WATER AND SANITATION SERVICES IN EUROPE

1981-1990

WORLD HEALTH ORGANIZATION
Regional Office for Europe
COPENHAGEN
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WORLD HEALTH ORGANIZATION
REGIONAL OFFICE FOR EUROPE

WELTGESUNDHEITSORGANISATION
REGIONALBÜRO FÜR EUROPA

ORGANISATION MONDIALE DE LA SANTÉ
BUREAU RÉGIONAL DE L'EUROPE

ВСЕМИРНАЯ ОРГАНИЗАЦИЯ ЗДРАВООХРАНЕНИЯ
ЕВРОПЕЙСКОЕ РЕГИОНАЛЬНОЕ БЮРО

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WATER AND SANITATION SERVICES IN EUROPE

1981 - 1990

TARGET 20

Water pollution

By 1990, all people of the Region should have adequate supplies of safe drinking-water, and by the year 1995 pollution of rivers, lakes and seas should no longer pose a threat to human health.

Index:

WATER SUPPLY
SANITATION
DRINKING WATER
EVALUATION STUDIES
EUR

FOREWORD

The WHO European Region covers not only continental Europe but also Israel, the Asiatic territories of Turkey and the USSR, and includes the world's largest island, Greenland. It might well be thought that in an area with so wide a spectrum of climatic conditions (from the Arctic areas of northern Europe to the deserts of Israel) and a great diversity of levels of development and sociocultural conditions, no common theme would be found in a study of the water and sanitation services. However, this survey shows such an expectation to be false. Although there are many superficial differences between the countries included in the survey, the close resemblances between the physical and geographical problems in the developed areas of the Region have created a remarkable similarity in the fundamental structures and objectives of the organizations set up to tackle them.

The provision of wholesome water is a priority objective of every public health programme in Europe, and it should be stressed that adequate and safe water and appropriate sanitation and the safe disposal of wastewaters are the only guarantee of health protection.

All arrangements made for the provision of water supply and waste disposal services are therefore based on this fundamental principle and have developed in such a way that they present many common aspects, regardless of the country or its socioeconomic and political system.

The survey draws attention to the difficulties that arise within countries because no one ministry or agency has an overall mandate for water and sanitation services. The result is a situation of scattered responsibility, with urban and rural services separated, geographical or political divisions, water supply being separated from waste disposal and, perhaps most important, division of responsibility between agriculture, power development, industry and water services for water resource exploitation and development. In most instances, although the Ministry of Health has a responsibility for water quality surveillance, it does not collect data on types of services and, as far as they are available, they are scattered among the different responsible agencies. This fact alone presented a major challenge in carrying out the survey and preparing this report.

The Global Programme for the International Drinking Water Supply and Sanitation Decade (IDWSSD) envisaged as its target the provision of adequate systems of safe drinking water supply and sanitation to the whole population of this planet by the end of the Decade 1980/1990. With regard to drinking water, the minimum level of services accepted was "access to safe water at least within 15 minutes' walking distance". Concerning sanitation, the minimum level of services adopted was "the provision of a hygienic pit-latrine".

Therefore, the European Region, complying with the Mar del Plata Declaration, and as an integral part of the Global Water Decade Programme, formulated its own Decade Target (Target No. 20), enunciating that:

> "BY 1990, ALL PEOPLE OF THE REGION SHOULD HAVE ADEQUATE SUPPLIES OF SAFE DRINKING WATER, AND BY THE YEAR 1995 POLLUTION OF RIVERS, LAKES AND SEAS SHOULD NO LONGER POSE A THREAT TO HUMAN HEALTH".

Because of the relatively advanced socioeconomic condition of the European Region in relation to other parts of the world, a minimum level of satisfactory service has been regarded as the provision of safe drinking water in every home. With regard to sanitation, the adopted minimum requirement should be a water-closet in each home, connected to a septic tank or to a similar method of disposal of wastewater onto soil. For rural areas, a ventilated pit-latrine was considered acceptable in appropriate circumstances.

Furthermore, the goals of the European Region were not only to protect the surface and subterranean sources of drinking water, but also to safeguard the quality of any water body used for recreational purposes and thus capable of affecting human health in case of pollution.

It has not been an easy task to measure how far the Member States of the Region have progressed towards achieving the objectives of the Water Decade Programme. It has been equally difficult to make an accurate assessment of the overall impact of the Decade Programme in relation to investments and the reduction obtained in water and sanitation-related diseases. One of the major constraints encountered has been the administrative decentralization that most countries in Europe are undertaking and which has resulted in difficulties in collecting data at national level, while excellent and abundant information is available at provincial, district or municipal levels.

The lesson learned in this respect is that regardless of the multiple advantages of decentralizing water and sanitation responsibilities, there should still be an appropriate system for data collection and analysis at central level for planning and evaluation purposes.

The purpose of this document is, therefore, to present, with the limitations mentioned above, an analysis of the data available by the end of the biennium 1988/1989 for the 32 Member States of the Region. A more comprehensive assessment, which will follow a new evaluation procedure and which has been adopted by the countries, is being implemented. The results are expected to reflect the situation at the end of the Water Decade Period and will be published in early 1991.

INTRODUCTION

The legal and administrative framework of water services in the different countries in Europe varies with the history of each country. There are the centralized arrangements in the socialist countries of eastern Europe, where the pressure of demand on limited water resources is acute, and the more localized arrangement in France, the Federal Republic of Germany or the United Kingdom. This variation conceals a surprising consistency in the fundamental policy and objectives.

Almost all of the 32 Member States provided answers to most of the questions contained in the survey questionnaire, although sometimes it was apparent that information was not available in a form that would enable answers to be readily provided.

The size of the chapters and their degree of detail unfortunately do not always reflect the importance of the country or the complexity of the water and sanitation services organization. The amount of detail presented for each country depends on the information provided by the national authorities. In some instances, this has resulted in relatively larger chapters on comparatively small countries, whereas some of the larger countries have short chapters containing limited information. This regrettable and unavoidable imbalance will be redressed when the survey is reviewed and updated.

There were two more general failings, which were probably due to the choice of questions. It was not possible to determine how many countries had standards or guidelines for drinking-water quality, the percentage of the water consumption complying with such standards, or how these compared with the WHO guidelines for drinking-water quality.

There has been a growing uniformity in the standards applied to drinking water since the introduction of the WHO European standards for drinking water in 1970 and the issue of the EEC directive on drinking water quality in 1978. The WHO standards have been widely used as the basis for developing national standards while the EEC directive, which is applicable throughout the Community, corresponds to a large extent with the WHO values.

Water supply

The widespread acceptance of the importance of water quality, not only for drinking-water but also for industrial and other purposes, entails the recognition that the action needed to ensure the preservation or restoration of water quality is much the same in different parts of Europe, however much the legal and administrative frameworks may vary. When water resources are large in relation to demand, it is comparatively simple to draw supplies from sources that are free from contamination. However, as demand presses upon resources, then, since all possible sources must be tapped, the protection of quality becomes more urgent. Water may have to be taken from sources that already carry a burden of wastewater discharged above the intake; such dual or, in some cases, multiple reuse emphasizes the need for effective and adequate treatment. The administrative problems are naturally greater when the discharge of wastes is in one country and the abstraction for use is in another country downstream, as on the River Danube.

Demand may be high compared with potential supply because geography and climate are unfavourable, as in the Mediterranean and Atlantic islands. Elsewhere, although a country may have ample or indeed very large reserves of water, these are so located that the greater part is remote from major concentrations of population and industry.

For example, Finland, despite its overall abundance of water, has had to build the longest continuous rock tunnel in the world - some 120 km - to supply Helsinki. In the Federal Republic of Germany, it has been necessary to make increasing use of bulk transfer schemes from one river basin to another to overcome shortages in some regions. In England and Wales, where total resources are small in relation to population, water services have been restructured within the last decade so as to ensure the coordinated development of water use, water quality and river management. Czechoslovakia, to assist in meeting a growing demand, carried out a hydrogeological survey to make water management more effective so that optimum utilization and protection of water resources is achieved without detriment to the environment.

Wastewater

The growth of cities and urban concentrations not only carries the demand for water beyond the capacity of local supplies but necessarily produces large volumes of waste-polluted water that must be discharged locally into surface water or into the ground. In addition to wastewater, there are substantial volumes of solid wastes or sludges which, if not safely handled, are a further cause of water pollution. Many surface waters can be used for drinking-water supply only after substantial expenditure on treatment, and part of the groundwater resources are also affected. Similarly, Hungary states that "pollution control and water quality protection are becoming increasingly important".

The Netherlands speaks of "ever growing difficulties, caused particularly by the poor quality of surface water and limited availability of groundwater". Even in Norway, which is a water-rich country, "the fact that population, industry and other activities are relatively concentrated and confined to certain areas led to quality, and sometimes quantity, problems of a more continental scope". Similarly, Turkey is a country "having an abundance of water resources, but continued migration to the towns has put further pressure on urban water supply and sanitation systems".

Common problems

There are a surprising number of similar characteristics in the way in which different countries have dealt with their common problems. In the majority of countries, groundwater has been the primary source of potable water, Spain being an exception in that up to the present "most of the water used has been derived from surface waters". However, more surface water is now being used except in Spain, where more groundwater is being used. In Belgium, the proportion of water drawn from surface sources is expected to increase from 30% in 1975 to around 50% by the end of this century. In Czechoslovakia, "the sources of supply are also changing, the movement being towards an increase in surface water supplies". In the Federal Republic of Germany, there is now a "tendency for the proportion of surface water to increase". In Hungary, potable supplies are likely to be drawn in a "slightly higher proportion from surface sources" and (as in many other countries) "industrial water supplies will mainly be derived from surface sources", while in Luxembourg, a surface source has already been developed to limit the call on groundwater supplies. In Portugal, it is expected that there will be greater resort to surface water, using multipurpose reservoirs and river basin transfer of water.

The shift to surface sources indicates that groundwaters are not often fully developed, yet they will continue to be of great importance. Moreover, they are frequently threatened with contamination, particularly by the deposit of solid wastes above aquifers and the infiltration through the soil of agrochemical products.

Finance

It was impossible to compare the cost of water services between different countries because of the lack of detailed information and also because, in some countries, either capital or running costs are subsidized while, in others, the organizations responsible for these services are expected to cover all their costs. Costs will vary substantially with the mix of groundwater and surface sources and the extent to which wastewaters are treated before discharge. Almost without exception, industry and commerce are charged for water according to the metered volumes supplied. Likewise, in the majority of countries, domestic consumers are charged by metered volumes, though in some countries charges are still related to the value of property for tax purposes. Where both systems are available, there is a tendency for an increase in the use of meters. There is much wider variation in charges for sewerage and sewage disposal. The most sophisticated systems, though these are a minority, relate charges to the volume of clean water supplied. In other cases, charges relate to property values or are fixed, while in a limited number of countries no charges of any kind are made. Trade effluent charges are equally various. In some cases none are levied, though many countries have moved or are moving towards charges for discharge into sewers or natural waters that relate to the volume and strength of the effluent.

Research

Almost all the countries of the Region devote a significant and growing proportion of their research efforts to questions related to water and wastewater disposal services. There is a need to intensify applied research in the field of water management and economy because of the increasing difficulties experienced in water utilization. Mostly the work is undertaken by a variety of government institutions, though universities are often associated with particular subjects. Since matters affecting water extend over a wide field - public health, engineering, chemistry and biochemistry, environmental protection - research activity must be distributed over a wide range of organizations. It is, however, to be noted that in those countries in which problems associated with water are more compelling, research organizations concentrating specifically on the water industry have been created and are operating successfully.

Provision of services

The statistical information provided with the replies to the questionnaire shows that in most of the countries in the European Region, almost the whole of the urban population has access to piped water and, where that has not been achieved, the service is being rapidly extended. The proportion of the rural population served is a good deal smaller than that of urban dwellers, and even in those countries that have made the greatest progress, there will always be a small number of isolated properties to which it will never be economic to supply piped water.

Provision of sewerage lags, as it always has, behind water supply. "However, only a few countries can not claim that all their urban population is served by a sewerage system. The number of sewerage systems in rural areas are lower everywhere." Indeed, it is most unlikely that there will ever be 100% connection in rural areas because there is a significant proportion of properties to which it is neither necessary nor economic to provide sewerage. For example, in Switzerland, despite strenuous and successful efforts in the last decade to increase rapidly the volume of wastewaters purified before discharge, it is unlikely that more than 85% of the population can be connected to a centralized system owing to the number of scattered and remote villages. Sanitation by cesspit or septic tank or other individual systems can be completely satisfactory for these properties if appropriate systems of surveillance and maintenance are adopted.

Sewage treatment, despite the enormous progress made in the last decade or so, lags behind sewerage. Much sewage is still being discharged raw and untreated. Although a growing volume is treated, it is only in a minority of countries that the greater part of sewage discharges receives secondary treatment.

Disappointingly little information was given about the disposal of sewage sludge, since the growth of the volume of treated sewage entails an increase in the volume of sewage sludge. It is important that sludge should be disposed of safely, inoffensively and, as far as possible, usefully. On present knowledge, the easiest way of dealing with sewage sludge is on farmland, subject to proper safeguards, as a soil conditioner and an aid to growing crops, and such figures as were supplied suggest that this is the destination of much sludge. Tipping as landfill is the next preferred solution.

There are other calls on water resources. In a number of countries, such as Italy, water for irrigation is critical for development (even in Norway there has been a marked increase in the area of irrigated land). The quality of the water used for irrigation is often as important as its quantity. Contaminated water may spread waterborne diseases if used on crops eaten raw. Some elements may inhibit plant growth, and cases have been known in which pollution by small traces of potent synthetic chemicals have destroyed crops.

Conclusion

The importance of protecting the quality of drinking water has been recognized for over 100 years. It was one of the first triumphs of the public health movement which understood the need for action even before the specific causative agents of waterborne diseases had been identified. But it is not a once-and-for-all victory. The growth of modern society has added new problems and complexities to the task. The expansion and concentration of population and industry have produced large, localized volumes of wastewater. New chemicals, hazardous even in trace quantities, further complicate the problems of the safe disposal of these wastewaters. Groundwater and surface water are further at risk from careless disposal of solid wastes and sludges, and airborne pollutants (acid rain) are already suspected of affecting some waters. Attention has already been drawn to the increasing reuse of water. Indeed, in some places, multiple reuse is becoming common. Such multiple use (this will often also be used in addition to water supply, e.g. navigation, water power) emphasizes the importance of coordinated multisectoral administrative arrangements that will ensure not only the protection of water from the many potential sources of pollution but also the effective treatment of wastewaters and water for supply to maintain public health standards.

Concentrations of population and industry frequently demand more than local water resources can supply. More and more remote sources have to be tapped and the water moved longer distances. Problems of quantity are interlocked with questions of quality. As shown by the country surveys in this volume, the first steps taken by many states in Europe are the creation of larger administrative units for water supply and/or for wastewater management. Only organizations that have a reasonably large area within their jurisdiction can develop the more distant sources now being exploited and can balance the need to dispose of wastewaters with the requirements of water supply in ways that will ensure the safe and efficient discharge of these functions by sound economic measures designed to minimize the very large sums of money that will inevitably have to be spent.

However, the survey suggests that it may be advisable, as envisaged in a number of countries and as implemented in some, to move towards treating the hydrological cycle as a process to be managed as an integrated whole. This would further optimization of water use and ensure the maintenance of public health standards. This approach would also help to balance the pressures of development and increased demand with supply in the face of ever-growing pollution, both in terms of volume and complexity of pollutants.

An analysis of the data available by the end of the biennium 1988/89 for the 32 Member States of the Region regarding the level of water and sanitation services, provided the following results:

With regard to the level of services given to the population, by the middle of 1989, the percentage of people connected at home to a water network had reached 93.2% in urban areas and 77.3% in rural areas. This represented approximately 725 million people, or 87.3% of the total population of Europe.

The percentage of population connected to a sewerage network had reached 90.0% in urban areas and 52.7% in rural areas. This represented approximately 633 million people, or 76.2% of the total population of Europe.

Therefore, the deficiencies which are expected in urban areas at the beginning of the next Decade will be largely due to the presence of slum areas in many large cities, particularly in the southern part of Europe. In rural communities, deficiencies in water supply still exist, but only in areas with a widely dispersed population and limited water resources. Concerning the disposal of human excreta, there will be very few families in Europe that will not have at least a pit-latrine at home.

