary sanitation and water supply development to achieve fuller health benefits, parallel construction of waste disposal facilities for approximately 184 million people would be required. The investment in the Region for sanitation based on a *per capita* cost of US $ 90 would be US $ 16 000 million or annually US $ 1 600 million. The question arises that even if all funds needed were made available, are the existing institutional infrastructures and manpower available in EMR countries adequate and fully geared to execute programmes and projects of such huge magnitude during the next ten years? Realistically speaking this might not be the case in many of the Member States.

NEEDS AND CONSTRAINTS

According to the classification[25] based on income and water service levels of Member Countries*, the range of the scale varies from 1A to 4C. Countries seem to be equally divided among the three classifications A, B and C. As regards GNP *per capita*, only five are capital-surplus (class 4); four have more than US $ 1 000 *per capita* (class 3); and the majority fall into classes 1 and 2.

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*This classification is as follows:

1 = < 300 $ *per capita*	A = < 35 per cent service
2 = 300 - 1 000 $ *per capita*	B = 35 per cent to 70 per cent service
3 = > 1 000 $ *per capita*	C = > 70 per cent service
4 = capital surplus country	

The countries in classes 3 and 4 face the same problems with regard to their water supply and sanitation programmes as those belonging to classes 1 and 2 in terms of shortage of managerial and technical skills, need for institution-strengthening, and weak coordination among related institutions. Because they have adequate financial resources, however, these countries are able to import technology, technical skills, and sometimes even labour to realize their development programmes. This situation does not eliminate the constraints which other countries of the Region face, though it may alleviate the adverse effects on the implementation programmes.

From the above analysis it is also evident that no minor adjustments to existing methodologies and techniques are likely to produce the desired results of providing safe water and hygienic methods of waste disposal. Obviously more radical approaches and revolutionary changes in the rate of progress are called for, if targets of the Decade are to be achieved in the foreseeable future.

The critical problems faced in particular by the remaining countries include:

(a) constraints at resource level, because of competition from other development sectors for the use of the limited available human, financial and material resources;
(b) lack of awareness among public opinion moulders of the needs and aspirations of the people, which would require higher priority to be given to the provision of basic sanitary services;
(c) lack of knowledge, understanding and motivation on the part of public administrators as to the importance of water supply and sanitation in a country's development;
(d) lack of knowledge as to the social and cultural aspects of sector development, particularly sanitation;
(e) fragmentation of responsibilities among many agencies, resulting in uncoordinated programme activities;
(f) absence of realistic financial policies, particularly for smaller communities and rural areas;

(g) lack of trained manpower;

(h) lack of appropriate technology and lack of use thereof.

The development of the water supply and sanitation sector is a capital-intensive and complex multidisciplinary exercise. As regards complexity, it is one of the most difficult of development activities in that it does not depend solely on the "hardware" aspect (finance, material and equipment) but also on cultural, institutional, socio-economic, industrial and community attitudes.

Most of the constraints encountered are not confined to countries of the Eastern Mediterranean Region, but are common, though at different levels of importance, to all developing countries.

Some of the principal constraints in the development of this sector are presented below.

Resource level

Climatological

Since all the countries of the Region are situated in the sub-arid to arid climatological belt, water sources are scarce, development costs are high, and the results are not always reliable either as regards quantity or quality.

Manpower

The dearth of managerial, technical and semi-skilled personnel is a major constraint in all aspects of development, but the problem is more acute in the water supply and sanitation sector. This is because, by their nature, most water supply and sanitation projects are comparatively small projects from the investment point of view - and even junior technicians derive more professional satisfaction from working in large "prestige" projects, where the salaries and amenities offered are far better than in the water and sanitation sector. Hence, the drain of national managerial and technical staff to other development projects.

Logistic difficulties in obtaining a consistent supply of material and equipment further hamper programmes in this sector. Although the material

and equipment needed for projects are not sophisticated, in most cases they have to be imported, as do also the spare parts. The prevailing economic situation in most countries does not always allow for this to be programmed and the resultant delays can upset established projects. Moreover, even if the availability of the "hardware" is secured, difficulties in storing, transport, etc., can jeopardize the programming and planning.

Informational

As the data on which it must be based are either non-existent or at best incomplete, the elaboration of the water supply and sanitation sector activities of national socio-economic plans is far from being adequate.

Projections of expenditure for the different years of the development plan are either under- or over-estimated, so that the financial provision from the national budget tends to vary. Furthermore, the funds generated from existing water schemes generally fall short of the anticipated revenue, for various reasons. At the same time, the foreign exchange component of the sector's expenditure cannot be consistently covered, either by the national budget or by the somewhat uncertain contributions of external assistance.

Technological Level

In most instances, in developing countries, various technologies are imported exclusively from the economically developed world. This is due to the fact that the responsible professionals are either trained in those developed countries or are oriented towards their standards, criteria and practices. Even the specialized workers that are imported have been conditioned to the environment in which they were trained and are inclined to apply the "stock-in-trade" models of that environment to the developing countries, instead of trying to find the most appropriate technology for water supply and sanitation schemes (they also would rather be associated with "prestige" technology projects). The absence of use of the appropriate technology makes water supply and sanitation schemes expensive to build and difficult to operate and maintain. An IBRD report[6] based on a review of some 18 000 publications on sanitation concluded that less than 2% of these are of practical value in developing countries.

The following description of the situation in one of the developing countries could be applied to some of the countries in the Eastern Mediterranean Region:

"To emulate the developed nations in providing potable water to rural communities, many nations have imported conventional water treatment (coagulation, sedimentation, rapid-sand filtration and chlorination) as a panacea for their rural health and water ills. For several reasons this has proved to be a disillusioning experience. Capital costs are high, and each plant must generally be tailored to a local set of conditions. This means that design and construction are time-consuming and require well-trained personnel. In Thailand operational difficulties in rural communities were found to be more numerous; laboratory equipment was not available for daily or weekly jar tests to determine proper chemical doses; operators were not sufficiently trained to perform or understand coagulation jar test results; chemical costs were expensive in rural areas and operators often tried to cut back on chemical use to reduce water treatment costs; chemicals ran short and ordering in advance or obtaining additional chemical deliveries on time was not always a simple task in distant communities; without proper dosages the chemical coagulation-sedimentation portions of the plant operated ineffectively with the result that turbidity loads were almost entirely handled by the rapid-sand filters; understanding of why or when to backwash the rapid-sand filter was generally not known; proper sizing of sand was often overlooked during construction in some areas; good sand was difficult to obtain; and lack of sufficient operating funds often curtailed use of chemicals and limited plant operation to 4-6 hours per day of discontinuous production. These difficulties left village leaders and villagers alike feeling cheated and deceived when what they received was seemingly an out-of-place and unworkable technology."(4)

Institutional Level

Safe water and sanitation are indispensable components of primary health care, as defined by WHO, for achieving the goal of HFA/2000. The health agencies therefore should assume a greater and more prominent role in the planning of sector development strategies and take an enlightened interest in sector coordination at all administrative levels.

It should be noted, however, that the proliferation of agencies and institutions often leads to duplication, overlapping, and inefficient functioning. This is particularly true in the water and sanitation sector. In cities, the water supply is often under a different management from waste collection and disposal. In rural areas, domestic water may be handled in a variety of ways - as a principal aim; as a subsidiary to irrigation; as a sector of the national water agency; or as a sector of the Ministry of Public Health. The same is true of sanitation.

Community Level

Community participation and self-reliance are major aspects in developing and operating water supply and sanitation schemes. Because of the different socio-economic conditions in different parts of a given country, it is not possible to adopt a tailor-made model for community participation in such schemes. A case-by-case, project-by-project approach to securing community involvement in terms of money and/or labour for implementation, maintenance and operation of the schemes needs to be studied and put into effect. Users must be consulted about design, and should be involved not only in maintenance but in promoting the use of the facilities.

Operation and Maintenance

Too often, even where technical design and capital investment costs are carefully taken into account, the estimates for operation and maintenance are either neglected or are imperfectly planned, and the consequence is neglect of the installations and the eventual decline or failure of the programme. It is therefore essential that the community should be involved in this task; that training of community personnel should be undertaken; but also that governments should share the cost of maintenance and operation of facilities.

Education of the Community

People do not always appreciate the benefits they can derive from water supply and sanitation; this is an obstacle to their participation in the planning, operation and maintenance of facilities. Education, through schools and the mass media, should be undertaken before the facilities are installed. Such education should also cover the appropriate use of the facilities, including personal hygiene practices.

Main Information Gaps

The areas where information is required for sector development in the countries of the Region are those relating to:

- water sources (reliable data, both qualitative and quantitative);
- appropriate technology, design, construction, operation and maintenance, criteria and standards;
- medium-term and short-term planning and programming policies and procedures;
- community participation, motivation and incentives;
- manpower requirements;
- manpower training;
- water quality monitoring and control;
- level of services and financial aspects;
- drinking water supplies and sanitation;
- inventory of existing schemes;
- organizational structures for the sector.

V ACHIEVEMENT OF THE GOALS OF THE INTERNATIONAL DECADE

Possible Framework for National Action Plans

In the general context as well as in relation to the International Drinking Water Supply and Sanitation Decade (1981-1990), action should focus on promoting:

Decade Programmes

1. Member States should prepare national plans establishing, on a long-term basis, strategies for implementation, goals, targets, mechanisms and identification of resources. These should be based on evaluation of the completed projects.

2. National consultation or conferences, if held at the country level, can provide an excellent forum for discussing policies and strategies, reviewing and assessing options, determining responsibilities, introducing policy orientation, involving mass media and stimulating open discussion on the re-allocation of priorities between sectors and within the water supply and sanitation sector. Such conferences held in some of the EMR countries have had a valuable impact on development of national Decade plans.