As for wastewater treatment and disposal, the answers received from 23 Member States made it possible to summarize the situation as follows:

- Of the total volume of sewage produced, 14% underwent primary treatment, 47% received secondary treatment, 18% received tertiary treatment and the remaining 21% was discharged untreated.

- Of both treated and untreated sewage, 62% was mainly discharged into freshwater surface bodies such as rivers, lakes and lagoons. The remainder was discharged either into the sea (about 30%) or used on land for irrigation or for recharging aquifers (about 8%). No accurate information existed, however, concerning the risk of pollution caused by discharge of raw sewage into the environment. In most instances, it was assumed that the water bodies receiving sewage possessed the necessary ability for self-recovery.

- Sewage sludge was found to be disposed of as follows: 14% into the sea, 3% into surface water bodies, 42% onto farmland, 31% used for landfilling, and 10% incinerated.

The above figures indicated that not only was the number of sewage systems insufficient to cover the total needs, but that also in many cases, the quality of the treated effluents did not correspond to national standards.

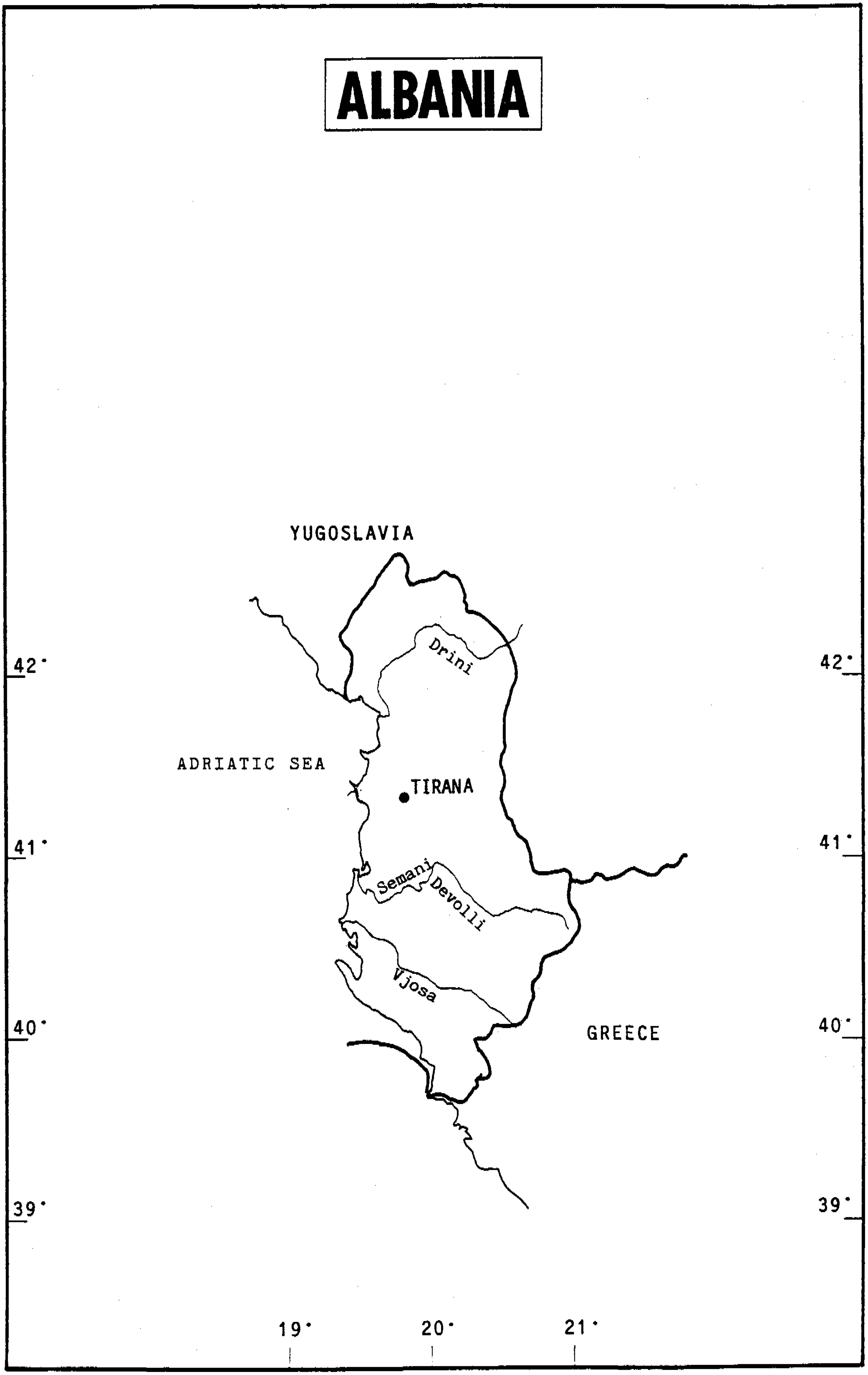
With regard to the epidemiological assessment of the evolution of diseases related to water and sanitation, the health statistics methods in use in the Region do unfortunately not make it possible to monitor properly such diseases as gastroenteritis, typhoid, hepatitis, cholera, dermatitis, amebiasis, shigellosis, salmonellosis, and other waterborne diseases which are still present in the Region. In many instances, the cases of illness reported are not supported by laboratory analyses, and the only indicators available are the number of outbreaks occurring per year per country.

The records available indicate that, with regard to the biological quality of drinking water, the progress made in this area has been satisfactory. However, there are still signs of concern due to repeated outbreaks of some of the diseases mentioned above, such as legionellosis and diarrhoea associated with the presence of Campylobacter. Protozoa and Helminths are also detected with increased frequency, particularly in rural water supplies. Giardiasis caused by the protozoan Giardia lamblia, and the presence of Entamoeba and Balantidium in water supplies that have not been filtered during the treatment process, also required increased attention of water managers for reducing the health risks of the population exposed.

Although bathing water quality continued to improve as a result of the adoption of national standards and criteria and the development of sanitary monitoring programmes to ensure compliance, several enteric and non-enteric diseases still continued to be associated with bathing waters, particularly in the Mediterranean, where relatively high summer temperatures resulted in prolonged exposure to seawater and beach sand. In the case of chemical contamination of seafood, while available evidence indicated that problems were probably confined to relatively isolated "high-consumption" coastal areas, the extent of the overall situation still requires determination.

In addition, as we enter into the last years of the Water Decade Programme, there was evidence that an increased number of countries in the Region will still be facing severe shortages of water and wastewater services, resulting from an ever growing demand and from population movements. Particularly from the exodus of rural people towards urban centres, and from seasonal tourist habits.

The Regional Office would appreciate receiving criticism and comments from readers with a view to the preparation of an improved and updated second edition. Correspondence should be addressed to: International Water Decade, WHO Regional Office for Europe, 8 Scherfigsvej, DK-2100 Copenhagen Ø, Denmark.


ALBANIA
YUGOSLAVIA
ADRIATIC SEA
TIRANA
GREECE
Drini
Semani
Devolli
Vjosa
42°
41°
40°
39°
19°
20°
21°

ALBANIA

Albania is situated in the west of the Balkans, along the eastern shore of the Adriatic Sea. It has boundaries in the north and east with Yugoslavia and in the south-east with Greece. It has an area of 28 748 km^2 and the population in 1986 was 3 million, giving a population density of 104.4 inhabitants per km^2. The terrain is mountainous, with one third of the country lying at an altitude of over 1000 m.

Government

The Socialist People's Republic of Albania is governed by a single-chamber legislature, the People's Assembly. It gathers twice a year in regular session and delegates its day-to-day functions to the Presidium of the People's Assembly. The approval of the plan for the economic and cultural development, the State budget, the various laws and the ratification of the decrees presented by the Presidium are among its numerous functions. It is also competent to ratify or denounce international treaties of particular importance.

The country is divided into 26 local government districts, each under a People's Council (Fig. 1).

Administrative organization of water services

The supply of potable water to the population is the responsibility of the Ministry of Municipal Economy, which manages the distribution of drinking-water through the municipal services of the district. These services are responsible for the development, operation and maintenance of the water supply systems of the cities and villages.

The water requirements of the other sectors (industry, agriculture, etc.) are the responsibility of the respective ministries. They are in turn responsible to the Council of Ministers for all water management questions in their sections (see Fig. 2).

Role of the health department with regard to water quality

The Ministry of Health is charged by the Council of Ministers to supervise the quality of potable water throughout the country. The Ministry has established water quality standards based on the country's experience and WHO's recommendations, and set up limit values for concentrations of harmful and toxic substances discharged into surface waters used for drinking and recreational purposes.

The Ministry has under its dependence the directorates of hygiene and epidemiology (DHEs), of which there is one in each district of the country. These bodies organize the monitoring of the drinking-water quality in the towns and villages under their jurisdiction through the district municipal services and use sampling methods to ensure the quality and purity of the water. The Institute of Hygiene and Epidemiology, which is responsible to the Ministry of Health, monitors drinking-water quality and surface water pollution on a national scale. It also provides technical assistance to the DHEs.

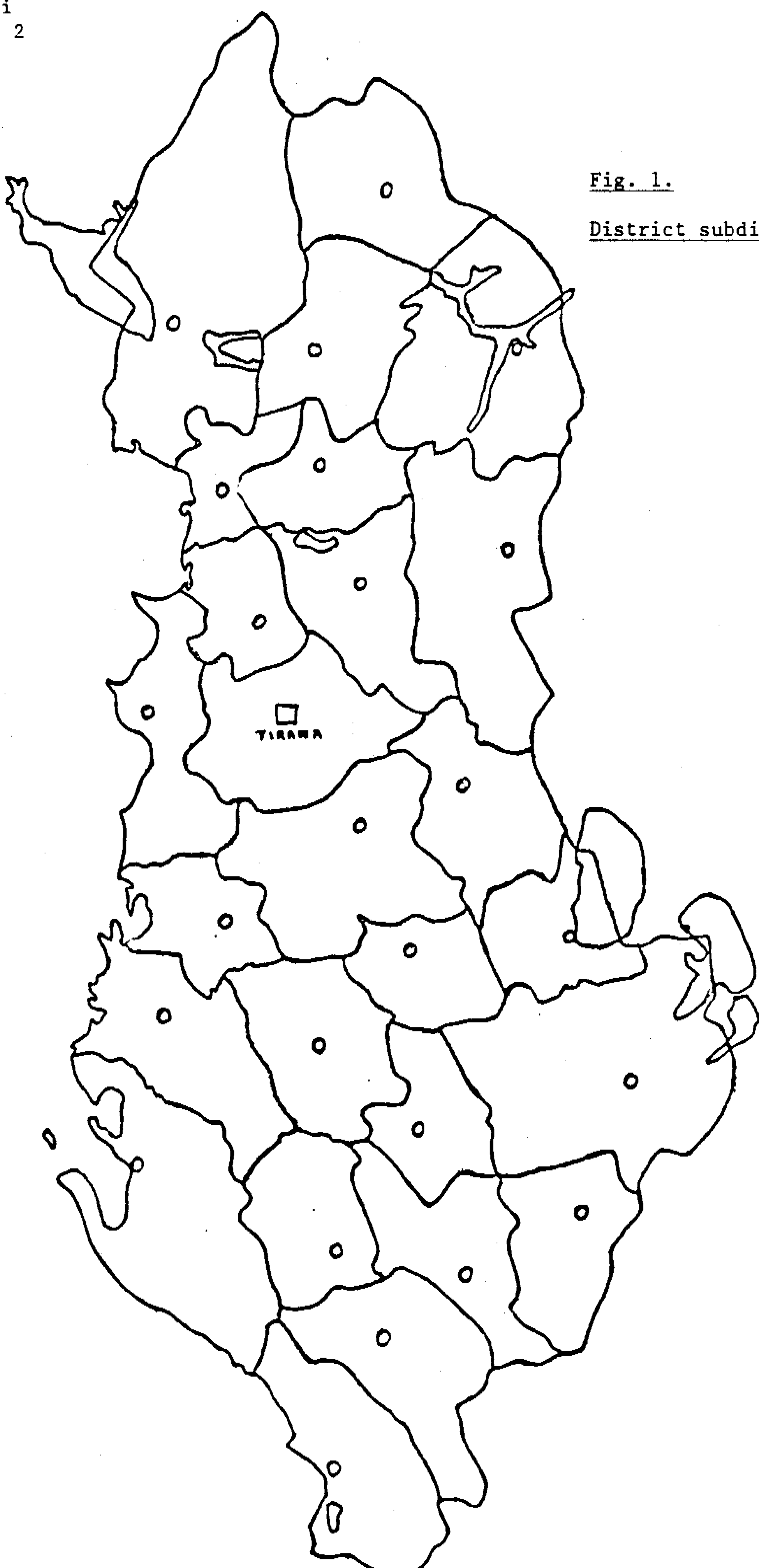


Fig. 1.

District subdivisions

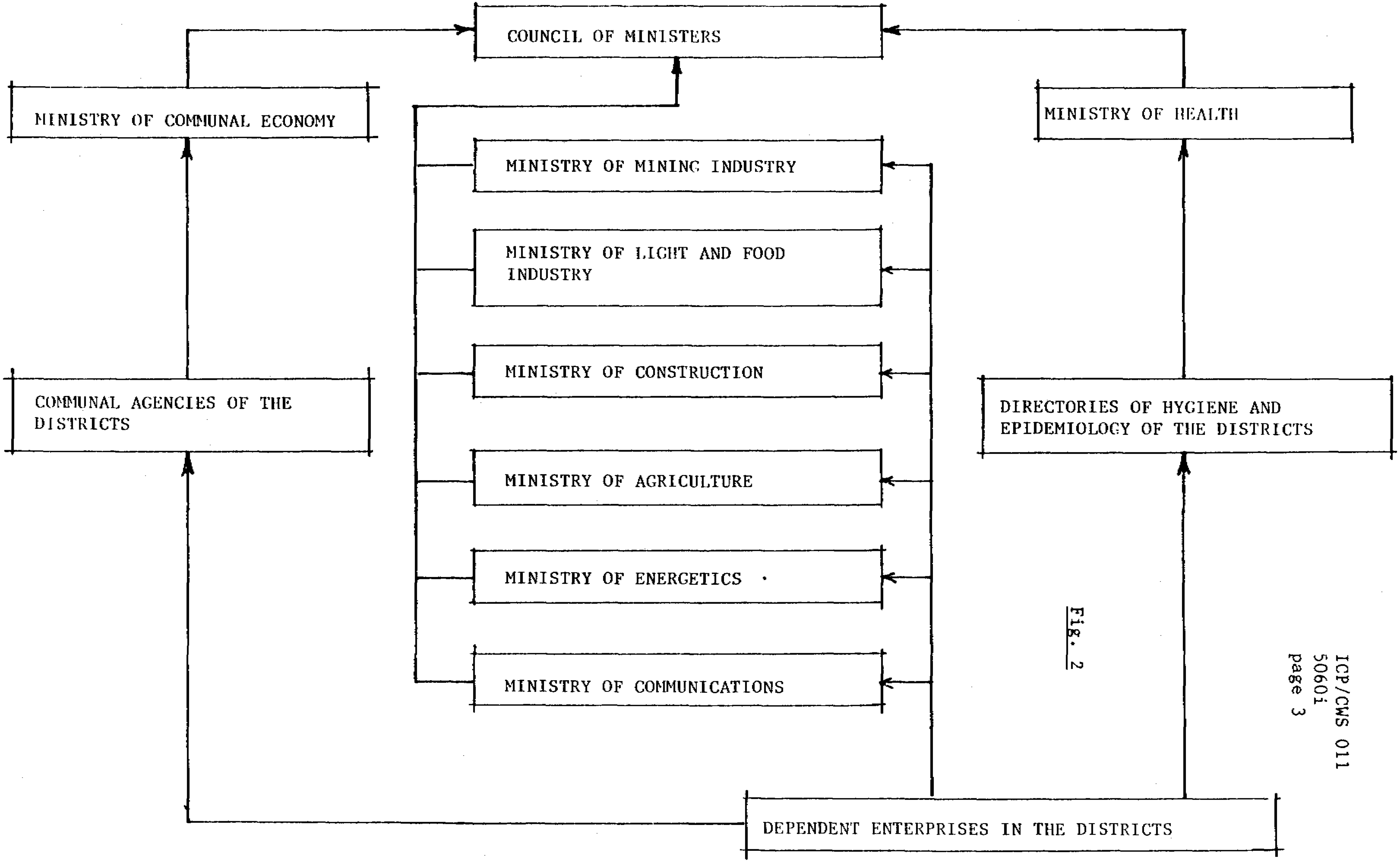

COUNCIL OF MINISTERS
MINISTRY OF COMMUNAL ECONOMY
MINISTRY OF HEALTH
MINISTRY OF MINING INDUSTRY
MINISTRY OF LIGHT AND FOOD INDUSTRY
MINISTRY OF CONSTRUCTION
COMMUNAL AGENCIES OF THE DISTRICTS
DIRECTORIES OF HYGIENE AND EPIDEMIOLOGY OF THE DISTRICTS
MINISTRY OF AGRICULTURE
MINISTRY OF ENERGETICS
MINISTRY OF COMMUNICATIONS
DEPENDENT ENTERPRISES IN THE DISTRICTS

Fig. 2

Water and related legislation

The legislation dealing with the quality of drinking water and its protection from pollution is contained in Decree No. 7 of 1968 on the State sanitary inspectorate and in Decree No. 5105 on the protection of the environment against pollution.