3. As the sector is very much diversified in most countries, in terms of division of responsibilities, it is vital that Member States establish a body or designate an existing agency or ministry to play the role of active co-ordination and to provide the much-needed dynamism. In some of the countries where high-level National Action Committees have already been established, these should be further strengthened with a view to making them fully effective.

Community participation

Massive efforts should be mobilized to encourage and motivate communities at an early stage, by a carefully planned use of communication media, which are also a permanent feature of training, and support programmes for community participation and health education. Communication media should utilize the community leaders, including Imams who in Islamic communities have a sizeable following. They in turn should be given short orientation courses which should emphasize the relationship between safe water, good sanitation, food hygiene, adequate nutrition levels and health. Cultural and behavioural aspects for each community should be given utmost importance, if sanitation programmes are to enjoy acceptability and therefore be successful.

An administrative framework with decentralization in view should be prepared at the national, regional and local government levels in the countries to seek collaboration and active participation of the communities for the promotion of Decade programmes. Needless to say, participation in the programmes and projects would be necessary at all stages, from the planning to the maintenance and operation of the facilities.

Information System

Information is essential for the design, management, operation and maintenance of water supply and sanitation facilities if programmes are to meet the criteria of cost-effectiveness, simplicity of operation and maintenance and repair, and also to encourage community participation. It might be mentioned that a principal constraint is generally not the lack of such information in a particular Member State; it is the failure to disseminate it within agencies responsible for development of the sector.

Responsibility for dissemination of information is not always clearly defined. There is therefore a need to designate an institution or agency charged with the tasks of collecting, processing, exchanging and transferring information and for making decisions on the choice of technology.

It is of interest to note that WHO's International Reference Centre for Community Water Supply in The Hague, has initiated a "Programme of Exchange and Transfer of Information" (POETRI) with the objective of strengthening national information and documentation infrastructure and improving their capacity to absorb scientific and technical information.

Human Resource Development

As already stated, the planning and implementation of human resource development may in fact be one of the most crucial elements contributing to the success or otherwise of the Decade programmes. The manpower development and training strategy should reflect the aims of the Decade and include the following activities:

- the elaboration of national manpower development schemes as part of the overall plan;

- strengthening of existing programmes of training sanitary engineers, financial analysts and managers;
- expansion of existing and establishment of new national and regional vocational/technical training institutions to cater for middle- and lower-level craftsmen for water supply and sanitation;
- special promotion of training for multi-purpose "barefoot technicians" (to use the equivalent of the Chinese "barefoot doctors") for engineering works;
- development of teaching and learning materials, manuals, guidelines and visual aids in local language(s).

Material Resources

Shortage of many materials such as cement, steel, pipes, pumps, chlorine gas and others are known to be impediments affecting progress in the sector work. A careful assessment of the appropriateness of the types of material and equipment now utilized for water and sanitation facilities should be undertaken. In the light of this, some new or strengthened capacities for producing required materials may have to be created. Where such local capacities do not exist, efforts should be made to assure availability of materials sufficient to meet targets of the Decade through the import or development of alternative technologies using available materials.

HEALTH EDUCATION

In view of the accelerated growth of populations and the increase in the pollution of water sources, health education is an essential element, in order to build up awareness of health benefits associated with safe water and sanitation. In most countries of the Region, however, health education is recognized as a difficult and weak component in the water supply and sanitation programmes.

Health education programmes, planned with local participation and in tune with social and cultural programmes, should be drawn up. These should be integrated with those for other activities of primary health care, such as population planning, mother and child health, nutrition, etc.

Operation and Maintenance

As already mentioned, the situation of operation and maintenance of water and sanitation utilities in EMR is not in a satisfactory state. There is thus an urgent need to assess the situation with a view to pinpointing the causes and finding solutions to the problems. Sufficient funds, better management practices and trained manpower must figure prominently in long-term planning for better operation and maintenance.

Water Quality Surveillance

The importance of an effective surveillance of the quality of water supplied to consumers, with proper measures taken to prevent water from becoming polluted, is well known. This implies that water supply improvements without sanitation and health education would never produce the desired results of health promotion.

Member States should therefore include programmes for water quality surveillance in support of Decade activities. Towards this end, they should establish or strengthen water quality surveillance at all stages of development and distribution; undertake staff training, including orientation of public health inspectors, sanitarians and water-works operators; strengthen laboratory services for bacteriological, chemical and physical testing of samples from rural and urban areas and undertake preparation of manuals and guidelines based on standards adopted and relevant legislation.

Research and Development Needs

During the Decade, enormous sums of money running into billions of dollars are likely to be invested in water supply and sanitation programmes, throughout the Eastern Mediterranean Region. The technology options in implementing the schemes in different parts of a particular country with varying degrees of development, different hydro-geological conditions, in addition to the difference between rural and urban environment, become highly complex to meet the requirements of appropriateness. The multi-disciplinary nature of the personnel involved adds yet another dimension regarding the development of appropriate technologies. The Member States

should: (i) establish or strengthen research organizations and relevant institutions in the universities by charging them with the tasks of determining the technical and economic feasibility of various technological options;
(ii) evaluate economic and environmental effects of technologies which provide for conservation of water, reclamation and re-use of wastewaters; and
(iii) develop energy-saving devices and technological innovations at intermediate levels to improve efficiency and enhance appropriateness. Work on alternative energy resources for use in the water sector would be another desirable activity.

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TABLE 1

BODY CONTENT, DAILY REQUIREMENTS AND DAILY INTAKES OF TRACE ELEMENTS IN ADULTS (APPROXIMATE VALUES IN mg)[a]

Element	Body content	Daily requirements	Dietary intake	% absorbed from diet
Si	18 000	3	20	1
Fe	4 200	10	13	7
F	2 600	1	0.3	85
Zn	2 300	3	13	40
Cu	75	2	5	35
V	25	0.003	2	5
I	20	0.2	0.2	100
Se	20	?	0.1	60
Sn	17	3	3	1
Mn	15	2.5	4	3
Ni	10	0.02	0.4	5
Mo	9	0.1	0.2	50
Cr	6	0.2	0.1	10
Co	1.5	0.00004	0.3	80
Ca	10	800	1 000	30
Mg	19 000	350	300	35

[a] Data taken from various sources.

TABLE 2

MAXIMUM CONTRIBUTION OF DRINKING WATER TO TOTAL DAILY INTAKE OF SOME ELEMENTS (APPROXIMATE VALUES)[a]

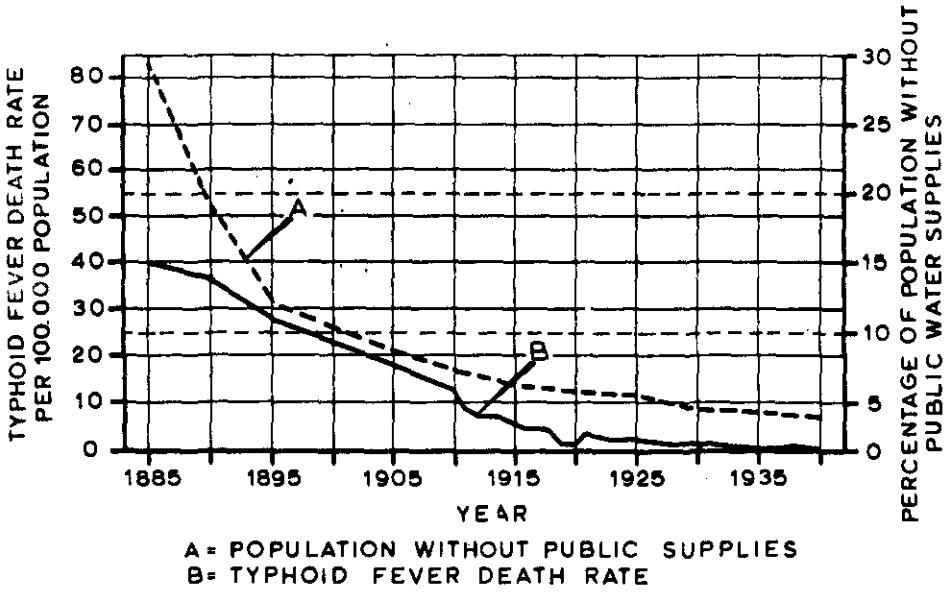
Element	Total daily intake (mg)	Maximum daily intake			
		from tap water		from mineral water	
		(mg)	(%)[b]	(mg)	(%)[b]
Li	0.1	0.02	20.0	7.5	>100
Mo	0.2	0.0004	0.2		
Se	0.2	0.005	2.5		
Sn	0.2	0.012	6.0		
Cr	0.2	0.01	5.0	0.06	30
I	0.2	0.005	2.5		
Ni	0.3	0.026	9.0	0.22	73
F	2.4	1.4	60.0		
V	2.0	0.012	0.6		
Cu	2.5	0.7	28.0	0.06	2,4
Mn	3.0	0.12	4.0	2.2	73.0
Zn	10.0	1.4	14.0	0.12	1.2
Fe	23.0	3.0	13.0	9.00	39.0
Mg	250	45	18	250	100
Ca	1 000	280	28	900	90

[a] Based on SCHROEDER, and ZOETMAN, B.C.J. and BRINKMANN, F.J.J., Human intake of minerals from drinking water in the European communities, *In*: Hardness of drinking water and public health, *Proceedings of a Colloquium, Commission Eur. Communities,* Luxembourg, 1975, pp. 173-202. Blank spaces indicate that data are unavailable.

[b] As percentage of total daily intake.