The Decree on the Protection of the Environment against Pollution was issued on 30 October 1973 by the Presidium of the People's Assembly. Article 2 of that decree prescribes: "State enterprises, institutions and organizations are prohibited from polluting the water, atmosphere, and land to a level that could endanger the health of the people or damage the country's flora and fauna. The tolerable limits of the liquid, fluid, and solid pollutants and radioactive substances to be discharged into the water, atmosphere, and land are determined by the ministries and by other central institutions".

Based on that Article, the Ministry of Public Health has determined the rates of permissible concentrations of hazardous and toxic materials discharged into surface water used for drinking and other municipal services, as well as the maximum permissible concentrations of toxic substances in the atmosphere of inhabited areas.

For the administration of the waterworks, special regulations were approved by the Council of Ministers in the Decree of 1978 which defines the responsibilities of the various ministries with regard to the operation and maintenance of water supply systems.

Other resolutions of the Council of Ministers in 1978 and 1980 established norms for the exploitation of drinking-water and industrial water by all categories of consumers. The ministries, on the basis of these resolutions, have compiled detailed instructions to be followed by their enterprises.

The Inspectorate for the Prevention of Pollution authorizes the construction or reconstruction, and the putting into operation of every unit that discharges liquid, fluid or solid pollutants. To carry out these tasks, the Inspectorate has laboratories for the examination of the quality of water, air and soil. It has all the necessary competence to take every measure required by the Decree on the protection of the environment against pollution whenever necessary. On 19 December 1986, the Council of Ministers of the People's Socialist Republic of Albania issued Decree No. 482 prescribing that by the year 1990, the whole rural population of Albania will be supplied with drinking-water facilities.

Water research

Water research is carried out by the ministries and their dependent institutions. The Ministry of Municipal Economy, through its institutions, investigates present and future needs of the population. The Institute of Hydrogeology (Ministry of Industry and Mining) studies the possibilities of finding new sources of water. The Institute of Public Utilities (Ministry of Construction) draws up construction plans for the waterworks needed in the country. The Institute of Hygiene and Epidemiology and the DHEs investigate water quality, the degree of pollution of surface waters and examine projects for new water plants, etc. The Ministry of Agriculture, through its institutions and the Institute of Hydrometeorology, studies the qualitative and quantitative aspects of inland waters used for irrigation. The Laboratory of Hydraulic Research (Academy of Sciences) carries out complex studies and experiments related to water power, irrigation, water supplies and sewage.

Finance

Water is metered, and householders and industrial enterprises served by the waterworks are charged according to the quantity they use. The cost of sewerage and all other types of waste disposal is met by the State.

Responsible agencies

Operation	Carried out by:
Water resources survey	Ministry of Municipal Economy Ministry of Health Municipal agencies Directorates of hygiene
Water management policy	Ministry of Municipal Economy
Drinking-water production	Ministry of Municipal Economy Municipal agencies
Drinking-water distribution	Ministry of Municipal Economy Municipal agencies
Drinking-water quality surveillance	Ministry of Health Directorates of hygiene
Agricultural irrigation	Ministry of Agriculture Cooperative farming enterprises
Industrial water supply	Ministry of Municipal Economy Municipal agencies
Underground water protection	Other ministries Municipal agencies
Surface water protection monitoring	Municipal agencies
Water pollution control	Directorates of hygiene
Water resources and allocation	Municipal agencies

Water resource availability and management

Rainfall

Albania's climate is characterized by mild winters, hot summers and moderately heavy rainfalls. Only the coastal regions enjoy truly Mediterranean weather, with temperatures becoming progressively higher in inland areas. The annual mean rainfall is about 1300 mm, but it is unevenly distributed throughout the year. Summer is usually a dry season when only 2.5-14% of the annual rainfall is received.

Precipitation is generally in the form of rain, although snow falls on the mountains. Because of the broken relief of the country, the geographic distribution of rainfall is uneven with most of the rain falling on the highlands (over 2000 mm per annum), particularly in the north-east, where the rain-carrying winds come from, while the plains and in particular the internal valleys are poorly watered (650-700 mm per annum). The annual amount of rainfall varies considerably from year to year.

Topography

The relief of Albania is largely mountainous, the mountains and hills representing 85% of the surface, while the plains make up the remaining 15%. The two areas are linked by the same hydrologic network and the deposits of the plains originate from the torrents which carry materials from the mountains to the fields. The mountains dominate mainly the north, west and south of the country. They are not especially high, their form being mostly peaked because of their relatively young age and the effects of freezing and thawing ice and torrent erosion. They are composed of calcareous, magmatic and partly flint rock.

The hills cover the western part of Albania and are relatively young. They are mostly composed of sandstone, flint conglomerates and calcareous gypseous rock.

The plains are situated in the west. They were formed in the Pliocene age and are composed of argillite and sandstone formations.

Population/water resources

The centres of population are evenly distributed. More than 95% of the potable and industrial water supplies come from groundwater sources that emerge spontaneously or are brought up by perforation. They are of good quality and the only processing they undergo is chlorination.

Future trends of water resources

Until recently all Albania's water requirements were met exclusively from groundwater sources, and for households and commerce this will continue until the year 2000. However, the intensive development of the country makes it necessary to develop and use surface water for industrial purposes. The use of surface water from rivers and dams for farming is already in an advanced stage of progress and the country has considerable experience in this field.

General statistics

Population

Population in urban areas	33.7%
Population in rural areas	66.3%

Drinking-water supply

Total piped supply for drinking purposes	1350 Ml/d[a]
Total population served by a piped public water supply	92.0%
Urban population served by a house connection	100.0%
Urban population without house connections but with reasonable access to public standposts	0.0%
Rural population served by house connections (public or private)	88.0%
Rural population without house connections but with reasonable access to public standposts	12.0%

Drinking water supply uses

Water supplied for domestic	17.5%
Water supplied for industrial and commercial use	82.5%
Other uses	0.0%

Industrial water supply: direct abstractions

Total supplied from inland waters for industrial use	55.0 Ml/d
Used for industrial cooling water	NA[b]
Usage as industrial process water	NA
Total coastal water used	13 Ml/d

Agricultural use: direct abstractions

Total amount abstracted for irrigation	20 700 Ml/d
Other agricultural uses including fish ponds	0 Ml/d

Wastewater disposal services

(a) % of urban population served by a sewerage network	NA
(b) % of urban population served by other adequate means	NA
(c) % of urban population lacking adequate disposal means	NA
(d) % of rural population served by a sewerage network	NA
(e) % of rural population served by other adequate means	NA
(f) % of rural population lacking adequate disposal means	NA

[a] 1 Ml/d = 1 million litres/day.

[b] NA = Not available

Sewage treatment

(g)	% of sewerage systems receiving primary treatment only	NA
(h)	% of sewerage systems receiving secondary treatment	NA
(i)	% of sewerage systems receiving tertiary treatment	NA
(j)	% of sewerage systems receiving no treatment (raw discharge)	NA

Discharge of treated sewage

(k)	% discharged into the sea	NA
(l)	% discharged into surface water bodies	NA
(m)	% discharged onto farmland	NA

Discharge of untreated sewage

(n)	% discharged into the sea	NA
(o)	% discharged into surface water bodies	NA
(p)	% discharged onto farmland	NA

Sludge disposal

(q)	% of sludge disposed into the sea	0.0%
(r)	% of sludge disposed into surface water bodies	0.0%
(s)	% of sludge disposed onto farmland	41.0%
(t)	% of sludge disposed as landfill	54.0%
(u)	% of sludge incinerated	5.0%

Note from the editor

It is estimated that in urban areas, as there is a water supply system connected to each home (100% coverage), there is probably also a wastewater connection to a sewage network, to a septic tank or to other adequate means of wastewater disposal. The same assumption can be made with regard to the percentage of population served in rural areas. Therefore, it is assumed that in urban areas the whole population is connected to municipal sewage networks while in rural areas, only 88% of the population disposes of an adequate wastewater disposal system. However, no figures were available.

Useful addresses

Governmental

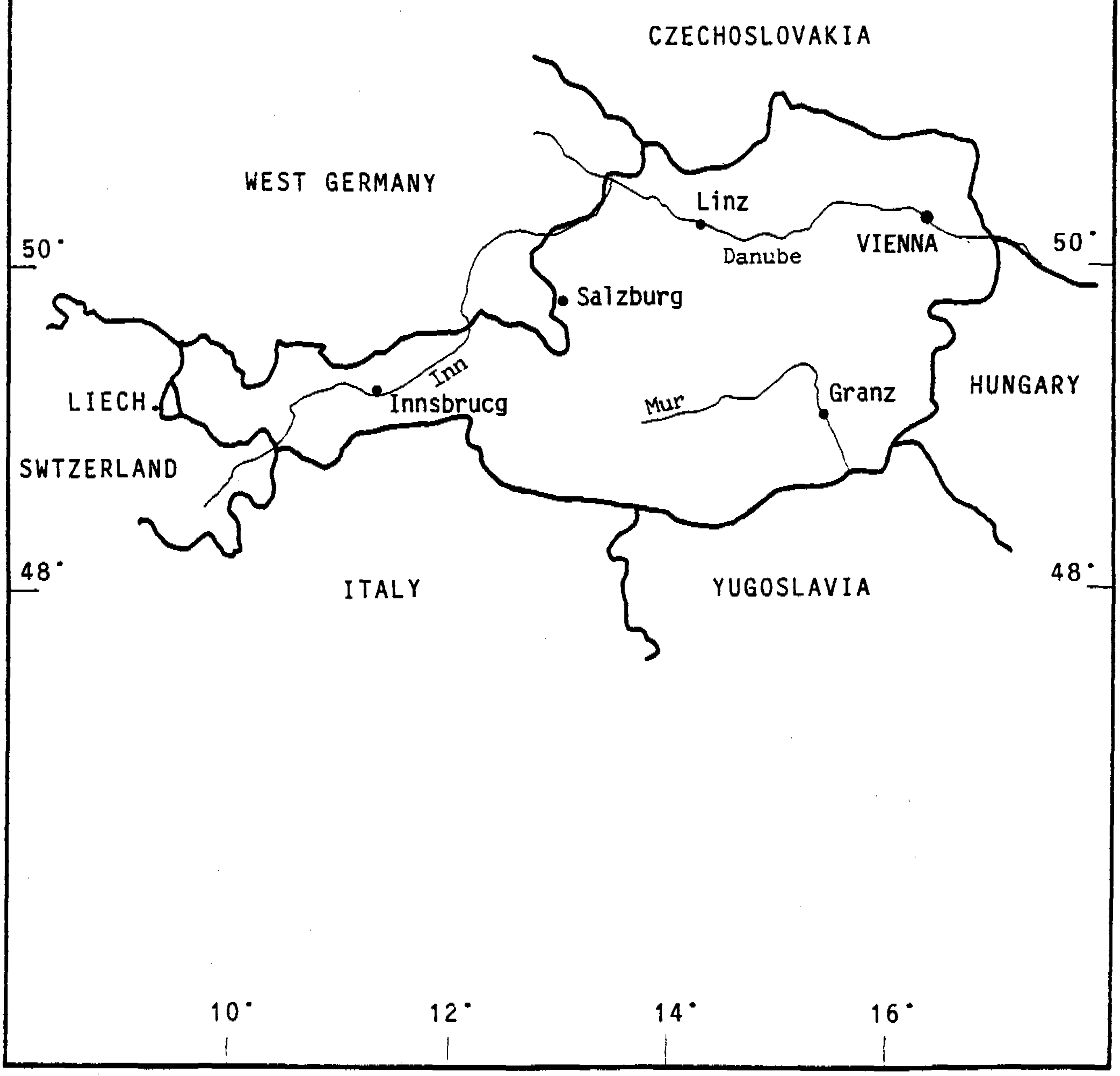
Ministry of Municipal Economy
Directorate of Water Supply and Sewage

Tel. 57 42
Telex 22 84

Ministry of Health
Directorate of Hygiene

Tel. 79 41
Telex 22 05

AUSTRIA


CZECHOSLOVAKIA
WEST GERMANY
Linz
VIENNA
Danube
50°
50°
Salzburg
Inn
Innsbrucg
LIECH.
Mur
Granz
HUNGARY
SWTZERLAND
48°
48°
ITALY
YUGOSLAVIA
10°
12°
14°
16°

AUSTRIA

The Republic of Austria is bounded by Czechoslovakia, the Federal Republic of Germany, Hungary, Italy, Switzerland, Yugoslavia and Liechtenstein. Most of Austria - the western, southern and central parts - lies among the eastern Alps. Of the total area, 92% is mountainous and only 4.5% is plain, mainly bordering on the Danube. It has an area of 83 849 km^2, and in 1985 had a population of 7 558 000, giving an average density of 90 inhabitants per km^2.

Government

Austria is a federal republic divided into nine provinces (Länder), each with its own provincial assembly (Landtag). The Federal Parliament has two chambers: the National Council (Nationalrat) and the Federal Council (Bundesrat).

Administrative organization of water services

There are two groups of organizations in Austria responsible for water services. The first consists of predominantly governmental services whilst the second comprises mainly private institutions. The responsibilities of both these groups of organizations are described in the Federal Act on Water Affairs.

Overall responsibility (including regulatory and surveillance activities) lies with the first group. It includes the following bodies and experts.

- The Authority on Water Affairs. This agency operates at the federal, provincial and local (regional) levels; it issues permits and licences and grants authorization to several other water services. It is entrusted with overall decision-making.

- The Water Management Fund. The Fund carries out its functions at the federal level and corresponding services are available at the provincial level. It is responsible for the financial promotion, mainly through loans, of water supply and wastewater facilities, including those related to industrial plants.

- The water quality surveillance services. They carry out their duties at the provincial level under the guidance of the federal services; they are responsible for monitoring wastewater discharges and river quality.

- The Federal Institute for Water Quality (Bundesanstalt für Wassergüte). Functioning at Federal level, this agency carries out water quality investigations and has responsibility for transboundary water pollution monitoring.

- The Environmental Protection Agency (Department for Water Balance of Karstic Regions (Umweltbundesamt Abteilung für Wasserhaushalt von Karstgebieten). This department carries out investigations on flow capacities and catchment areas.

- Senior experts. These are experts in administration, water engineering and public health; they are at the disposal of the Authority on Water Affairs and their services are available at the federal and provincial levels.

- Water management register. Records of relevant facts and data are kept in the register and an information service is available to the public. It is maintained at the federal level, but similar services exist at the provincial level.

- The hydrographical service. This service examines quantitatively all factors pertaining to the water cycle (surface and sub-surface water, precipitation, evaporation, temperature and suspended solids). It operates at the federal and provincial levels.

- Water management planning bodies. They provide advice to the Authority on Water Affairs and operate at the provincial level.

The second group of water services places special responsibility, in individual cases, on the water user. They include the following.

- Regional water associations. They are established by local initiative or by order of the Authority on Water Affairs; they have, inter alia, responsibility for the construction and management of regional water supply or wastewater disposal facilities. Their terms of reference are authorized and controlled by the Authority on Water Affairs; their activities include the provision of finance, operation, maintenance and surveillance of water and sewage networks.

- Other users. Their responsibility varies according to the provisions and orders imposed by the Authority on Water Affairs.

- Waterworks. Services are provided by municipalities or by private undertakings.

- Wastewater purification plants. Services are provided mostly in the framework of municipal activities; with regard to industrial wastewater networks, they are provided by the private institutions concerned.

Role of the health department with regard to water quality

The Federal Chancellery - Department of Public Health is the country's supreme health authority. It is responsible for formulating health policy, drafting legislation and general directives, and ensuring the technical supervision of health services and training. The governor of each province implements the directives of the Federal Ministry.

According to the Federal Act on Water Affairs, a hygienist has to present his expert opinion before a waterworks or a sewage plant can be installed.

Water and related legislation

The Federal Water Law is embodied in the Constitution (Article 10(I), No. 10). The Federal Minister of Agriculture and Forestry has prime authority. In special matters, cooperation with the ministries competent for health and environmental protection may be required. The Water Law has had many amendments, of which the Act of 22 May 1966 (Bundesgesetzblatt, 1969, p. 1283 et seq.) in the first line deals with special provisions for pollution control.

The Federal Act on Water Affairs (WRG.BEBI No. 215, revised version BEBI No. 207, 1969) constitutes the legal basis for water administration in Austria. In particular, this is the basis for the Authority on Water Affairs which is involved at the federal, provincial and local (regional) levels. Within the framework of the law, goals for water management are defined, decisions taken, licences provided and difficulties resolved by taking appropriate administrative proceedings following expert opinion by water engineers and others. General water quality objectives have been set within the framework of the Act, and these have led to a number of regulations and ordinances. Water quality objectives and measures for the protection of water quality of the Rivers Danube and Mur have also been specified.

At governmental level, guidelines for defining effluent standards and for river quality protection have been drawn up. Specialized guidelines concerning the exploitation of gravel near to groundwater resources and for the protection of groundwater quality from landfills have been issued.

The Austrian Institute for Standardization also provides standards with respect to different matters of water quality protection. These are not binding on the administration but can be referred to by consultants for specific installations. It has issued standards on public drinking-water supply that cover drinking-water quality and the maintenance of that quality (Ö NORM M 6250 and M 6251). It also prepares standards on the requirements of wastewater discharged from specific industries as guide values.

Where no recommendations are available regarding the quality of raw waters or water used for drinking-water supply in individual cases, these are derived from international standards or directives, e.g. WHO, EEC,.

Within the framework of the Federal Act on the Promotion of Hydraulic Constructions, the Water Management Fund has been entrusted with financial promotion in the field of water supply, wastewater disposal and treatment. The Act has been amended by supplementary legislation that takes into account the technical considerations required for future water management projections permitting the promotion of overall and long-term planning in the field of the protection and management of water resources.

Federal support for plants to purify discharges, and for other anti-pollution investments, is provided by long-term loans and preferential income taxes. Prior permission is required for activities that could lead to the pollution of water or otherwise injure the interests of other parties who have special rights or interest in its use. Permits and enforcement of the Water Law are in the hands of the local water authorities with respect to water supply plants, with expert advice from the local public health offices.

The Federal Law Gazette (Bundesgesetzblatt) No. 34, 23 December 1969, within the framework of the Federal Act on Water Affairs, provides for the Water Management Register to record important data and information on water management throughout Austria.

The responsibility for the collection and treatment of domestic sewage lies with the communes or municipalities. In many cases, communes have joined together to provide sewage treatment in a regional plant.

Water research

The Federal Ministry of Sciences and Research is currently compiling a register of research projects being carried out in Austria. This will include details of funds provided by the Austrian administration.

There are several levels of water research, i.e. governmental, public and private. In this, federal and regional institutes, scientific institutes, economic associations and private institutions are involved. A survey of water research carried out by the Austrian Association on Water Economy (Österreichischer Wasserwirtschaftsverband) highlighted the need to coordinate the great variety of water research activities conducted in Austria.

At present, it is felt that there is a growing need to intensify applied research in the field of water management and economics. This arises from the difficulties encountered by many water utilities resulting from the greater impact on water resources by modern society. Thus, more emphasis is needed on water planning and the collection of data to aid evaluation and decision-making especially for the prevention of water pollution.

Within the legal framework, applied research in the field of water economics and management is carried out by the federal institutes. In addition, the Federal Ministry of Agriculture and Forestry, in accordance with the Law on Federal Ministries, places research contracts based on a medium-term programme. Many of the projects deal with water protection and problems concerning the natural water cycle, available water reserves, flood control, drainage and irrigation for agricultural purposes.

One of the federal institutes concerned with water economics and management, the Federal Institute for Water Quality, collects and compiles data on water quality, paying special attention to pollutants. The Institute also deals with methods of analysis and treatment of water and water management.

The Department for Water Balance of Karstic Regions of the Environmental Protection Agency is carrying out investigations to determine the water balance and water reserves in karstic areas. This will form part of an overall assessment of Austrian water reserves. Studies leading to the development of improved tracer methods for hydrological investigations have been implemented and are seen as an important element in this work.

Finance

Finance for waterworks and sewage treatment plants owned by communities is derived principally from charges to householders, businesses and farmers for water supply and for other services such as sewage and sewage treatment.

Service charges

Potable water supply

A basic installation fee is charged by the waterworks. The level of fee varies according to the communities. Water is charged at a basic tariff with decreasing rates for large water users. Increased rates are applied in some special cases.

Sewage

The authority for sewage charges rests with the communities. A basic installation fee is charged. Treatment costs for wastewater are charged according to a formula that takes into account the floor area of the building, the amount of water supplied or the amount of wastewater.

Industrial effluent

The communities are entitled to charge fees for the treatment of trade or industrial effluents from the individual industries. There is no common level for fixing these charges as arrangements are based on private law.

Responsible agencies[a]

Operation	Carried out by:
Water resources survey	Federal Ministry of Agriculture and Forestry (Hydrographical Service; Water Management Register); Federal Ministry of Sciences and Research (Natural Resources Investigation); relevant institutions of the provincial governments
Water management policy	Federal government and provincial governments (in particular the Federal Ministry of Agriculture and Forestry)
Drinking-water production	Public, provincial and local water supply companies and associations
Drinking-water distribution	Municipalities and private waterworks
Drinking-water quality surveillance	General surveillance carried out by public health services (individual surveillance imposed on them)
Agricultural irrigation	So far only local companies and private enterprises
Industrial water supply	Waterworks (associations, companies or municipalities) or industrial management (in case of own industrial water supply)
Underground water protection	Generally: authority on water affairs, water quality surveillance services (provincial government) and monitoring institutes
Surface water protection monitoring	As above
Water pollution control	As above[b]
Water resources storage and allocation	Authority on Water Affairs and water supply associations

[a] General responsibility is held by the Authority on Water Affairs and by specialized administrative services. Individual responsibility is imposed on organizations or individuals within the framework of the Federal Act on Water Affairs, especially when water permits or licences are granted.

[b] and individually: all polluters according to their legal obligations and individual obligations imposed

Water resource availability and management

Rainfall

The hydrographic conditions prevailing in Austria are favourable compared to those of many other countries. The mean annual precipitation of the entire federal territory amounts to about 1190 mm, i.e. some 100 billion m^3 of water, about 54 billion of which constitute surface runoff. This corresponds to a discharge of 653 mm. In addition, a mean annual amount of some 35 billion m^3 of water flows into Austria from other countries, which is mainly carried by the Danube and Inn.

Owing to Austria's mountainous nature and influences from various climatic zones, the precipitation differs greatly from one part of the country to another. In general, the precipitation decreases gradually from west to east, the mean annual figures decreasing from more than 2500 mm in the west to about 500 mm in the east. However, in the western part of Austria, too, there are some zones which are considered as being relatively arid.

The areas with the highest rates of precipitation are mainly situated in the north-eastern and southern Limestone Alps, which bear most of the impact of the bad weather fronts coming from the Atlantic and Mediterranean areas. These areas are relatively narrow in the south, whilst they are rather extensive in the north and form the northern parts of the federal provinces of Vorarlberg, Tirol and of the Salzkammergut. The rates of precipitation prevailing in the Central Alps are considerably lower (despite their greater altitudes) than those in the northern and southern subsidiary mountain chains. In fact, the central Alpine valleys, with mean annual precipitations of 600-800 mm, constitute the areas which are considered as being arid.

Topography

The type of surface runoff mainly depends on the precipitation, but also on the geological structure, vegetation and temperature. In Austria, there are relatively numerous types of rivers and streams which vary in size and distribution, the type being determined by the natural conditions. These types include streams formed by glacier runoffs, mountain rivers with glacial influence and other mountain rivers, watercourses flowing from the Lower Alps and the Bohemian Chain and from the basin areas with runoff regimens which vary considerably and, finally, the large main rivers into which various tributaries flow.

The distribution of the runoffs in the course of the year is extremely important for the various uses of water.

Since Austria is a mountainous country, the greater share of its water resources is surface water, but qualitywise its groundwater resources are of considerable importance. Groundwater is mainly found in the plains situated in the eastern part of the country and in the Alpine valleys. Mountain and crevice water largely occurs in karstic areas and potential karstic areas, which cover about one sixth of Austria's area. Regions with relatively large resources of groundwater (covering about an eighth of Austria) are to be found in the following federal provinces: Burgenland 35%, Carinthia 9%, Lower Austria 16%, Vienna 48%, Upper Austria 11%, Vorarlberg 10%, Salzburg 5%, Styria 10% and Tirol 4% (percentage of groundwater used in relation to other water sources).

Population/water resources

Water supply

About 1000 large and medium-sized waterworks, together with approximately 4000 small waterworks, supply 6.97 million inhabitants with 510 million m^3 drinking-water per annum. This corresponds to an average usage of about 220 l /capita per day. Of this water 59% is gained from springs, 37% from groundwater and only 4% from surface water. About one sixth of Austria constitutes karstic regions, and this accounts for the high proportion of spring waters used since these mostly originate from these areas.

The needs for water for larger towns are calculated by multiplying the total number of the population by an assumed water usage/capita per day (generally between 300-400 l/capita per day, though higher usage may be assumed if local conditions indicate this). For smaller settlements and especially those of a more rural nature, water demand is estimated by summing the total needs, i.e. domestic needs (domestic, cattle rearing), public needs (schools, hospitals, fire-fighting) and special needs (tourism, businesses).

In order to meet peak demand, particularly in industrial and tourist areas where considerable seasonal variations occur, and also to cope with future increasing demand and regional variation, efforts are being made to develop regional water supply systems. These will involve large-scale installations, often promoted by government grants.

The water administration of Vienna estimates the specific water demand for the year 2000 to be between 400 l/capita per day and 450 l/capita per day. This can be contrasted with that found in Tirol today, where owing to economic and seasonal reasons the specific water demand varies from 120 l/capita per day for small settlements to 500 l/capita per day for towns and even up to 1000 l/capita per day for a typical tourist centre.

Wastewater management

The population of Austria is approximately 7.6 million. The total wastewater from all communities, however, amounts to about 11 million population equivalents (PE). In addition, industry is estimated to account for a further 18 million PE. The total for Austria is therefore approximately 29 million PE (1 PE consists of 60 g BOD_5/day and 100 g COD/day). The industrial component comes mainly from the following industries:

Pulp and paper	9 million PE
Food processing	5 million PE
Chemical	1 million PE
Others	3 million PE

At present, about one half of the wastewater is treated (about 14 million PE). The greater part of this (about 12 million PE) is treated in regional plants, with the remaining in smaller, isolated plants.

The regional wastewater plants treat wastewater from the provincial capitals and from industries and settlements located within the respective regional catchment area. Most are organized into associations (either water purification or wastewater associations).

According to information from the Association Diet of the Austrian Water Associations (Verbandstag der Österreichischen Wasserbande), there are just over 150 such water associations in Austria, each treating between 10 000 PE and 50 000 PE, i.e. about two thirds of the total treated. It will therefore be seen that the majority of such plants can be considered either medium or small in size. Most of the wastewater treated by the water associations is from domestic or trade application. Industrial wastewaters are usually treated in separate plants which are normally not connected or only partly connected to regional facilities. It was easier to integrate communities into regional wastewater management systems in this way rather than to establish joint facilities capable of treating wastewater from both the communities and industry.

Future trends of water resources

Austria may be considered comparatively rich in water. However, the problem of water supply, and more especially the security of future supplies, is becoming increasingly important. The following points outline the present situation and the foreseeable development with regard to water reserves and water demand.

- In Austria, precipitation, and accordingly basic water supply, is reasonably assured, and precipitation usually takes place in convenient areas.

- The main areas providing water are the mountain zones with their considerable contributions to precipitation and runoff as well as the groundwater aquifers accompanying large surface waters.

- In future, it should be possible to maintain an adequate water supply, except in a few genuinely arid zones, provided the population density and industry do not increase excessively.

- Continuous efforts directed towards water quality control and protection measures are, however, a prerequisite for maintenance of an adequate water supply.

- Difficulties may be expected, however, in areas where the demand for water supply by the community or by industry is expected to increase considerably. This could be further compounded by increasing use of water amenities and opposition to the development of additional water supply resources.

- It will be necessary to allocate future water supplies carefully, both in terms of quantity and quality, balancing the needs of water utilization areas with the waters available in the catchment areas.

General statistics

Population

Population in urban areas[a]	56.0%
Population in rural areas[a]	44.0%

Drinking-water supply

Total piped supply for drinking purposes	520 Mm^3/a[b]
Total population served by a piped public water supply	80.0%
Urban population served by a house connection	100.0%
Urban population without house connections but with reasonable access to public standposts	0.0%
Rural population served by house connections (public and private)	70.0%
Rural population without house connections but with reasonable access to private water supply (house-wells, springwater supply)	30.0%

Drinking water supply uses

Water supplied for domestic and commercial use	87.0%
Water supplied for industrial use	13.0%
Other uses	0.0%

Industrial water supply: direct abstractions

Total supplied from inland waters for industrial use	1500 Mm^3/a
Used for industrial cooling water	66.0 %
Usage as industrial process water	33.0 %
Total coastal water used	0 Ml/d[c]

Agricultural use: direct abstractions

Total amount abstracted for irrigation during a three-month growth period	55 Mm^3/a
Other agricultural uses including fish ponds	0 Ml/d

[a] The overall Austrian land-use planning concept estimates rural areas to cover 90% of the land area and contains approximately 50% of the population.