FIGURE 1

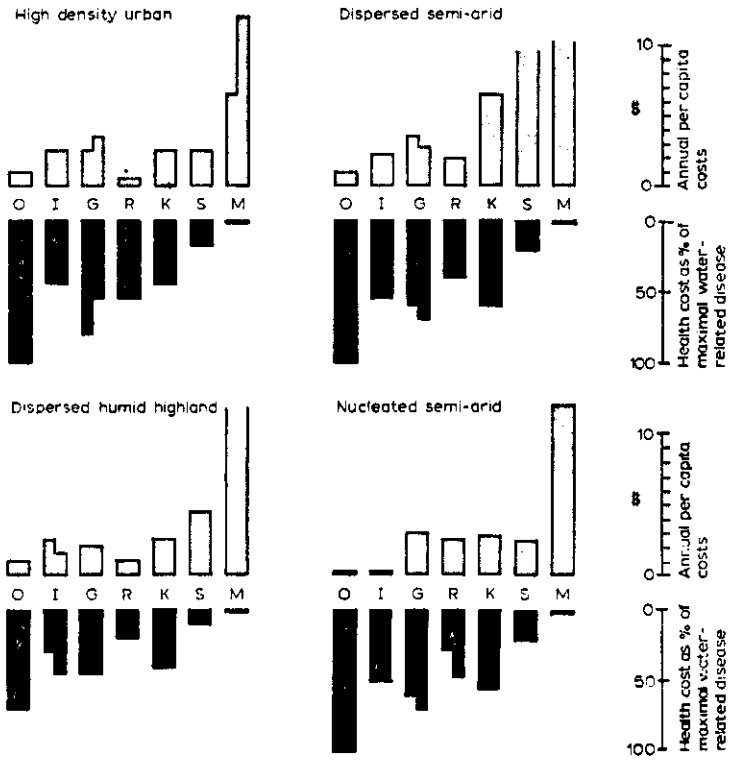
RELATION OF TYPHOID FEVER DEATH RATE TO
PERCENTAGE OF POPULATION WITHOUT PUBLIC WATER SUPPLIES IN
THE STATE OF MASSACHUSETTS, USA



A = POPULATION WITHOUT PUBLIC SUPPLIES
B = TYPHOID FEVER DEATH RATE

FIGURE 2

THE DIVERSITY OF DISEASE-COSTS AND THE VARIABLE BENEFITS RESULTING FROM DIFFERENT IMPROVEMENTS TO WATER SUPPLIES IN FOUR DIFFERENT HABITATS IN DEVELOPING COUNTRIES



Improvement categories: 0, nil; I, individual; G, small group improvement; R, rural pipelines; K, kiosk or municipal standpipe; S, single tap in house; M, multiple taps in house.

FIGURE 3

REDUCTION IN THE DEATH-RATE
FROM TYPHOID BY SANITATION OF EXCRETA DISPOSAL

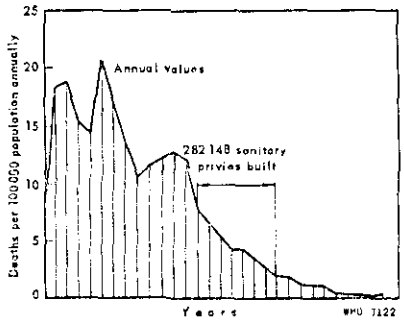


FIGURE 4

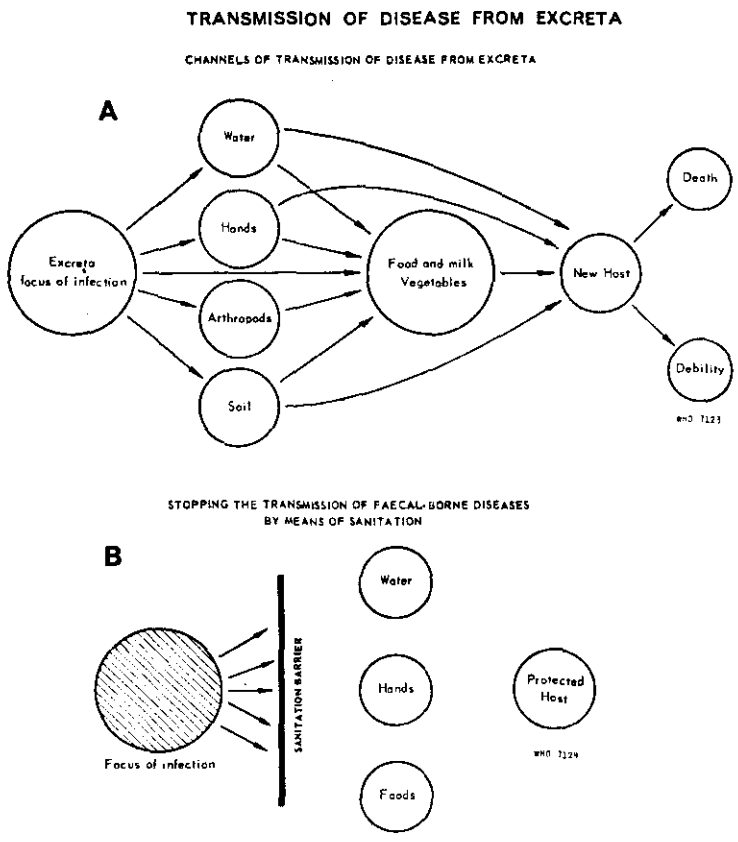


FIGURE 5

ACCESS TO SAFE WATER

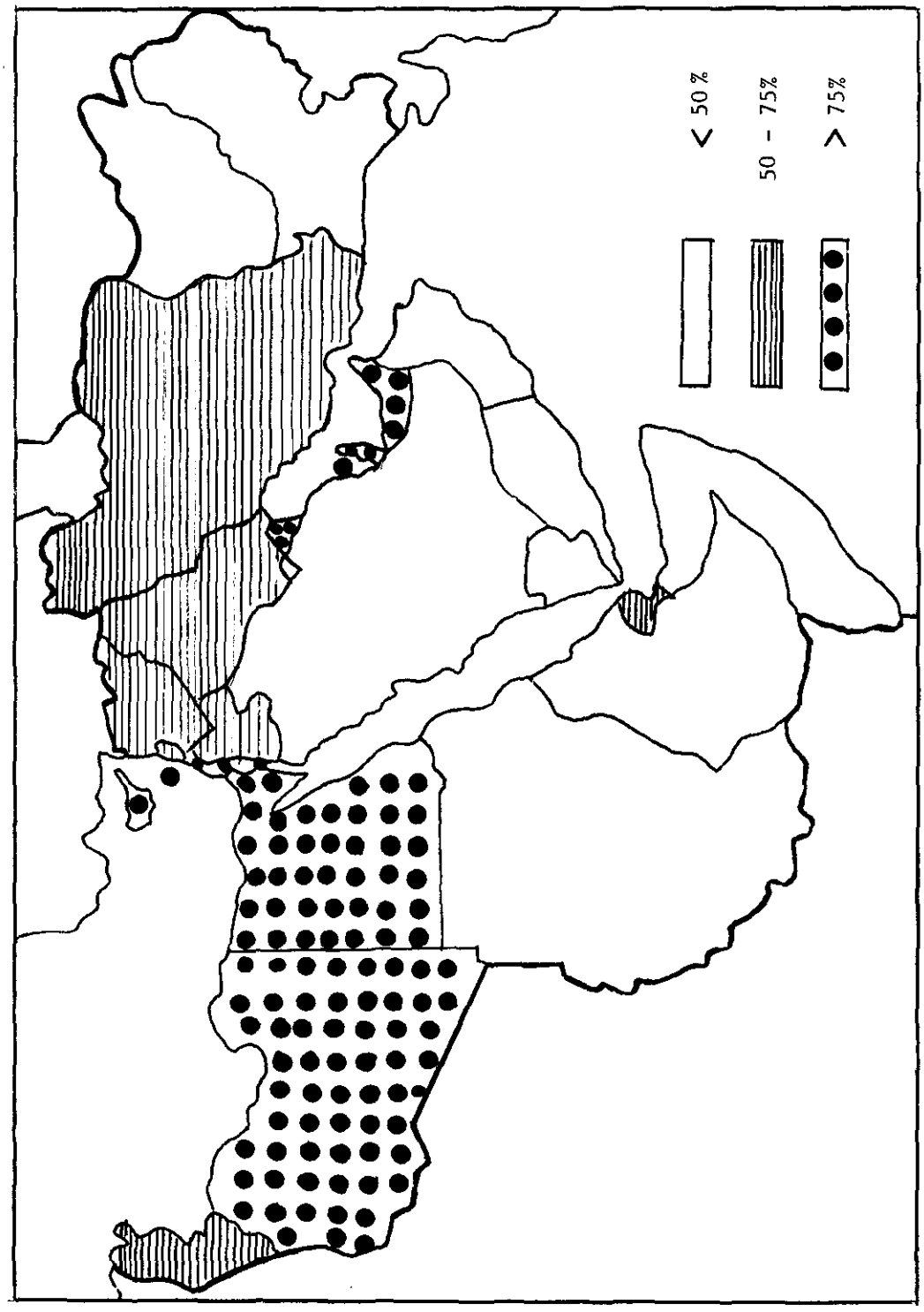


FIGURE 6

DEVELOPMENT OF POPULATION AND DRINKING WATER AND SANITATION COVERAGE
(WATER)