[b] 1 Mm^3/a = 1 million cubic meters per annum

[c] 1 Ml/d = 1 million litres per day

Wastewater disposal services

(a)	% of urban population served by a sewerage network	100.0%
(b)	% of urban population served by other adequate means	0.0%
(c)	% of urban population lacking adequate disposal means	0.0%
(d)	% of rural population served by a sewerage network	20.0%
(e)	% of rural population served by other adequate means	80.0%
(f)	% of rural population lacking adequate disposal means	0.0%

Sewage treatment

(g)	% of sewerage systems receiving primary treatment only	5.0%
(h)	% of sewerage systems receiving secondary treatment	80.0%
(i)	% of sewerage systems receiving tertiary treatment	5.0%
(j)	% of sewerage systems receiving no treatment (raw discharge)	10.0%

Discharge of treated wastewater

(k)	% discharged into the sea	0.0%
(l)	% discharged into surface water bodies	100.0%
(m)	% discharged onto farmland	0.0%

Discharge of untreated sewage

(n)	% discharged into the sea	0.0%
(o)	% discharged into surface water bodies	100.0%
(p)	% discharged onto farmland	0.0%

Sludge disposal

(q)	% of sludge disposed into the sea	0.0%
(r)	% of sludge disposed into surface water bodies	0.0%
(s)	% of sludge disposed onto farmland	30.0%
(t)	% of sludge disposed as landfill	50.0%
(u)	% of sludge incinerated	20.0%

Useful addresses

Governmental

Federal Ministry of Agriculture and Forestry (Bundesministerium für Land- und Forstwirtschaft)
Sektion IV/Abteilung 1
Stubenring 1
1010 Vienna

Tel. (0222) 7500

Water industry

Austrian Water Economy Association (Österreichischer Wasserwirtschaftsverband) (ÖWWV)
An der Hülben 4
1010 Vienna

Tel. (0222) 527444

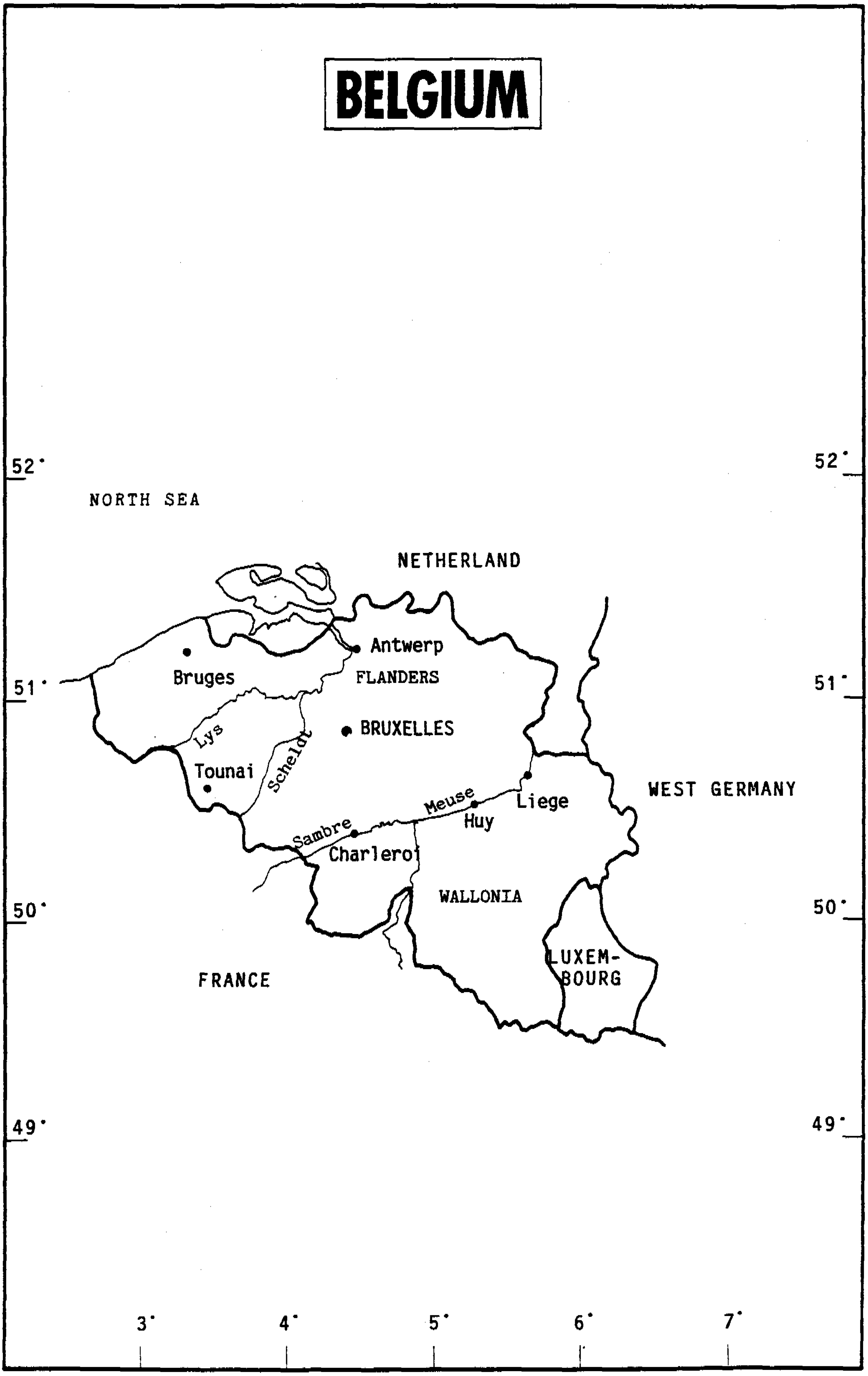
Austrian Gas and Water Boards Association (Österreichische Vereinigung für das Gas- und Wasserfach) (ÖVGW)
Schubertring 14
1010 Vienna

Tel. (0222) 531588

Water research

Federal Institute for Water Quality (Bundesanstalt für Wassergüte
Schiffmühlenstrasse 120
1223 Vienna

Tel. (0222) 234591


BELGIUM
52°
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NORTH SEA
NETHERLAND
Antwerp
Bruges
FLANDERS
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Lys
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Meuse
Liege
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Charleroi
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BELGIUM

Belgium is bounded by France, the Federal Republic of Germany, Luxembourg, the Netherlands and the North Sea. It has an area of 30 513 km^2, and in 1983 had a population of 9 863 374, giving an average density of 323 inhabitants per km^2. The capital, Brussels, has a population of just over one million.

Government

Belgium is a constitutional and hereditary monarchy, with a two-chamber Parliament consisting of the Senate and the Chamber of Representatives.

The country is divided into nine provinces, which are both territorial entities of the State and autonomous political units responsible for provincial interests. Each province has a governor, who is both the representative of the national and regional governments and the executive agent of the elected provincial council. The unit of local government is the municipality, of which there are 600. Each municipality has an elected council and a burgomaster and is an autonomous authority in all municipal matters. Two new administrative levels were introduced in 1979: the region, of which there are three (Flanders, Walloonia and Brussels) and the community, of which there are two (Flemish-speaking and French-speaking).

Administrative organization of water services

In Belgium, responsibility for water supply rests with the municipalities, which decide how the public is to be supplied with drinking-water. A great many municipalities have set up intermunicipal companies, which are responsible for specialized technical activities such as the supply and distribution of potable water.

The most important examples of these companies are:

- the Brussels Intercommunal Waterworks (Compagnie Intercommunale Bruxelloise des Eaux (CIBE) or Brussels Intercommunale Watermaatschappij (BIWM)), which, with a yearly distribution of 110 million m^3 of potable water, supplies the 19 municipalities of Brussels and 52 other municipalities;

- the Antwerp Waterworks (Antwerpse Waterwerken) (AWW) with a yearly distribution of 125 000 000 m^3 of water, supplies the city of Antwerp and 13 suburbs.

These companies, together with the National Waterworks (Nationale Maatschappij der Waterleidigen NMW) which has a yearly distribution of 170 million m^3 of water, are the three largest in the country; they also provide significant bulk supplies of water outside their own areas. The National Waterworks was founded in 1913 to provide water supply in areas not covered by the municipalities. This company, however, has been abolished by the Act of 28 December 1984 in order to allow the Flemish and the Walloon Community to found their own companies to take over the duties of the National Waterworks (within this framework). For this purpose, the Flemish Company for Water Supply (Vlaamse Maatschappij voor Watervoorziening) was founded. These three organizations supply about 70% of the drinking-water in Belgium.

There are three other major companies:

- Provincial and Intermunicipal Drinking-water Company of the Province of Antwerp (Provinciale en Intercommunale Drinkwater-maatschappij der Provincie Antwerpen PIDPA);

- Intermunicipal Water Supply Company for Flanders (Tussengemeentelijke Maatschappij der Vlaanderen voor Waterbedeling TMVW);

- Intermunicipal Water Supply Company for the Conurbation of Liège and its Surrounding Districts (Compagnie Intercommunale des Eaux de l'Agglomération Liègeoise et Extensions CIEALE).

Each of these companies supplies in a year between 30 million and 40 million m^3 of water which, together with the city of Ghent, represents a further 20% of the total demand in Belgium. The remaining 10% is supplied by about 200 smaller companies.

All the water supply companies belong to the public sector. The municipalities, the provinces and the State are the only shareholders.

The production and distribution of drinking-water has so far been the only task of these water companies. They are not responsible for sewerage or sewage disposal. The supply zones of the major water companies are shown in Fig. 1.

The responsibility for the standards of quality and for the construction of large national infrastructure works lies with the National Secretary of State for Public Health attached to the National Minister for Social Affairs. The other responsibilities for water supply lie with the three regional ministries in Flanders, Walloonia and Brussels.

The regional ministries are also responsible for sewage treatment and sludge disposal. Each area has its own organization, which is also responsible for management tasks such as the issuance of discharge permits, monitoring of the conditions of discharges, surveys for surface and underground water sources, and the control of industrial wastes, except when they are treated on-site.

However, the central government still retains a certain number of responsibilities in the field of wastewater, such as the promulgation of regulations concerning standards of quality for domestic and industrial emissaries. At regional level, the organizations (see Fig. 2) are the Wastewater Treatment Company for the Coastal Basin (Waterzuiveringsmaatschappij voor het Kustbekken), which has been operating since 1975 and the Flemish Wastewater Treatment Company (Vlaamse Waterzuiveringsmaatschappij), which became operative in 1982. Walloonia and Brussels have not yet reached a decision on this subject.

Fig. 1. Important Belgian Drinking Water Companies

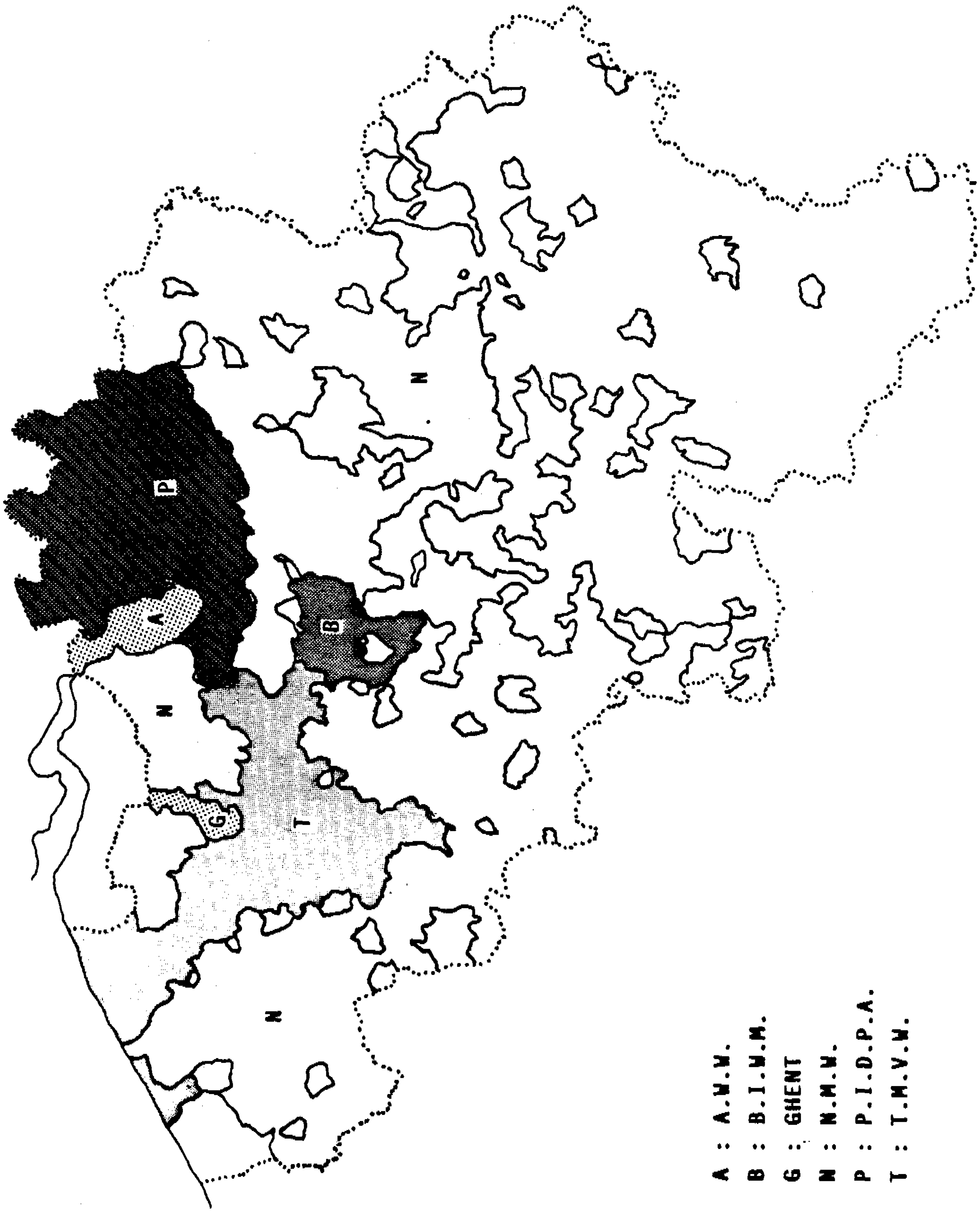
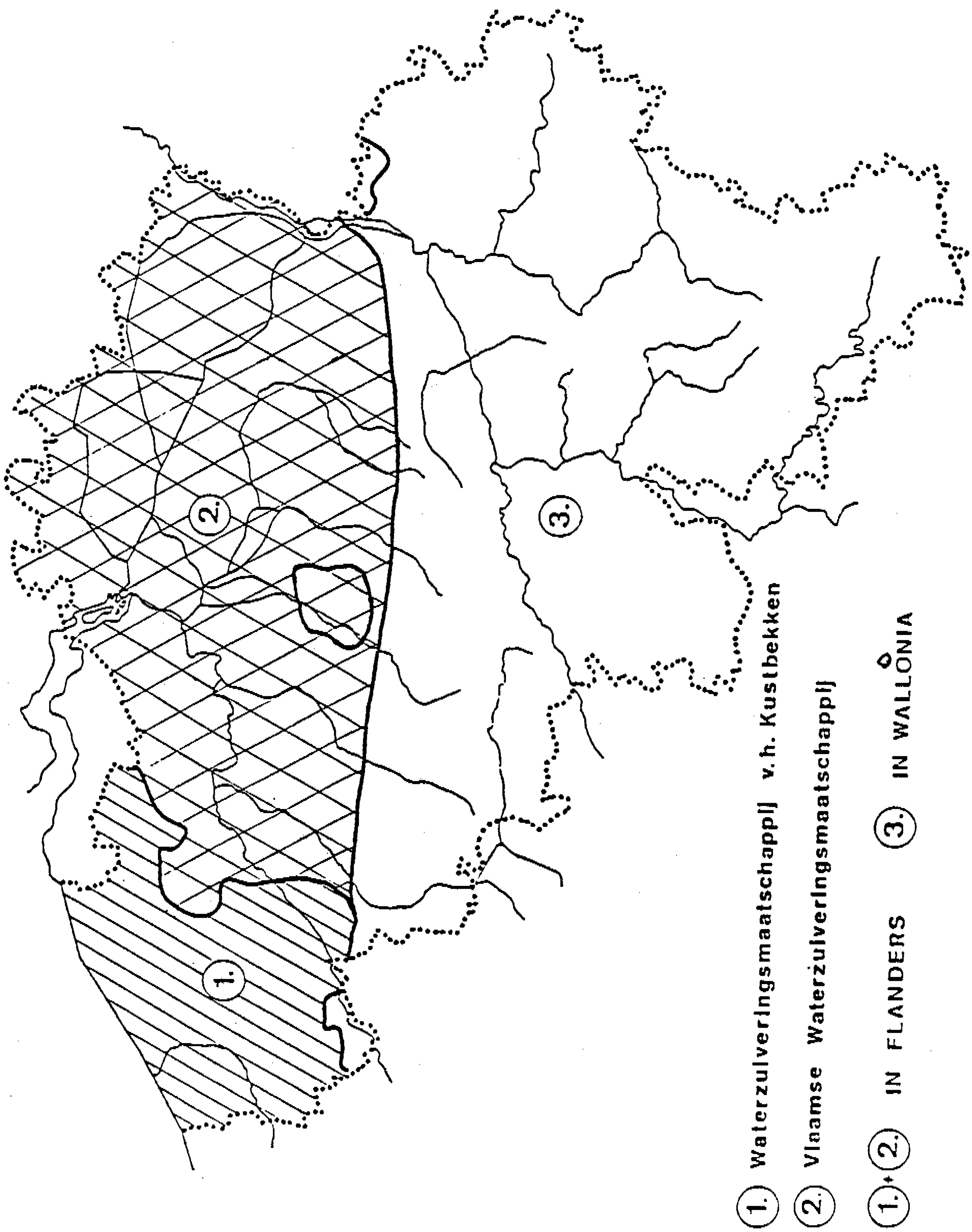


Fig. 2. Belgian Wastewater Companies



The role of the health department with regard to water quality

In Belgium, the operation and duties of water undertakings are regulated by royal decrees which enact the Law of 24 January 1977 on the Control of Foodstuffs, Substances used as Foods and Other Products. The Royal Decree of 27 April 1984 provides that the Regional Services and the Institute of Hygiene and Epidemiology are allowed to check water quality at any time by visiting the technical plants and by taking samples from any part of the supply and distribution system. Whenever an incident or a breakdown occurs at a treatment plant or in a section of the distribution system that would endanger the safety of the water supply, the undertaking is obliged to warn the consumers and the State Secretary of the Department of Public Health that the water supply is no longer potable.