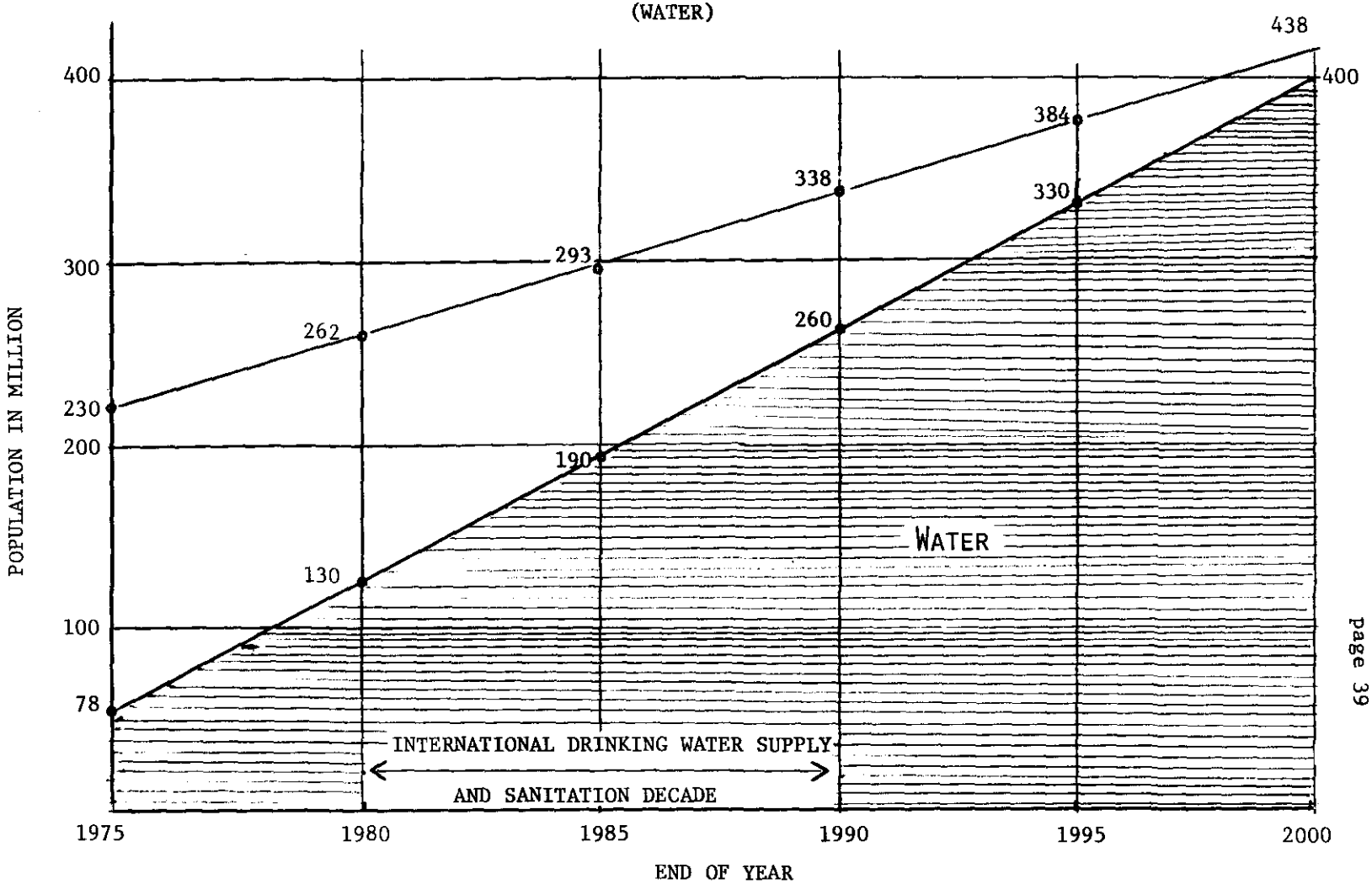


FIGURE 7

DEVELOPMENT OF POPULATION AND DRINKING WATER AND SANITATION COVERAGE
(SANITATION)

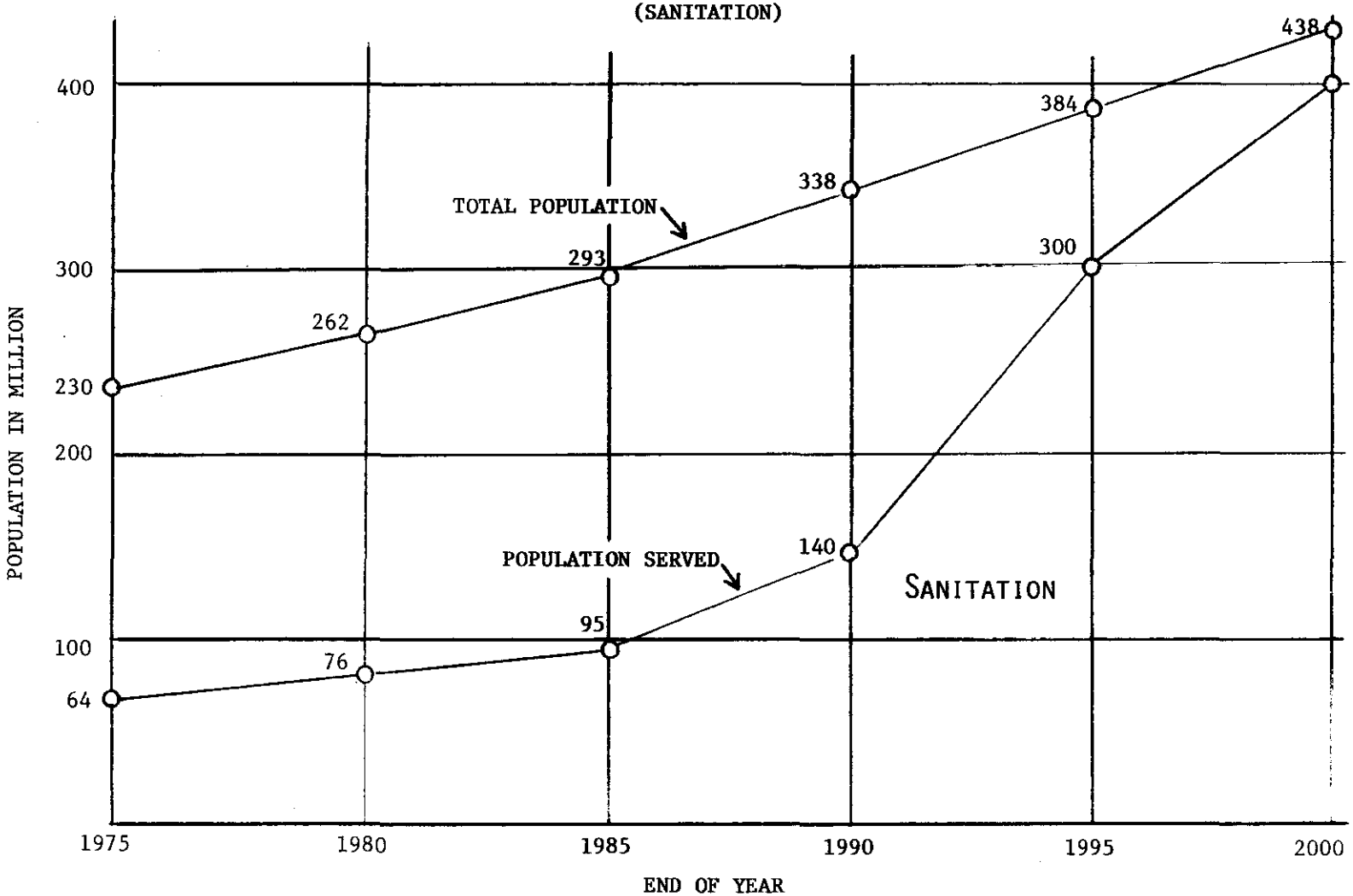


TABLE 3

CLASSIFICATION OF DISEASES RELATED TO WATER SUPPLIES AND SANITATION

Category	Examples	Cause	Relevant improvements
I Waterborne infections			
(a) classical (b) non-classical	Typhoid, cholera, infective hepatitis	Water which has been contaminated by poor sanitation acts as vehicle for infecting agent.	Ensure microbiological sterility Improve sanitation and water quality
II Infections from washing in polluted water			
(a) Diseases due to lack of water for washing	Scabies, trachoma, bacillary dysentery	Insufficient available water to allow people to wash regularly; infections develop.	Provide more water Improve personal cleanliness
(b) Diseases from washing in polluted water	Skin sepsis, cutaneous fungal infections		
III Water-based diseases			
(a) Penetrating skin (b) Ingested	Schistosomiasis Guinea worm	Essential part of life cycle of infecting agent takes place in aquatic animal; person drinks or walks in the water.	Avoid infested water Protect source
IV Infections carried by water-related insect vectors			
(a) Biting near water (b) Breeding in water	Sleeping sickness, malaria, yellow fever	Infection-carrying insects breed in water and bite near it, especially when water is stagnant	Water piped from source Water piped to site of use

TABLE 4

MAIN INFECTIVE DISEASES IN RELATION TO WATER SUPPLIES

Category	Disease	Frequency	Severity	Chronicity	% reduction by water improvements
Ia	Cholera	+	+++		90
Ia	Typhoid	++	+++		80
Ia	Leptospirosis	±	++		80
Ia	Tularaemia		++		40?
Ib	Paratyphoid	+	++		40
Ib	Infective hepatitis	++	+++	+	10?
Ib	Some enteroviruses	++	+		10?
Ia, IIb	Bacillary dysentery	++	+++		50
Ia, IIb	Amoebic dysentery	+	++	++	50
Ib, IIb	Gastroenteritis	+++	+++		50
IIa	Skin sepsis and ulcers	+++	+	+	50
IIa	Trachoma	+++	++	++	60
IIa	Conjunctivitis	++	+	+	70
IIa	Scabies	++	+	+	80
IIa	Yaws	+	++	+	70
IIa	Leprosy	++	++	++	50
IIa	Tinea	+	+		50
IIa	Louseborne fevers		+++		40
IIb	Diarrhoeal diseases	+++	+++		50
IIb	Ascariasis	+++	+	+	40
IIIa	Schistosomiasis	++	++	++	60
IIIb	Guinea worm	++	++	+	100
IVa	Gambian sleeping sickness	+	+++	+	80
IVb	Onchocerciasis	++	++	++	20?
IVb	Yellow fever	+	+++		10?

TABLE 5

ESTIMATED COST OF TYPHOID FEVER AND OF DIARRHOEA AND ENTERITIS PER 100 000 POPULATION IN CERTAIN COUNTRIES FOR THE YEAR 1949

Country	Income *per caput* (US $)	Typhoid fever		Diarrhoea and enteritis		Total deaths	Total cases	Funeral Expenses[c] (US $)	Medical care[c] (US $)	Value of lives lost[c] (US $)	Value of working time lost[c] (US $)	Total cost (US $)
		deaths[a]	cases	deaths[b]	cases							
USA	1 452	0.1	1	5.7	285	5.8	286	1 160	21 450	17 795	14 635	55 040
France	450	2.0	20	21.4	1 070	23.4	1 090	1 450	25 800	28 500	17 250	73 000
Portugal	140	8.6	86	195.2	9 760	203.8	9 846	3 930	72 300	66 800	48 200	191 230
Japan	98	1.3	13	88.0	4 400	89.3	4 413	1 200	22 850	18 500	15 200	57 750
Colombia	200	12.4	124	128.1	6 405	140.5	6 529	3 875	68 900	76 800	46 200	195 775
Ceylon	83	12.0	120	69.5	3 475	81.5	3 595	930	15 700	22 000	10 500	49 130
Dominican Republic	94	13.5	135	118.2	5 910	131.7	6 045	1 700	29 900	35 350	19 950	86 900
India[d]	54	58.6	234	65.8	3 290	124.4	3 524	925	9 840	40 700	6 800	58 265

[a] Typhoid fever mortality rate assumed to be 10%.

[b] Diarrhoea and enteritis mortality rate assumed to be 2%.

[c] Funeral expenses based on $200 in USA; [19] medical care costs based on $75 per case in USA; [19] value of lives lost (ages 0-45) from typhoid and paratyphoid fevers estimated at $15 500 and from diarrhoea and enteritis (ages 0-45) at $2 850 for USA. [19] Working time lost per case assumed to be two weeks, with a value of $50 in USA. The estimated unit cost of funerals and medical care and the value of lives and working time lost for countries other than the USA were assumed to be in the same ratio to similar costs and values in the USA as the *per caput* income for those countries to that for the USA.

[d] Mortality rates for typhoid fever and for diarrhoea and enteritis are not available for India. The rates and values listed are those for cholera and for diarrhoea and dysentery.

TABLE 6

ESTIMATED *PER CAPUT* COST OF RURAL WATER SUPPLIES AND LATRINES AND COST OF TYPHOID FEVER AND OF DIARRHOEAL AND ENTERITIS PER 100 000 POPULATION FOR CERTAIN COUNTRIES IN 1949

Country	Cost *per caput* of water supplies (US $)[a]		Cost *per caput* at latrines (US $)[a]		Total cost per 100 000 population (US $)	Cost of typhoid fever and of diarrhoea and enteritis per 100 000 population (US $)	Approximate number of years required for amortization of water supply and sanitation facilities from savings
	capital cost	maintenance	capital cost	maintenance			
USA	17.00	0.55	14.00	5.75	3 730 000	55 720	68
France	5.25	0.17	4.35	1.80	1 157 000	73 000	16
Portugal	1.65	0.05	1.35	0.55	360 000	191 230	2
Japan	1.15	0.04	0.95	0.40	254 000	57 750	5
Columbia	2.35	0.08	1.95	0.80	518 000	195 775	3
Ceylon	0.98	0.03	0.80	0.33	214 000	49 130	4
Dominican Republic	1.10	0.04	0.94	0.38	246 000	86 900	3
India[24]	0.63	0.02	0.52	0.21	138 000	58 265	3

[a] This includes the cost of labour, materials, and equipment. These costs could be reduced considerably by the use of voluntary labour and materials available locally to the householder.

TABLE 7

ESTIMATED SERVICE COVERAGE FOR DRINKING-WATER SUPPLY IN DEVELOPING COUNTRIES, 1970-1980[a]

	1970		1975		1980	
	Population served (in millions)	Percentage of total population	Population served (in millions)	Percentage of total population	Population served (in millions)	Percentage of total population
Urban	316	67	450	77	526	75
Rural	182	14	313	22	469	29
Total	498	29	763	38	995	43

TABLE 8

ESTIMATED SERVICE COVERAGE FOR SANITATION IN DEVELOPING COUNTRIES, 1970-1980[a]

	1970		1975		1980	
	Population served (in millions)	Percentage of total population	Population served (in millions)	Percentage of total population	Population served (in millions)	Percentage of total population
Urban	337	71	437	75	372	53
Rural	134	11	209	15	213	13
Total	471	27	646	33	585	25

[a]WHO estimates submitted to the General Assembly of the United Nations by the Secretary-General in his report on the International Drinking Water Supply and Sanitation Decade: Present situation and prospects (United Nations document A/35/150).

Figures do not include the People's Republic of China.

TABLE 9

No.	Country	10^6 - Total 1980 Population			Urban W/S		Rural W/S		Urban Sanitat'n		Rural Sanitat'n	
		Urban	Rural	Total	%	No.	%	No.	%	No.	%	No.
1	Afghanistan	2.2	13.3	15.5	20	0.4	8	1.1	NA	NA	NA	NA
2	Bahrain	0.3	0.0	0.3	100	0.3	100	0.04	100	0.26	100	0.04
3	Cyprus	0.3	0.4	0.7	100	0.3	100	0.4	NA	NA	NA	NA
4	Democratic Yemen	0.6	1.3	1.9	68	0.4	23	0.3	NA	-	-	-
5	Djibouti	0.3	0.0	0.34	53	0.2	20	0.0	43	0.13	20	0.01
6	Egypt	18.5	23.5	42.0	97	17.9	74	17.4	70	13.00	5	1.20
7	Iran	17.1	20.9	38.0	86	14.7	33	6.9	NA	NA	NA	NA
8	Iraq	8.4	4.7	13.1	97	8.1	22	1.0	NA	-	-	-
9	Jordan	1.4	1.8	3.2	100	1.4	55	0.9	100	1.4	35	0.5
10	Kuwait	1.4	0.0	1.4	75	1.1	0	0.0	20	0.3	-	-
11	Lebanon	2.2	1.0	3.2	90	2.0	85	0.9	NA	-	-	-
12	Libyan Arab Republic	1.8	2.0	3.0	90	0.9	75	1.5	30	0.3	10	0.2
13	Oman	0.1	0.8	0.9	70	0.1	10	0.1	60	0.1	-	-
14	Pakistan	23.0	50.4	82.4	61	14.0	17	10.1	42	10.0	NA	NA
15	Qatar	0.2	0.0	0.2	90*	0.2*	50*	0.0*	NA	NA	NA	NA
16	Saudi Arabia	3.4	5.0	8.4	65	2.2	20	1.0	NA	-	-	-
17	Somalia	1.0	2.6	3.6	58	0.6	20	0.5	NA	NA	NA	NA
18	Sudan	3.7	14.7	18.4	49	1.8	45	6.6	80	3.0	NA	NA

*Estimate

No.	Country	10^6 - Total 1980 Population			Urban W/S		Rural W/S		Urban Sanitation		Rural Sanitation	
		Urban	Rural	Total	%	No.	%	No.	%	No.	%	No.
19	Syrian Arab Republic	4.0	4.6	8.6	90	3.6	55	2.5	70	2.8	15	0.7
20	Tunisia	3.1	3.3	6.4	96	3.0	29	1.0	64	2.0	60	2.0
21	United Arab Emirates	0.7	0.1	0.8	88	0.6	50	0.1	NA	-	-	-
22	Yemen Arab Republic	0.4	5.5	5.9	95	0.4	6	0.3	-	-	-	-
23	Israel	2.8	1.0	3.8	100*	2.8	100*	1.0				
	Total	96.1	165.9	262.0	80	77.0	32	53.6				
	1990 (Estimate)	130[1]	200[2]	338[3]	95	123.5	60	124.8				
	1980-1990 Increase	33.9	42.1	76	15	46.5	28	71.2				

*Estimate [1]Growth Rate 3.1% [2]Growth Rate 2.3% [3]Growth Rate 2.6%

TABLE 10

EASY ACCESS TO SAFE DRINKING WATER

Line	Country	YES/TOTAL 10^6	YES %	Range		
				<50%	50-75%	>75%
1	Afghanistan	1.5/15.5	10	x		
2	Bahrain	0.3/0.3	100			x
3	Cyprus	0.7/0.7	100			x
4	Democratic Yemen	0.7/1.9	37	x		
5	Djibouti	0.2/0.3	67		x	
6	Egypt	35.3/42	84			x
7	Iran	21.6/38	57		x	
8	Iraq	9.1/13.1	69		x	
9	Jordan	2.3/3.2	72		x	
10	Kuwait	1.1/1.4	78			x
11	Lebanon	2.9/3.2	91			x
12	Libyan Arab Jamahiriya	2.4/3.0	80			x
13	Oman	0.2/0.9	22	x		
14	Pakistan	24.1/82.4	29	x		
15	Qatar	0.2/0.2	90			x
16	Saudi Arabia	2.2/8.4	26	x		
17	Somalia	1.1/3.6	30	x		
18	Sudan	8.4/18.4	46	x		
19	Syrian Arab Republic	6.1/8.6	71		x	
20	Tunisia	4/6.4	62		x	
21	United Arab Emirates	0.7/0.8	88			x
22	Yemen Arab Republic	0.7/5.9	12	x		
23	Israel	3.8/3.8	100			x
24	Total	129.3/262				
25	Range Nos.			8	6	9
26	Unserved, Total	132.7				
27*	Unserved, Lines Σ 1,4,13,14,17,18,22	92.1				
28	Lines 27/26(%)	69.3				

*includes countries which must heavily depend on bilateral and international assistance.