At any time, water undertakings can be asked to pass on analytical results concerning water quality to the above-mentioned services. They must also inform the Department of Public Health of the State Secretary for Health when new intakes or new installations for storage and treatment of water destined for human consumption are put into service.

The Health Department also issues, after taking account of the EEC directives, the parameters and corresponding maximum values to be observed for the supply of drinking-water to the consumers. Although regionalization in Belgium has transferred some powers from the national to the regional governments, the authority for technical regulations remains at the national level.

Water and related legislation

In the past, the quality of raw water that was to receive further treatment was laid down in the Law of 11 March 1950 and the Royal Decree of 29 December 1953. This law divided raw water into three classes, the first being the only water that could be transformed into drinking-water. In order to be so classified, the raw water had to meet severe conditions.

Due to administrative problems with the enforcement of this law, the protection of surface waters was not totally satisfactory and a new legislation was approved in 1971, (Water Laws covering Surface Water and Groundwater, Laws of 26 March 1971) by which Belgium was divided into three catchment areas. Full application of these laws was delayed by disagreement between the Flemish and the Walloon communities. The Crown Order of 3 August 1976 repealed earlier orders and laid down detailed regulations for wastewater discharges into surface waters. In addition to the usual restrictions on physical and chemical parameters, it included a special prohibition on the use of garbage grinders. Wastewater containing infectious organisms must be disinfected before discharge. The basic responsibility for water supply and wastewater was transferred to the regions in 1981. Special companies have been established to organize, plan, construct and operate water and waste disposal facilities. The Minister of Public Health and Family Affairs sets standards, while enforcement is at the commune level. Permits to discharge treated sewage must be obtained from the purification company in the area. Protected catchment areas for the protection of groundwater may be set up by Crown order. Licences for abstracting groundwater are reviewed by the Administration of Mines for expert advice but are issued by the Water Department of the Ministry of Public Health and Family Affairs.

The new legislation is supported by the Royal Decree of 27 April 1984 and it is based on the requirements of the EEC Directive No. 80/778/EC.

Marine pollution laws follow various international and area-wide conventions. The London Convention for the Prevention of Pollution of the Sea by Oil of 12 May 1954 and its amendments are implemented in the Laws of 4 July 1962 and 29 November 1967, and the 1958 Geneva Convention on the High Seas is implemented in the Law of 29 July 1971. The Belgian Navy and the Civil Defence share responsibility for implementing the marine pollution laws.

Water research

The Research Institute for Water

The Water Research Syndicate (SVW) was founded in 1974, but in 1985 it was reconverted into the (Flemish) Research Institute for Water. Its aims are:

- to study techniques and problems related to the production of drinking-water and the treatment of industrial water and domestic wastewater;

- to plan research programmes on the above-mentioned techniques and problems;

- to collaborate with foreign organizations for the study of problems related to water supplies and wastewater disposal;

- to advise and give scientific aid to all members.

Members of the SVW are:

Mr S. Beernaert, GOM - West-Flanders, Baron Buzettelaan 33, 8320 Brugge (President, S.V.W.).

Mr P. Dejonghe, Study Centre for Nuclear Energy, Boeretang 200, 2400 Mol (Vice-President, S.V.W.).

Mr G. Bovyn, Director-General P.I.D.P.A., Desguinlei 246, 2018 Antwerp (Administrative Secretary. S.V.W.).

Mr J. Dirickx, Director-General, Antwerp Waterworks, Mechelsesteenweg 64, 2018 Antwerp.

Mr J. Janssens, c/o Antwerp Waterworks, Mechelse Steenweg 64, 2018 Antwerp (President of the Technical Committee, S.V.W.).

Mr K. De Brabander, Chief of Department, Institute of Hygiene and Epidemiology, Juliette Wytsmanstraat 14, 1050 Brussels.

Dr I. Cappaert, Director, Flemish Wastewater Treatment Company, Graanmarkt 2, 9300 Aalst.

Mr B. Breda, Cabinet Adviser, Office of the Federal Minister for the Environment, Water Policy and Education, Jozef II-straat 30, 1040 Brussels.

Mr A. Samuel, Director-General, Intermunicipal Water Supply Company for Flanders, Stropkaai 14, 9000 Ghent.

Mr W. Maes, c/o P.I.D.P.A., Desguinlei 246, 2018 Antwerp (Bookkeeping, S.V.W.).

There is very close collaboration with the Belgian universities where research on water is carried out. All officials concerned with drinking-water supply and wastewater treatment may also become members of the SVW.

Research projects are currently being carried out on the following subjects:

- new filter materials;
- optimization of the sludge treatment processes;
- ozonization followed by activated carbon filtration;
- the influence of storage of water in a reservoir on the coagulation/flotation/filtration process;
- the removal of nitrates by biological denitrification and reverse osmosis;
- the removal of haloforms (literature study);
- disinfection of drinking-water with H_2O_2 and NH_2Cl;
- toxicological study of flocculating agents;
- study of pre-ozonization;
- treatment of nitrogenous effluents.

Study and Documentation Centre on Environmental Matters (Centre d'Etude et de Documentation de l'Environnement (CEBEDEAU)

Based at the University of Liège, CEBEDEAU is a centre for basic and applied research on environmental problems. Its fields of study include drinking water treatment, wastewater treatment, water corrosion and treatment of industrial waste.

CEBEDEAU acts as a scientific consultant to numerous organizations, including local and national government departments, public and private companies, and it also undertakes projects for international organizations, including the EEC and WHO.

Many research projects are carried out in close collaboration with universities and other research institutes, and as part of its training function, many of CEBEDEAU's project leaders also teach at universities and give guidance to students and postgraduates.

CEBEDEAU's other services include a large up-to-date library, a monthly review published by its sister company CEBEDOC, and an annual international conference, which has taken place for the last 36 years.

Finance

Revenue income

The Belgian water supply companies get their revenues from payments of water bills by the consumers, but some companies are sometimes subsidized by Government Institutions when extensions to the supply and distribution systems are envisaged.

Service charges

Potable water supply

All domestic and industrial consumption is metered with the exception of the domestic consumers supplied by the Antwerp Waterworks. They have a free choice between payment after metering or payment on the basis of a fixed tariff according to the standard of the sanitary installation in the dwelling.

Sewage charges

There is no charge for sewage disposal as yet, although in one part of Flanders, there is an environmental tax which is partially used to cover the cost of sewage disposal.

Industrial effluent

There is also no industrial effluent charge as yet.

Responsible agencies

Operation	Carried out by
Water resources survey	Regional Services and Institute of Hygiene and Epidemiology (Public Health Department)
Water management policy	Regional Administrations
Drinking-water production	Public water supply companies under the control of regional administrations
Drinking-water distribution	Public water supply companies under the control of regional administrations
Drinking-water quality surveillance	Institute of Hygiene and Epidemiology and Public Water Supply Companies
Agricultural irrigation	Ministry of Agriculture, Regional Administrations
Industrial water supply	Ministry of Economic Affairs, Regional Administrations
Underground water protection	Economic Affairs and Public Health, Regional Administrations
Surface water protection monitoring	Regional Administrations and Wastewater Treatment Companies
Water pollution control	Public Health Regional Administrations
Water resources storage and allocation	Public Health Regional Administrations

Water resource availability and management

Rainfall

The average yearly rainfall along the Belgian coast is 650 mm, divided over 163 rainy days. In Brussels, a quantity of 780 mm is spread over 200 rainy days, while in the eastern part of the country the rainfall amounts to approximately 1300 mm in 196 rainy days. The prevailing direction of the wind is south-west.

Topography

The country is divided into four main geographical areas.

(a) South Belgium (south of the Rivers Sambre and Meuse) consists of the Ardennes (approximately +500-700 m) and the lower Condroz (approximately +250 m to +350 m), both formed by folded solid rock from the Palaeozoic Age, hard sandstone strata and softer schist and limestone, which were later, during the Quaternary, strongly eroded and uplifted to form plateaux, cut through by river erosion and covered with a Quaternary layer of sandy and loamy soil. The caves carved in limestone, as well as the sandy upper layers of the Quaternary Age covering the marshy plateaux, form locally important water reserves.

(b) Central Belgium, which is located between on the one hand the Rivers Scheldt and Lys and on the other hand the Meuse and Sambre, has also been uplifted and transformed by river erosion under periglacial conditions into a sloping landscape (approximately +100 m to +200 m). The chalky and sandy layers form important water reserves which, confined between loamy layers, form artesian aquifers.

(c) Lower Belgium is located between the sea and the Rivers Scheldt and Lys. The covering sands of Tertiary origin were strongly eroded and covered with river deposits of continental origin in the draining valleys composed of sandy and gravel terraces, levelled by mainly Aeolic covering sand (levels +10 m to +100 m). Especially in the east of the lower part of the country (Meuse Valley), important water reserves are formed by these deposits of gravel.

In Central and Lower Belgium, declining north-westward, the bedrock is mainly covered with Tertiary layers of marine origin, alternatively composed of sandy and loamy layers, locally resting on a chalky substratum of Mesozoic Age (in the extreme western and eastern parts of the country) and covered with a Quaternary upper layer.

The water table in this covering layer fluctuates as a result of seasonal variations in rainfall followed by infiltration, and also as a result of the natural surface water runoff towards the Rivers Ijzer, Scheldt and Meuse which brings all surface waters towards the sea.

(d) Finally, the coastal zone in the north-western part of the country is composed of a dune belt containing a limited layer of sweet-fresh-water reserve which is covered by an upper layer of loam, peat and sand.

Population/water resources (see Fig. 3)

The most densely populated areas are the centre of the country, between and alongside the Rivers Scheldt and Lys and also the Meuse and Sambre.

The southern part of the country, which is the least densely populated, receives most of the rainfall feeding the River Meuse. The Meuse water is used by the Antwerp Waterworks and the Brussels Waterworks. The Brussels Waterworks also use some groundwater, while other water supply companies use mostly groundwater. The National Waterworks possess two storage reservoirs for surface water with associated treatment works.

Future trends of water resources

In 1985, surface water contributed 33% to the total drinking-water supply and it is estimated that before the end of the century this will amount to some 50%. Groundwater sources provide 67% of the total amount of water needed.

In the Flemish part of the country, there is a strong tendency towards self-supporting policies in the field of drinking-water supply, and the construction of several storage reservoirs for surface water is proposed.

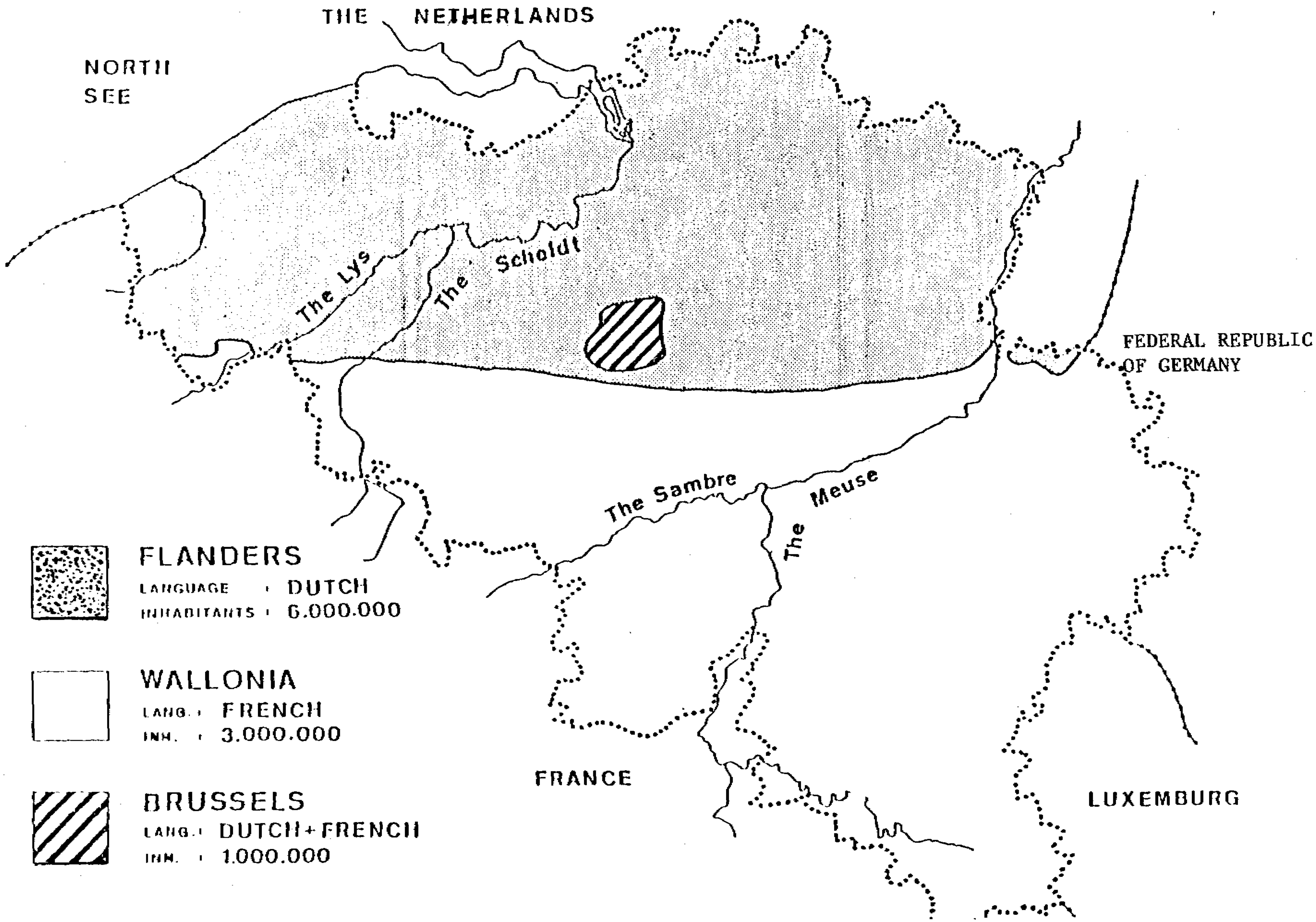


Fig. 3. Languages spoken in Belgium

General statistics

Population

Population in urban areas	70.0%
Population in rural areas[a]	30.0%

Drinking-water supply

Total piped supply for drinking purposes	1500 Ml/d[b]
Total population served by a piped public water supply	97.0%
Urban population served by a house connection	100.0%
Urban population without house connections but with reasonable access to public standposts	0.0%
Rural population served by house connections (public and private)	90.0%
Rural population without house connections but with reasonable access to public standposts	10.0%

Drinking water supply uses

Water supplied for domestic and commercial use	68.0%
Water supplied for industrial use	32.0%
Other uses	0.0%

Industrial water supply: direct abstractions

Total supplied from inland waters for industrial use[c]	19 000 Ml/d
Used for industrial cooling water	90.0 %
Usage as industrial process water	10.0 %
Total coastal water used Ml/d[d]	NA

Agricultural use: direct abstrations

Total amount abstracted for irrigation	NA Ml/d
Other agricultural uses including fish ponds	NA Ml/d

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[a] Rural areas: when the house is isolated or when the number of inhabitants of the district or the hamlet is less than 2000.

[b] 1 Ml/d = 1 million litres/day.

[c] Hydraulic power stations not included.

[d] NA = Not available

Wastewater disposal services

(a)	% of urban population served by a sewerage network	100.0%
(b)	% of urban population served by other adequate means	0.0%
(c)	% of urban population lacking adequate disposal means	0.0%
(d)	% of rural population served by a sewerage network	*
(e)	% of rural population served by other adequate means	*
(f)	% of rural population lacking adequate disposal means	0.0%

Sewage treatment

(g)	% of sewerage systems receiving primary treatment only	NA
(h)	% of sewerage systems receiving secondary treatment	NA
(i)	% of sewerage systems receiving tertiary treatment	NA
(j)	% of sewerage systems receiving no treatment (raw discharge)	75.0%

Discharge of treated sewage

(k)	% discharged into the sea	NA
(l)	% discharged into surface water bodies	NA
(m)	% discharged onto farmland	NA

Discharge of untreated sewage

(n)	% discharged into the sea	NA
(o)	% discharged into surface water bodies	NA
(p)	% discharged onto farmland	NA

Sludge disposal

(q)	% of sludge disposed into the sea	NA
(r)	% of sludge disposed into surface water bodies	NA
(s)	% of sludge disposed onto farmland	80.0%
(t)	% of sludge disposed as landfill	18.0%
(u)	% of sludge incinerated	2.0%

* Note from the editor

It is estimated that in urban areas, as there is a water supply system connected to each home (100% coverage), there is also a wastewater connection to a sewage network.