TABLE 11

NATIONAL AND SECTOR DATA RELEVANT TO INTERNATIONAL DRINKING WATER SUPPLY AND SANITATION DECADE, 1981 - 1990

No.	Country	*National Data					Sector Data							Classification of Country	Remarks
		Population		GNP	**Social Indicators		Safe Water		Adequate Sanitation		Sector Organization	Strategy and Planning	Cost, Investment, Finance		
		m	u/r %	$ Per cap.	Poorest in % of population	Quality of Life Index	Urb Pop %	Rur Pop %	Urb Pop %	Rur Pop %					
1	Afghanistan	15.5	15:71 with 14.0 Nomads	190	63	i = 1 = 42 1t = 12	20* HC = 7 SP = 13	3*	low	very low	Three main govt.agencies responsible for sector; institutional reforms required; manpower shortage; expatriates; low community participation; manpower development required.	Planning cycle 79-84 with targets water u 50%, r 13%; sanitation neglected; no Decade plan, planning assistance, adapted technology and pre-investment studies needed	Sec low priority (especially in r) with 1.3% of tot inv; low int cash generation; shortage of funds for O & M in r; new tariff urgent; many ext fin ag.	1A	* Interm (other than in Kabul) and insufficient quantities
2	Bahrain	0.34	78:22	3 790			100 HC = 100 SP = 0	100*	100	100	3 ag responsible for sec; a re-organization within General Authority for elect, water and sewerage planned; lack of trained manpower; expatriates; training prog required; legislation for water resources use and sewerage effluent necessary	National targets and Decade Plan being defined; 3 aquifers depleted and contaminated by saline intrusion reverting to costly desalinated water; water conservation priority; treatment and re-use of sewerage effluent recommended	O & M cost* twice revenue with poor collection; existing tariff not based on capital charges and not conducting to conservation, metering and new tariff recommended	4C	* Based on national report to WHO 1980
3	Cyprus	0.60		1 830	7	85	100 by HC	100 HC = 98 SP = 2			3 ag responsible for sec; good coor; design and construction of proj by international firms.	Main problem is development of additional water resources; mainly surface supplies; proper allocation of water resources between domestic and agricultural use necessary.	Govt finances up to 50% of proj costs; ext TA and CA required.	3C	
4	Democratic Yemen	1.9	33:57 10% Nomads	340		i = 40 1 = 47 1t = 27	68 HC = 34 SP = 22	24*	Low	Very low	3 main institutions responsible for sec: PWC, Local Admin. Org & Local Cooperatives, need strengthening managerial staff shortage; poor O & M due to lack of funds; non-availability of suitable construction contractors & constraint.	Draft Plan 79 - 83 prepared with priority to sec; many proj in progress; no sec goals but Govt strategy is to achieve Decade targets; TA for hydrogeologic survey and proj prep needed.	Low internal cash generation; new tariff structure needed; many ext ag (mainly UN); increased CA required.	2A	*Irregular and of dubious quality and critical in desert areas.

* Population and GNP data are mostly for 1977 and urban/rural distribution data for 1975 (World Bank Report, 1979)

** Population subsisting below a line of minimum income necessary to buy basic requirements of food, clothing and shelter (OECD Observer; Overseas Development Council, Washington, 1978).

NATIONAL AND SECTOR DATA RELEVANT TO INTERNATIONAL DRINKING WATER SUPPLY AND SANITATION DECADE, 1981 - 1990

No.	Country	National Data					Sector Data							Classification of Country	Remarks
		Population		GNP	Social Indicators		Safe Water		Adequate Sanitation		Sector Organization	Strategy and Planning	Cost, Investment, Finance		
		m	u/r %	$ Per cap.	Poorest in % of population	Quality of Life Index	Urb Pop %	Rur Pop %	Urb Pop %	Rur Pop %					
5	Djibouti	0.30	91:9	580			53* HC = 40 SP = 13	20	43	20	RED responsible for water supply in u; Génie Rural for r; Ministry of Public Works responsible for san in u, local authorities in r; weak coor; manpower shortage; lack of spare parts are major constraints; intensive training prog urgent.	No planning mechanism, no Decade plan, proj executed according to availability of ext CA; planning assistance and pre-investment studies required.	Low int cash generation; proj implemented out of ext grants; need for continued CA for sec dev.		*Interm serv and dubious quality other than Djibouti town
6	Egypt	38.5	42:58	320		41 i = 101 l = 54 lt = 44	97* HC = 88 SP = 9	56	70**	5	Ministry of Housing and Reconstruction controls sec with GOPW in charge of r, GCWA in Cairo, AWA in Alex for water, local authorities for other centres; GOSSD responsible for san, SCA responsible for Canal Zone; inadequate institutions; skilled manpower shortage.	Plan cycle 76 - 80; no decade plan but Govt committed to achieve decade goals by increasing sec allocations; pre-inv studies and well-prepared projects required.	Sec 3.5% of tot inv; mainly from Govt contributions; low int cash generation; low absorptive capacity due to lengthy procedures; need for extensive CA, and new tariff.	2A	*Excessive system leakage, interm serv. **With overloaded and poorly maintained sewerage systems.
7	Iran	34.8	45:55	2 160	5	37 i = 120 l = 52 lt = 50	86 HC = 68 SP = 18	33			Regional Water Boards for water in large u centres, municipalities in small centres Ministry of Energy responsible for san in u; Ministry of Health responsible for water and san inv; staffing problems; manpower training prog required.	VIth Planning Cycle 78 - 83, Sec planning by Govt agencies; community involvement encouraged inv; Govt committed to achieve Decade goals for water no targets for ssn.	Sec. 3% of tot public inv cost of sec prog for present Plan $ 700 m of which $ 500 m for water as Govt grants to sec ag; low int cash generation.	3B	Sector information as in 1978

NATIONAL AND SECTOR DATA RELEVANT TO INTERNATIONAL DRINKING WATER SUPPLY AND SANITATION DECADE, 1981 - 1990

No.	Country	National Data: Population m	Population u/r %	GNP $ Per cap.	Social Indicators: Poorest in % of population	Social Indicators: Quality of Life Index	Sector Data: Safe Water Urb Pop %	Safe Water Rur Pop %	Adequate Sanitation Urb Pop %	Adequate Sanitation Rur Pop %	Sector Organization	Strategy and Planning	Cost, Investment, Finance	Classification of Country	Remarks
8	Iraq	12.0	64:36	1 550	11	45 i = 104 l = 55 lt =	90*	14	Low**	Low	5 Ministries involved in sec; re-organization in one State Org completed; Baghdad has Water and Sewerage Boards; poor O & M; shortage of skilled manpower, training prog required; community participation in r to be strengthened.	Plan cycle 76 - 80; no sector targets but Govt committed to Decade goals; hydrogeologic survey and planning assistance needed.	Sec 2% of tot inv; of which 70% for water; low inv cash generation not covering O & M; under-expenditure of Govt allocations; estimated inv for Decade; water $ 1 510 m, san $ 2 750 m.	3B	*Interm serv other than Baghdad, excessive leakage. **Many sewerage schemes under construction.
9	Jordan	3.2	55:45	710	19	46 i = 22 l = 56 lt = 59	60* HC** = 48 SP = 12	55	60 *** Unsatisfactory	Low	6 sec ag involved with weak coor but re-organization planned by merging into one (WSC) in 85; poor O & M, low community participation in r; inadequate manpower; training prog required.	Plan cycle 76 - 80; no targets for sec; dev plan especially for management of water resources and adapted techn in r needed; good prospects to achieve Decade goals if funds become available.	Sec 4% of tot inv; of which 3% for water supply; CA 40% of tot inv by many ag but with u bias; low int cash generation (hardly cover O & M); continued CA required.	2B	*Interm serv excessive leakage. **In Amman City. ***A health hazard due to discharge of untreated effluents but many projects are in progress or planned.
10	Kuwait	1.3	84:16	12 270	Less than 5	73 i = 44 l = 69 lt = 60	95* HC = 70 Vendors = 25		20**		Ministry of Elect and Water in charge of water supply; Ministry of Public Works for Sewerage; weak institutions and weak coor manpower shortage; expatriates.	Plan cycle 76 - 81; sec has priority; Decade targets will most probably be achieved; long-term planning for water resources and re-use of sewerage effluents for agriculture being prepared.	No financial constraints; high cost per capita due to desalination process; water tariff does not cover operating cost, no revenue from brackish water or sewerage.	4C	*Dual system, desalinated water for drinking and brackish for gardening and fire fighting. **Connected to public system; ongoing projects will allow 100% by 1990

NATIONAL AND SECTOR DATA RELEVANT TO INTERNATIONAL DRINKING WATER SUPPLY AND SANITATION DECADE, 1981 - 1990

No	Country	National Data: Population m	Population u/r %	GNP $ Per cap.	Social Indicators: Poorest in % of population	Social Indicators: Quality of Life Index	Sector Data: Safe Water Urb Pop %	Safe Water Rur Pop %	Adequate Sanitation Urb Pop %	Adequate Sanitation Rur Pop %	Sector Organization	Strategy and Planning	Cost, Investment, Finance	Classification of Country	Remarks
11	Lebanon	2.9	70:30			i = l = 65 lt =	Last events that affected Lebanon make it difficult to present accurate and up-to-date information regarding the water supply and sanitation at present.				Service des Eaux of the Ministry of Hydraulic and Electical Resources in charge of water supply.	Attention is now given to rehabilitation of systems, as many were seriously damaged during the conflict.			
12	Libyan Arab Jamahiriya	2.6	44:56	6 680	Less than 5	43 i = 42* l = 55 lt = 45	100**	100**	20		Ministry of Municipalities responsible for sec with 3 Directorate General; need for better coor; institutional reforms to avoid overlapping of activities	Plan cycle 76 - 80; unprecedented acceleration of sec during last plan; inf/data systems, Decade plan; proj identification and preparation needed.	Sec 5.3% of tot inv, p.c cost high for water supply proj ($ 700 - 1 000), double for sewerage; no fin constraints but limited absorptive capacity	4C	*Est. **Interm serv. and doubtful quality in some areas
13	Oman	1.7	22:78*	2 540	14		37**	65	60		***Ministry of Elect and water resonsible for drinking water supplies, Min of Land Affairs and Municpalities res for r & u sew. schemes. Manpower shortage; expatriates, weak coor.	Plan cycle 76 - 80; no sec targets; national water supply plan being prepared by consultants; san not priority.	Sec 2.85% of tot inv; Govt only source of capital dev; high p.c. cost for water and san.	3A	*Est. **Excessive leakage, many proj under construction. ***Based on National Report sent to WHO.
14	Pakistan	74.9	28:72	190	34	28 i = 113 l = 51 lt = 21	68* HC = 40 SP = 28	17* HC = 3 SP = 14	42*	2*	Sec responsibility under Min of Local Govt in bigger provinces & Min of Public Works for smaller provinces; poor O & M due to fin constraints; national expertise adequate except for large proj; community motivation and involvement in r need strengthening.	Plan cycle 77 - 83; current plan targets for water 84% u, 37% r, for san 61% u 10% r; san in r severe problem; low cost technology for u and r san required.	Proposed sec allocation 6.5% of tot inv; funding is major constraint; tariffs low; collection poor; CA about 50% of inv by many ag.	1A	*Average values; conditions vary from province to province
15	Qatar	0.21		2 781*			100* HC = 99 SP = 1	83	100	100	Rapid	Assessment Work was not	carried out for Qatar		* 1975 figures

NATIONAL AND SECTOR DATA RELEVANT TO INTERNATIONAL DRINKING WATER SUPPLY AND SANITATION DECADE, 1981 - 1990

No.	Country	National Data					Sector Data							Classification of Country	Remarks
		Population		GNP	Social Indicators		Safe Water		Adequate Sanitation		Sector Organization	Strategy and Planning	Cost, Investment, Finance		
		m	u/r %	$ Per cap.	Poorest in % of population	Quality of Life Index	Urb Pop %	Rur Pop %	Urb Pop %	Rur Pop %					
16	Saudi Arabia	7.6	59:41	6 040	10	29 i = l = 48 lt = 15*	100 HC = 69 SP = 31	84	99	100	Min. of Municipal & Rural Affairs responsible for water supply; shortage of professional and skilled personnel; expatriates; intensive training prog priority.	Plan cycle 75 - 80; very large-scale dev prog under way since 1970 with u bias and desalination plants; water resources and conservation major problem; need to establish water code; new technology for water purification required; well-defined national water policy needed.	Govt subsidizes water sales; no financial constraints.	4	*Est.
17	Somalia	3.6	27:73	110	75	19 i = l = 43 lt = 50	58 HC = 9 SP = 49	20	low	very low	WDA in charge of water supply other than hargeisa & Kisimayo; WRDC advisory body but not active; poor coor; shortage of skilled personnel; low community involvement in r.	Plan cycle 74-78; about 30% of national water supply prog 76 - 83 now completed; need for planning assistance, ground water survey and adapted technology especially in r.	Sec 3.6% of tot inv; low absorptive capacity; low internal cash generation; many ext ag; lack of well prepared proj; continued CA required.	1A	*A sewerage system for Mogadishu will be constructed
18	Sudan	16.9	20:80	290	43	18 i = 132 l = 46 lt = 20	49* HC = 37 SP = 12	45*	80**	very low	4 Min share responsibility for sec; weak coor; poor O & M; excessive leakage in distribution systems; institutional reforms required.	Plan cycle 78 - 83; no long term plan; no Decade plan; planning assistances, pre-inv studies and ground water survey needed.	Sec 8% of tot inv; low int cash generation; low absorptive capacity; many ext ag with 60% of tot inv; substantial CA ncessary to achieve Decade goals.	1B	*In the Northern Region; situation lagging in Southern Region. **Of which 3% by waterborne sewerage, the balance by individual systems.

NATIONAL AND SECTOR DATA RELEVANT TO INTERNATIONAL DRINKING WATER SUPPLY AND SANITATION DECADE, 1981 - 1990

No.	Country	National Data: Population m	Population u/r %	GNP $ Per cap.	Social Indicators: Poorest in % of population	Quality of Life Index	Sector Data: Safe Water Urb Pop %	Safe Water Rur Pop %	Adequate Sanitation Urb Pop %	Adequate Sanitation Rur Pop %	Sector Organization	Strategy and Planning	Cost, Investment, Finance	Classification of Country	Remarks
19	Syrian Arab Republic	7.8	47:53	910	10	64 i = 22 l = 57 lt = 53	90* HC = 75 SP = 15	55	70	10-15**	Many ag, weak coor; manpower constraints; training prog in progress; institutional strengthening required.	Plan cycle 76 - 80; sec is priority; national dev plan needed. Decade targets likely to be achieved if funds be made available; san lower priority and needs special attention in view of increasing pollution of water resources.	Sec 4.8% of the inv of which 60% for u water; low int cash generation; Central Govt principal source of dev funds; many ext ag; limited absorptive capacity; est for Decade $ 1 482 m of which $ 1 044 m for water.	2C	*Interm serv excessive leakage; **in large r communities; no data for small r villages.
20	Tunisia	5.9	48:52	860	10	35 i = 128 l = 57 lt = 38	96 HC = 67 SP = 29	29 HC = 4 SP = 25	64**	60	SONEDE responsible for water supply; ONAS for sewerage; better coor required study in progress; good performance of sec ag; adequate manpower.	Plan cycle 77 - 81; aims at total coverage of 74% water supply and san by 81; u bias; decade targets likely to be achieved; san lagging but now receiving attention; scarcity of water resources = a problem; long term planning and management of water resources priority.	Sec 6% of tot inv with $ 464m for water (75%) and $ 153m for sewerage; low int cash generation; new tariff introduced; many ag notably World Bank.	2B	*WB Country Economic Memorandum, November 1978 **Connected to public sewerage systems.
21	United Arab Emirates	0.8	86:14*	14 420		34* i = l = lt =	88**	50	24***		Many ag; divided responsibility and weak coor; inadequate staff; expatriates; weak institutions; Org for water use and control under consideration.	Sec priority construction aspect has been greatly accelerated, no long-term planning but Min of Planning established; master plan for water resources under prep; pre-inv studies required.	No fin constraints; budgetary allocations on annual basis and earmarking on ad hoc basis high p.c. cost; Govt provides all dev funds; revenue from water cover 1/10 - 1/3 cost of O & M; no charges for sewerage; new tariff structure needed.	4C	*Est. r includes nomads. **Interm serv uncertain quality, excessive leakage. ***Connected to sewerage Systems.
22	Yemen Arab Republic	5.0	8:92	430		11 i = 160 l = 47 lt = 13	30* HC = 15 SP = 15	2	Low*	Very Low	Min of Public Works responsible for sec; NWSA responsible for water and san in u; severe shortage of skilled staff; TA personnel needed.	Plan cycle 76 - 81; sec priority but with many constraints: fin, manpower low motivation of communities for san in r, poor accessibility of many localities; hydrogeologic survey and planning assistanced needed.	Sec 10% of dev prog budget; many ext ag with 70% of tot inv; est inv for current plan $ 119 m; low absorptive capacity.	2A	*Expected to rise to 50% in 1980 after completion of Sanaa proj

ABBREVIATIONS

ag	agency
av	average
CA	Capital Assistance
com	committee
coor	coordination
dev	development
est	estimate
exist	existing
ext	external
fin	finance
HC	House Connections
inc	including
int	internal
interm	intermittent
intl	international
inv	investment
loc	local
m	million
Min	Ministry
O & M	Operation and Maintenance
org	organization
p.c.	per capita
p.y.	per year
pol	policy
pop	population
prep	preparation
prog	programme
proj	project
r	rural
reg	regional
rev	revision
SP	standposts
san	sanitation
serv	service
TA	Technical Assistance
tot	total
u	urban
i	infant mortality (age 0-1) per 1 000
l	average life expectancy at birth (years)
lt	adult literacy rate in % (15 years and over)

ANNEX I

UNITED NATIONS WATER CONFERENCE - RESOLUTION II AND PLAN OF ACTION[1]

Resolution II, *Community Water Supply*

THE UNITED NATIONS WATER CONFERENCE

IN VIEW OF the course taken by the discussions and the aspirations of the countries represented at the United Nations Water Conference and in view also of what was proposed at Habitat: United Nations Conference on Human Settlements, and

CONSIDERING that:

(a) All peoples, whatever their stage of development and their social and economic conditions, have the right to have access to drinking water in quantities and of a quality equal to their basic needs;

(b) It is universally recognized that the availability to man of that resource is essential both for life and his full development, both as an individual and as an integral part of society;

(c) To a significant extent similar considerations apply to all that concerns the disposal of waste water, including sewage, industrial and agricultural wastes and other harmful sources, which are the main task of the public sanitation systems of each country;

(d) The fundamental challenge facing all mankind can be met only with full international co-operation in all its aspects, entailing the mobilization of physical, economic and human resources.

(e) It is imperative to facilitate ways of achieving this essential co-operation, so that water is attainable and is justly and equitably distributed among the people within the respective countries;

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[1] Report of the United Nations Water Conference, Mar del Plata, 14-25 March 1977, New York, 1977, E/CONF.70/29 (United Nations publication, Sales No. E.77.II.A.12), pp. 66-70.