A different assumption can be made with regard to the percentage of population served in rural areas (90% connected to a water supply system). Although no figures were made available, we estimated that 50% of the population connected to a water system are also connected to a sewage network. We also assumed that the remaining rural population is connected to a septic tank or to other adequate means of wastewater disposal.

Useful addresses

Governmental

National

Secretary of State for Public Health and the Environment attached to the Minister of Social Affairs (Staatssecretaris voor Volksgezondheid en Leefmilieu toegevoegd aan de Minister van Sociale Zaken)
Wetstraat 56
1040 Brussels

Regional

Flanders:

Gemeenschapsminister van Leefmilieu, Waterbeleid en Onderwijs
Jozef II Straat 30 (4de v.)
1040 Brussels
Tel: (02) 2170150

Brussels:

Staatssecretaris voor het Brussels Gewest, bevoegd voor het waterbeleid
Hertogstraat 9
1000 Brussels

Walloonie:

State Secretariat
for Water, Environment and Rural Affairs
Walloon Region
Rue Van Apre 97
5100 Namur

Direction générale des Ressources naturelles
et de l'Environnement
L'ESPINOIS
Avenue Albert ler, 187
5000 Namur

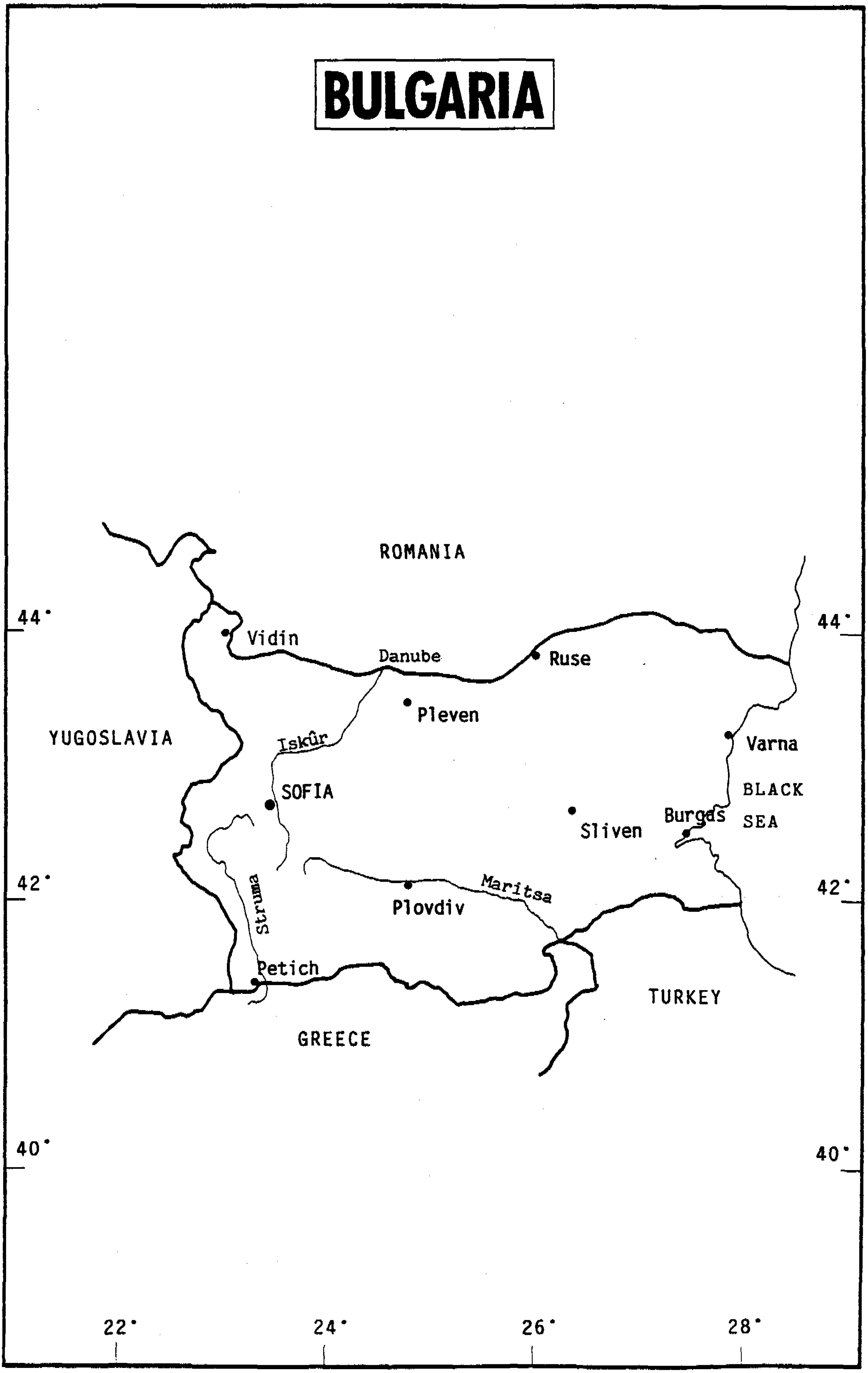
Water industry

National Association for Water Supply Companies
NAVEWA-ANSEAU
Waterloosesteenweg 255
1060 Brussels
Tel: (02) 537 43 02

<u>Water research</u>

Water Research Institute (SVW)
Institute of Hygiene and Epidemiology
Ministry of Public Health and Environment
Juliette Wytsmanstraat 14
<u>1050 Brussels</u>

Study and Documentation Centre on Environmental Matters (Centre d'Etude et de Documentation de l'Environnement) (CEBEDEAU)
Rue A. Stevart 2
<u>4000 Liège</u>


BULGARIA
ROMANIA
44°
Vidin
Danube
Ruse
Pleven
YUGOSLAVIA
Iskûr
Varna
SOFIA
BLACK
SEA
Burgas
Sliven
42°
Maritsa
Plovdiv
Struma
Petich
TURKEY
GREECE
40°
22°
24°
26°
28°

BULGARIA

The People's Republic of Bulgaria is situated in the Balkan peninsula. Its southern and western borders are formed by ranges of hills, separating it from Turkey and Greece to the south and Yugoslavia to the west. To the north, the frontier with Romania is mainly formed by the River Danube; to the east, there is the coastline on the Black Sea. In the census of December 1985 the population totalled 8 942 976. The average population density was 80.6 inhabitants per km^2 within a total area of 110 912 km^2.

Government

Under the 1971 Constitution, the supreme organ of state power of the People's Republic of Bulgaria, and the only legislative organ, is the single-chamber National Assembly (one deputy per 30 000 persons). The National Assembly elects the Council of State as its permanent institution (presidium) and also elects the Council of Ministers, which is the supreme executive and administrative body of the State but responsible to the National Assembly. The presidium consists of the president, two vice-presidents, a secretary and 15 members. It summons the assembly, fixes the dates of elections and exercises certain other functions, particularly when the assembly is not in session.

For purposes of local administration, the country is divided into 28 regional provinces (okruzi) including the capital, Sofia, which has the status of an independent district. The local authorities are responsible for all economic, social and cultural affairs of local importance in accordance with the laws of the country. The regional provinces are subdivided into 136 urban and 1016 rural communes.

Administrative organization of water services

The Committee for Nature Protection set up under the Council of Ministers is concerned with the whole range of activities that affect the use of water. All waters, surface and underground, in the territory of the People's Republic of Bulgaria, including the territorial sea waters, are State and national property. In order to develop the water economy, the Committee for-Nature Protection together with the relevant ministries, committees, central administrations and district people's councils draw up a unified perspective plan, which is then approved by the Council of Ministers.

Controls to ensure correct and suitable use of waters is exercised not only by the Committee for Nature Protection but also by the Ministry of Construction and Architecture, the Ministry of Public Health and the executive committees of the district people's councils, the State Department for Water Supply and Sewerage, the National Agro-Industrial Association and the Ministry of Energy.

The Committee for Nature Protection is an agency that was set up in 1976 under the Council of Ministers. It controls and coordinates work on the problems related to the prevention of water pollution. The Committee prepares and submits orders, laws, regulations, etc., for approval by the Council of Ministers. Its agencies are the district inspectorates for nature protection, some of which incorporate laboratories for water quality control.

The Ministry of Construction and Architecture is responsible for the provision of water supplies to all settlements. It develops the long-term plans and programmes which are followed for the research, design, construction and development of the water supply systems. This function is carried out:

- through the Institute for Water Supply and Sewerage for designing, investigation and research work;
- through the principal organization for hydraulic construction (for large sites, the smaller ones are dealt with by the regional construction organizations);
- by investment in large schemes that involve two or more regions through the State Department for Water Supply and Sewerage and in smaller sites through the respective districts;
- by developing water supply and sewerage sites through the State Department for Water Supply and Sewerage and the 28 regional provinces, each of which has a chemical and microbiological laboratory where the quality of the water intended for public consumption is monitored.

Role of the health department with regard to water quality

Ministry of Public Health

The Directorate for Hygiene and Epidemiology is concerned with problems relating to drinking-water quality and quantity. It has both legislative and control functions and coordinates all work on problems related to public water supply. Its agencies are the hygiene and epidemiology inspectorates, which are administered by the public health authorities attached to the people's councils; branches of these inspectorates are established in all larger towns but not districts. The inspectorates and their branches exercise control over water supply sources and the quality of potable water. Each of them has chemical and microbiological laboratories, where samples of water are analysed.

The role of the hygiene and epidemiological inspectorates

The quality of drinking-water is continuously and automatically checked at the laboratories of the State Department for Water Supply and Sewerage. In the smaller pumping stations, only the quality of the disinfection is controlled, but at the same laboratories checks are made on the efficiency of the treatment plant. The chemical and microbiological laboratories at the hygiene and epidemiological inspectorates are also responsible for checking the efficiency of the wastewater purification processes and for ensuring drinking-water quality. All operations concerning the public health aspects of water resources, abstraction protection zones and equipment for public water supplies are managed by a physician, the chief of the department for municipal hygiene and the hygiene and epidemiology inspectorate. When necessary, he informs one of the vice-presidents of the district people's councils, who is responsible for the local water supply. The latter organizes the coordination between the different services responsible for water supply and gives the orders necessary to solve any problems concerning public water supply or purification of wastewaters, in accordance with the existing laws.

Water and related legislation

The basic document regulating the usage of water in the People's Republic of Bulgaria is the Law on Water (D'rzhaven Vestnik, 11 April 1969, No. 29) and the decree for bringing it into effect.

The Law for the Protection of Air, Water and Soil from Pollution (D'rzhaven Vestnik, 29 October 1963, No. 84) established the General Directorate of Water Resources, which worked with the Ministry of Public Health and the Ministry of Agriculture and the food industry to formulate a number of decrees and orders. Among the more important is the amended Order No. 96 of 12 December 1969 (IDHL, 21: 557) specifying the various health protection areas for the control of water pollution. Zone A is fully protected as a water supply area and may not be used for agriculture or other purposes. Zone B may be used for agriculture and for building, subject to hygiene regulations that are established by a commission designated by the Minister of Construction and Architecture. The duties of the General Directorate of Water Resources are now assigned to the Committee for Nature Protection, under the Council of Ministers, which operates regional inspection stations where water samples may be analysed and appropriate action taken.

Drinking water has to conform to the Bulgarian State Standard 2823-83. This document specifies the organoleptic, physiochemical, radiological, microbiological and biological values, to which drinking-water fit for human consumption has to conform. The conditions for water sampling, analysis and supervision on behalf of the Ministry of Construction and Architecture and the State Department for Water Supply and Sewerage, as well as the functions of the Ministry of Public Health bodies responsible for drinking-water control, are also outlined in this document. The following documents are also relevant:

- order concerning the use of water supply and sewerage systems (D'rzhaven Vestnik, No. 37, 1962);

- order concerning the use of water supply and sewerage systems (D'rzhaven Vestnik, No. 30, 1964;

- order concerning sanitary protection zones around water courses and water supplies installations (Official Gazette No. 24 of 24 March 1974);

- standards and regulations for designing public water supply systems, water mains and equipment for building installations (Construction and Architecture Bulletin, No. 9, 1967), etc.

Bulgaria is a member of the Danube Commission and has agreements with Turkey and Romania regarding pollution of the Black Sea.

Water research

Research into water-related problems is carried out by the Scientific Institute of Hygiene and Occupational Health, which is part of the Medical Academy, the departments of hydrometeorology and oceanology of the Bulgarian Academy of Sciences. The Design Institute for Water Supply and Sewerage, the Committee for Nature Protection and the National Agro-Industrial Association are also involved in research.

Finance

Revenue income

The economic enterprise water supply and sewerage obtains its revenue from households and industrial enterprises for water supplied to them. The annual income average 101 000 leva. For 1981 the amount received was 101 329 leva.

Service charges

Potable water supply: information not available.

Sewage charges: information not available.

Industrial effluent: information not available.

Water resources availability and management

Rainfall

Rivers and underground water are the most important sources but artificial and natural lakes also make a major contribution. Over the whole territory of Bulgaria the average annual rainfall is 660 mm (73.2 milliard m^3). From this 75% evaporates and only 25% remains as runoff. The total abstraction of underground waters is calculated at $3x10^9$ m^3. The aquifers are rather shallow. The capacity of 366 lakes in the mountains is about $11x10^6$ m^3, of which $7x10^6$ are in the Rila Mountains and $4x10^6$ in the Pirin Mountains.

Five hundred and nine artificial lakes have been constructed. According to the classification of the International Committee, the larger artificial lakes have a capacity of $7.07x10^9$ m^3.

Topography

The average height of the country above sea level is 470 m. Most of the country is hilly or mountainous.

The underground waters of south-east Dobrudza consist mainly of fresh underground water which is influenced by the local soil - lithologic conditions.

The district of the Tundza interstream aquifer is characterized by a varied geological structure. The territory comes within the limits of the Sredna Gora hydrogeological district where the rocks are of fissured, karst and porous type. In the eastern aquifer of Maritza the waters are related to the strata and other types of soil formed by rich humus materials, heavy clay and resinous substances.

The geological structure in the Stara Zagora field is comparatively uniform. The district is in a seismically active region. After the strong earthquakes of 1909 and 1912 a large area has sunk and as a result the flow of underground waters coming from the mountain of Sredna Gora has been abruptly slowed down. This has caused their level to rise. The soils in this area are rich in water soluble salts.

The area of the upper stream of the river Vacha comprises part of the Central Rodopi. In the peripheral part, most of the rocks are granites and rhyolites containing the minerals of potassium-sodium feldspar and here and there metal sulphides.

The west part of the upper Thracian lowland includes the area of the Pazardzik-Plovdiv Valley and the surrounding mountain chains. The chemical composition of the underground waters in this area vary according to the mineral composition of the rocks. In areas with soils with high levels of salts, the mineral content of the waters is also high.

The factors affecting the great variety of the chemical characteristics of the underground waters in the plain east of Sofia are the mixed mineral composition of the rocks and their shallow location. The higher manganese content in the waters is determined by natural factors, such as the manganese ores around Kremikovci and the presence of manganese concretions in pliocenic clays in the area of Sofia.

General statistics

Population

Population in urban areas	66.0%
Population in rural areas	34.0%

Drinking-water supply

Total piped supply for drinking purposes	1470 Ml/d[a]
Total population served by a piped public water supply	98.0%
Urban population served by a house connection	100.0%
Urban population without house connections but with reasonable access to public standposts	0.0%
Rural population served by house connections (public and private)	94.0%
Rural population without house connections but with reasonable access to public standposts	6.0%

Drinking water supply uses

Water supplied for domestic and commercial use	67.9%
Water supplied for industrial use	32.1%
Other uses	0.0%

Industrial water supply: direct abstractions

Total supplied from inland waters for industrial use[b]	4020 Ml/d
Used for industrial cooling water	NA[c] %
Usage as industrial process water	NA %
Total coastal water used	NA Ml/d

Agricultural use: direct abstrations[d]

Total amount abstracted for irrigation[d]	NA Ml/d
Other agricultural uses including fish ponds	NA Ml/d

[a] 1 Ml/d = 1 million litres/day.

[b] The use of water in agriculture has increased by about 2% annually over the period 1971-78.

[c] NA = Not available

[d] For 120 days irrigating season.