(f) Those countries which are in a position to provide assistance, as well as international or regional organizations, should undertake to do so until the objective is attained, seeking to simplify regulations and administrative arrangements;

(g) Organizations of the United Nations system and other international organizations are making progress towards possible establishment of a consultative group mechanism on community water programmes,

RECOMMENDS

(a) That where human needs have not yet been satisfied, national development policies and plans should give priority to the supplying of drinking water for the entire population and to the final disposal of waste water; and should also actively involve, encourage and support efforts being undertaken by local voluntary organizations;

(b) That Governments reaffirm their commitment made at Habitat to "adopt programmes with realistic standards for quality and quantity to provide water for urban and rural areas by 1990, if possible";

(c) That with a view to achieving these ends, the nations which need to develop their systems for providing drinking water and sanitation should prepare for 1980 programmes and plans to provide coverage for populations and to expand and maintain existing systems, institutional development and human resources utilization, and identification of the resources which are found to be necessary;

(d) That the United Nations agencies should co-ordinate their work efforts to help Member States, when they so request, in the work of preparation referred to in subparagraph (c) above;

(e) That in 1980 the national programmes which have been implemented for that purpose, and the extent to which the countries concerned have succeeded in mobilizing local and national support should be reviewed by an appropriate mechanism to be determined by the Economic and Social Council and based on the use of existing machinery, with a view to attaining co-ordinated action toward agreed targets;

(f) That in accordance with the decisions of the existing structures of the Economic and Social Council, appropriate external assistance should be available in order to assist in building, operating and maintaining these systems;

(g) That the Plan of Action formulated below should be implemented in a co-ordinated manner at the national and international levels.

PLAN OF ACTION

In order to be able to reach the targets of Habitat recommendation C.12, drastic measures have to be taken. This will need firm commitment on the part of countries and the international community.

A. PRIORITY AREAS FOR ACTION

1. Action must focus on promoting

(a) increased awareness of the problem;

(b) commitment of national Governments to provide all people with water of safe quality and adequate quantity and basic sanitary facilities by 1990, according priority to the poor and less privileged and to water scarce areas; and

(c) larger allocation to this sector from the total resources available for general economic and social development.

2. Action must be taken to remedy constraints of manpower shortage (especially at the intermediate and lower levels), inadequacies in institutions and organization, and lack of appropriate and cost-effective technology.

3. New approaches should be developed which will result in larger flows of national, international and bilateral funds on more favourable and flexible conditions, so as to enable countries to increase the speed of implementation and, more important, enable the more effective use of the additional resources.

4. Communities must be provided with effective education on domestic hygiene and must be motivated and involved as appropriate at every level of the programme, including the planning, construction, operation, maintenance

and financing of services, and the monitoring and safeguarding of the quality of the water supplied.

B. RECOMMENDATIONS FOR ACTION AT NATIONAL LEVEL

5. Each country should establish goals for 1990 which match as far as possible the global targets adopted. In order to attain these goals, each country should:

(a) Develop national plans and programmes for community water supply and sanitation, and identify intermediate milestones within the context of socio-economic development plan periods and objectives, giving priority attention to the segments of the population in greatest need;

(b) Immediately initiate engineering and feasibility studies on projects that are considered to be of the highest priority, and are based on a cost-effective technology appropriate to local conditions, with community participation, good management, and provision for operation and maintenance;

(c) Assess the manpower situation and, on the basis of this assessment, establish training programmes at the national level, to meet the immediate and future needs for additional professional staff, intermediate level technicians and, most important, village technicians;

(d) Promote massive national campaigns to mobilize public opinion regarding the provision of basic sanitary services and develop appropriate procedures to ensure the active participation of communities in the programme;

(e) Establish appropriate institutions, if these do not exist, and assign to them specific responsibilities for the planning, implementation and monitoring of progress of the programme;

(f) Co-ordinate the efforts of all sectors active in rural areas, utilizing the manpower and other resources available, to ensure the provision of technically and socially acceptable sanitary facilities in rural areas;

(g) Develop a national revolving fund, in the first instance financed from substantially increased loans and grants from national and foreign sources,

for water supply and sanitation which will encourage both the mobilization of resources for this sector and the equitable participation of beneficiaries; discourage wasteful consumption; and include a flexible combination of rates and, where necessary, explicit subsidies or other measures designed to achieve the economic and social objectives of the programmes.

C. RECOMMENDATIONS FOR ACTION THROUGH INTERNATIONAL CO-OPERATION

6. To achieve the Habitat targets, the international community must adopt new approaches to support increased national commitments with particular reference to the least developed and most seriously affected countries. It is, therefore, recommended that:

(a) Financial contributions be increased to strengthen the capabilities of international and bilateral agencies co-operating with Governments in the extension of community water supply and sanitation;
(b) At the request of national Governments, co-operation be extended to the formulation and implementation of high priority projects and programmes for community water supply and sanitation, with analysis of goals, methods and resources;
(c) Collaboration with the ongoing activity of the World Health Organization for monitoring and reporting on the status and progress of community water supply and sanitation be intensified.

7. The international community should give high priority to collaborating with Governments with regard to manpower surveys, the establishment of national training programmes (to meet immediate and future needs for professional staff, intermediate level technicians, and village technicians), research, and the promotion of community participation.

8. There should be even greater emphasis on social benefits. Multilateral and bilateral financing institutions should recognize the need for a higher level of grants and low interest-bearing loans to community water supply and sanitation programmes and, where this practice is already accepted, increase the proportion of such loans. They should be prepared to shoulder a higher proportion of local costs when financing community water supply and sanitation,

increase their total allocations especially to rural water supply and sanitation, and complement local efforts in the rehabilitation and maintenance of systems.

9. Developing countries should foster co-operation among themselves, *inter alia*, in the establishment of intercountry training facilities; the development of appropriate technologies and of methodologies for training and management, and the exchange of experts and information, so that experience available elsewhere can be adapted to local conditions.

10. An effective clearing-house mechanism should be developed through international co-operation, by strengthening existing mechanisms if available, at the national, regional and international levels, to provide for the communication of selected information concerning all elements of community water supply and sanitation. An interrelated communication function should be included at every stage in all community water supply and sanitation projects.

11. Regular consultations should be held among Governments, international organizations, the international scientific community and relevant non-governmental organizations to ensure co-ordinated and accelerated action in the area of rural water supply and sanitation.

12. Co-ordination within the United Nations system should be improved at country level in order to ensure (a) a multidisciplinary approach in the development of community water supply and sanitation services; and (b) that rural water supplies and sanitation form part of integrated rural development projects.

ANNEX II

Resolution 35/18 of the General Assembly of the United Nations

Proclamation of the International Drinking Water Supply and Sanitation Decade, 1981-1990

THE GENERAL ASSEMBLY,

DEEPLY CONCERNED that a large portion of the world's population does not have reasonable access to safe and ample water supplies and that an even larger part is without adequate sanitation facilities,

CONCERNED ALSO that the plight of that population will not improve significantly unless there is a major commitment and effort on the part of Governments and of the international community to bring about the necessary changes,

RECALLING that Habitat: United Nations Conference on Human Settlements[1] called for Governments to adopt programmes to provide safe drinking water for all by 1990, if possible,

RECALLING FURTHER that in the Mar del Plata Action Plan the United Nations Water Conference called for the designation of the period 1981 - 1990 as the International Drinking Water Supply and Sanitation Decade,[2]

NOTING WITH SATISFACTION the growing efforts by Governments and by intergovernmental and non-governmental organizations, in response to that Plan, to increase the flow of technical and financial co-operation to developing countries in water supply and sanitation,

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[1] See Report of Habitat: United Nations Conference on Human Settlements, Vancouver, 31 May - 11 June 1976 (United Nations publication, Sales No. E.76.IV.7 and corrigendum), chap. II, recommendation C.12.

[2] See Report of the United Nations Water Conference, Mar del Plata, 14-25 March 1977 (United Nations publication, Sales No. E.77.II.A.12), and corrigendum, chap. I, para. 15.

RECALLING ALSO its resolution 34/191 of 18 December 1979, by which it decided to hold a special one-day meeting to launch formally the International Drinking Water Supply and Sanitation Decade,

BEARING IN MIND resolution 25, entitled "International Drinking Water Supply and Sanitation Decade", adopted on 30 July 1980 by the World Conference of the United Nations Decade for Women: Equality, Development and Peace,[1]

1. PROCLAIMS the period 1981 - 1990 as the International Drinking Water Supply and Sanitation Decade, during which Member States will assume a commitment to bring about a substantial improvement in the standards and levels of services in drinking water supply and sanitation by the year 1990;

2. CALLS UPON Governments which have not yet done so to develop the necessary policies and set the targets to this end, to take all appropriate steps for their implementation, to set sufficiently high priorities for the activities concerned and to mobilize adequate resources to achieve their targets for the Decade;

3. URGES Governments to strengthen, as appropriate, their institutional frameworks for carrying out these activities, to mobilize the necessary technical expertise at all levels and, in general, to heighten popular awareness and support through education and public participation programmes;

4. CALLS UPON Governments, organs, organizations and bodies of the United Nations system and other intergovernmental and non-governmental organizations concerned to continue and, if possible, to increase their technical and financial co-operation with developing countries in order to enable them to attain the targets they have set, and to continue also their efforts to co-ordinate their activities so as to maximize the impact of their assistance to developing countries;

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[1] Report of the World Conference of the United Nations Decade for Women: Equality, Development and Peace, Copenhagen, 14-30 July 1980 (United Nations publication, Sales No. E.80.IV.3), chap. I. sect. B.

5. CALLS UPON the regional commissions to review periodically, on the basis of national reports, the progress being made by the Governments of their respective regions in establishing national targets and carrying out programmes to attain those targets;

6. DECIDES to review at its fortieth session the progress made towards the attainment of the Decade's national and international goals, as outlined in the reports of the Secretary-General concerning the present situation and prospects relative to the Decade[1] and requests the Secretary-General, in consultation with the Administrative Committee on Co-ordination, to prepare a comprehensive analysis of the situation on the basis of progress reports by Governments and by the international organizations concerned and to submit it to the General Assembly at the session through the Economic and Social Council.

55th plenary meeting
10 November 1980

[1] United Nations document A/35/367 and Add.1.