Wastewater disposal services

(a)	% of urban population served by a sewerage network	NA
(b)	% of urban population served by other adequate means	NA
(c)	% of urban population lacking adequate disposal means	NA
(d)	% of rural population served by a sewerage network	NA
(e)	% of rural population served by other adequate means	NA
(f)	% of rural population lacking adequate disposal means	NA

Sewage treatment

(g)	% of sewerage systems receiving primary treatment only	NA
(h)	% of sewerage systems receiving secondary treatment	NA
(i)	% of sewerage systems receiving tertiary treatment	NA
(j)	% of sewerage systems receiving no treatment (raw discharge)	55.5%

Discharge of treated sewage

(k)	% discharged into the sea	NA
(l)	% discharged into surface water bodies	NA
(m)	% discharged onto farmland	NA

Discharge of untreated sewage

(n)	% discharged into the sea	NA
(o)	% discharged into surface water bodies	NA
(p)	% discharged onto farmland	NA

Sludge disposal

(q)	% of sludge disposed into the sea	NA
(r)	% of sludge disposed into surface water bodies	NA
(s)	% of sludge disposed onto farmland	NA
(t)	% of sludge disposed as landfill	NA
(u)	% of sludge incinerated	NA

Note from the editor

It is estimated that in urban areas, as there is a water supply system connected to each home (100% coverage), there is probably also a wastewater connection to a sewage network, to a septic tank or to other adequate means of wastewater disposal. The same assumption can be made with regard to the percentage of population served in rural areas. However, no figures were available.

Useful addresses

Governmental

Committee for Nature Protection
2 St. Triaditza
Sofia

Telex: 22145

Water industry

Economic Directorate Water Supply and Sewerage
12 St. Uzundzovska
Sofia

Tel: 87-49-52 and 87-06-46
Telex: 22311

Water research

Scientific Institute of Hygiene and Occupational Health
Medical Academy

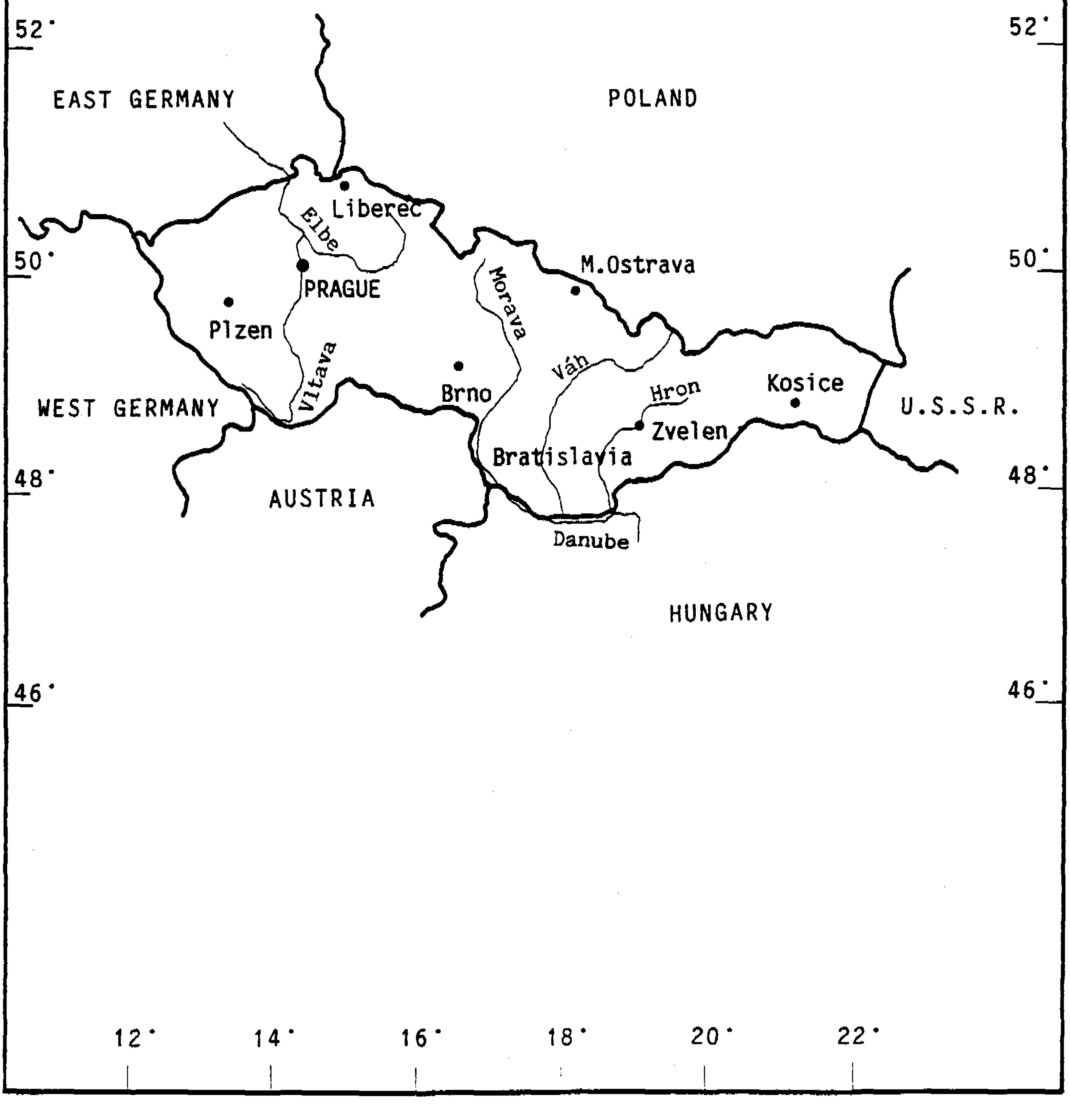
The Committee for Nature Protection

Bulgarian Academy of Sciences

Design Institute for Water Supply and Sewerage

The National Agro-Industrial Association

CZECHOSLOVAKIA



CZECHOSLOVAKIA

Czechoslovakia is bordered to the north by Poland and the German Democratic Republic, to the south by Hungary and Austria, to the west by the Federal Republic of Germany and to the east by the USSR. In 1985, the estimated population was 15 503 426, with a population in the capital, Prague, of 1 186 000. The total area of the country is 127 903 km^2 with a population density of 121 inhabitants per km^2. The population is relatively young: in 1981, 24% were under the age of 15 years and 12% were over the age of 65 years.

Government

The Czechoslovak Socialist Republic is a federal state in which the Czech and Slovak peoples enjoy equal rights. The Czech Socialist Republic (CSR) is divided into seven regions (75 districts), its capital being Prague, which has the status of a region; the Slovak Socialist Republic (SSR) has three regions (37 districts) and its capital, Bratislava, also has the status of a region. The supreme organ of the federal state power is the Federal Assembly, which has two chambers: the House of the People and the House of Nations. Each constituent republic has its own elected National Council or Parliament, which is responsible for all matters except external relations, defence, overseas trade, transport and communications.

The regions and districts are administered by people's councils. There are some 10 000 municipalities, of which over 8000 have a population of less than 1000.

Administrative organization of the water services

The administration of water services in both constituent republics is identical, and the structure of the water services conforms to the general administrative organization.

In both republics, the Ministry of Forestry and Water Management has overall responsibility for water and water-related affairs and for the administration of all State water management projects.

The Ministry is responsible for ensuring the care and control of water resources, monitoring water pollution quality, preparing legislation and drawing up the general water management plan (see the end of this section). Any resultant directives are carried out by the regions and districts.

At the regional and district levels, water services are dealt with by the water management department of the regional national and district national committees. The committees are responsible for granting consent for water utilization and for construction of water schemes, control of water pollution and emergency measures in the case of accidental spillage or contamination. The cities of Prague and Bratislava have their own national committees, and in Prague and Bratislava the national committees are also responsible for the waterworks and sewage works. There are nine of these in the CSR and four in the SSR and their catchment areas conform to the administrative divisions of each republic. They are responsible for the provision of all water supplies to industry, agriculture and domestic users and for wastewater disposal and sewage treatment.

In addition, there is a second type of water enterprise in both republics, namely the river authorities, which are responsible directly to the Ministry of Forestry and Water Management. There are five in the CSR and four in the SSR, and their geographic areas conform to river basins. They are responsible for the management of watercourses and for surface water supply. This includes maintenance of waterways for navigation, surveillance of water quality in streams and technical and water engineering developments. These two types of enterprise form the basis of the water industry in Czechoslovakia.

There are a number of other bodies in both republics that carry out various functions within the administration. All of these bodies are responsible to the Ministry of Forestry and Water Management of the respective republics.

- The Water Pollution Inspection Boards (CSR and SSR). Responsible for control and maintenance of water quality, through its regional inspection boards.

- Hydroprojekt (CSR) and Hydroconsult (SSR). Undertake engineering design, geological survey, water and data analysis.

- Water Management and Development and Construction Enterprise (CSR) and Water Management Construction Enterprise (SSR). Undertake investment and design studies for engineering work, technical safety supervision and technical development.

- Water Resources Enterprise (CSR and SSR). Carries out engineering, geological and hydrogeological survey work, especially in the groundwater field.

- Hydrometeorological Institute (CSR and SSR). Provides funding and services in hydrology, meteorology, climatology and atmospheric pollution. It also registers the quality and quantity of water resources.

- State Water Management Fund (SSR). The Fund was created to avoid compensation for damage caused by water pollution and to support the construction and operation of wastewater treatment plants.

- Flood Control Commission (SSR). Provides flood control.

Water resource development in Czechoslovakia progresses according to the requirement of the national economy, as set out in the five-year development plans and carried out under the annual plans. Looking forward to the next decade, forecasts and the need to meet demand are summarized in the general water management plan of the CSR and the SSR (1975). The aims of the plan are set out in Water Law No. 138 of 31 October 1973 (IDHL, 26: 511).

Role of the health department with regard to water quality

The responsibilities of the Ministries of Health of both republics regarding water quality are set out in Public Health Law No. 20 of 1966, which deals with the cooperation between the ministries and the water authorities in the preparation and development of water management projects. The law also provides for the appointment of a chief hygienist of Slovakia itself.

The Ministries of Health and of Forestry and Water Management work together to produce directives and regulations concerning water, which are then carried out by the health commission and department of health of the regional and district national committees.

Water and related legislation

The principles of water legislation in Czechoslovakia are set out in the Water Law of 1973. The law covers the full range of water management problems, including water protection, groundwater and public water supply, and the payment for water supplies. This law serves as a basis for a number of decrees, including Decree No. 25 of 26 March 1975 of the Czech Socialist Republic, establishing indicators of the permissible level of water pollution (IDHL, 29: 321), and the corresponding Decree No. 30 of 26 March 1975 of the Slovak Socialist Republic. Indicators of the permissible levels are set in terms of toxic elements, other chemical water quality parameters, and biological parameters. The latter include the behaviour of salmonoid fish in watercourses designed for water supply and of cyprinoid (carp family) fish in other surface waters. Also included is the pollution (saprobity) index, based on work done at the Department of Water and Environmental Technology in Prague.

The Water Law states that groundwater is reserved for drinking and other specified purposes, as ordered by the Ministry of Health. Natural medicinal waters come under special regulations. Important natural aquifers may be designated as "protected water resource zones". Discharges of wastewater must not jeopardize the quality of surface water or groundwater.

The Ministry of Health's Order No. 45 of 13 June 1966 (IDHL, 18: 327) establishes, inter alia, three classes of water: (a) drinking-water; (b) water of domestic quality that may be used, if drinking-water is not available, for bathing, washing and watering animals; and (c) water of industrial quality that may be used for any other purpose except the preparation of food.

Oil pollution of surface water is covered in Order No. 35 of 1972 of the Ministry of Forestry and Water Management of the Czech Socialist Republic and No. 12 of 1973 of the Slovak Socialist Republic.

In addition to these laws, both republics have separate legislation covering the State administration of water management. The Czech National Council Law No. 130 of 1974 and the Slovak National Council Law No. 135 of 1974 deal with the application of the Water Law in each country.

All three laws came into force in April 1978. To enable compliance with them further legislation was passed in both countries. In the SSR, for example, a number of decrees were passed dealing with payment for water services, public waterworks, water distribution and flood control.

There is also a hygiene service in both republics, directed by a chief hygienist and operated by hygiene officers appointed by the national committees. There are numerous hygiene stations of different size and status throughout Czechoslovakia, and one of the responsibilities of the stations is to verify water quality.

Administration of water supply and pollution control follows a special pattern because the country is divided into river basins that do not always follow regional boundaries. There is a water board for each river basin, which administers the water regulations. The water board must prepare documents based on expert opinions which set limits appropriate to the local conditions in response to requests for withdrawals or discharges. These expert opinions are binding on the political authorities in the region. Surface water and the beds of rivers and lakes are State property administered by the Ministries of Forestry and Water Management. Surface water and groundwater, beyond normal domestic needs, must be purchased from the State. The water boards levy fees for discharges of polluted water. At present these fees are based on volume, suspended solids and organic matter such as biochemical oxygen demand (BOD). Other pollutants may be added later. The aim is to make the fees somewhat larger than the cost of removing the pollutants. Fees paid for the discharge of pollutants go into a no-year-limit fund that is earmarked for the improvement of water. Capital costs for the construction of approved municipal treatment plants come from the State Treasury, but operating costs are paid from the regional budgets. Every factory above a certain size must employ a water officer whose responsibility is both to the factory and to the State. Likewise, other ministries and regional administrative units must have water officers.

The district or regional hygienist, who is the Director of the district or regional Institute of Hygiene and Epidemiology, has prime authority in matters endangering public health and is authorized to take all necessary measures, including stopping industrial production, if necessary, to protect health. The director of public health, who is the chief hygienist, has overall authority at the republic level. In health matters concerning water, the Ministry of Health and the Ministry of Forestry and Water Management must act in accord.

Czechoslovakia has bilateral agreements on pollution control and environmental protection with each of its neighbouring countries. The Danube forms 100 km of the border with Hungary, and Czechoslovakia is a member of the Danube Commission. An agreement between Czechoslovakia and Poland signed on 21 March 1958 deals with the use of water resources in frontier waters. A similar agreement was signed with Austria on 7 December 1967. Czechoslovakia is a member of CMEA, which has a committee that establishes standard methods for the analysis of water, air, etc. These methods are binding in matters involving bilateral agreements between CMEA countries and form the basis of many local standard methods. Flood control of transboundary water courses (the Danube, the Labe, the Odra, the Visla, etc.) is also covered by agreements with neighbouring countries.

Water research

Until 1968, the main body of research in both republics was the Water Research Institute. There were two branches, one in Prague and one in Bratislava, but after 1968 they became independent research bodies while retaining the same name. Both institutes are quite large; for example, in Bratislava there are 500 people working at the institute, 200 of them in the field of water supply engineering.

The research covers a broad range of projects in the fields of hydrology, hydraulics, water conservation and treatment, and waste treatment and disposal.

Other organizations which undertake research as a subsidiary function have already been mentioned under the section dealing with administration, such as Hydroconsult and Hydroprojekt, and the hydrometeorological institutes.

Finance

The work of the national water management authorities is financed from the State budget or from the national committee budget, and revenue from these organizations and enterprises contributes to the State budget. Major investments are again financed from the State budget according to planned investment limits.

Water enterprises derive their revenue from service charges. The revenue consists of charges levied for water supply, wastewater disposal through the public sewerage system, and effluents discharged into surface water.

Charges are differentiated according to the type of consumer, the prices paid by householders being substantially lower than those paid by other users. Charges also vary for non-domestic users, depending on the source of supply, from either main, surface water or groundwater. Hydroelectric companies pay the water authorities for water used for power generation at a mutually agreed rate.

Water resource availability and management

Rain is the main input to the country's available surface water and groundwater. The mean annual rainfall for Czechoslovakia is 751 mm, and the annual evapotranspiration is between 400 mm and 500 mm, rising to 600 mm in the southwest during the summer. There is a mean annual surface runoff of 27 740 million m^3. The availability of groundwater varies throughout the country, the groundwater capacity being estimated at 2442 million m^3 per annum.

The topography of the country divides it naturally into two parts. The CSR is part of the Bohemian massif, made up essentially of crystalline rock. In the inner part of the massif, to the south, there are areas of heavy impermeable Tertiary clays, which have created a number of small freshwater lakes. Slovakia is part of the Carpathian mountain range, which is mainly crystalline in structure. A small number of limestone ranges are to be found in the west, noticeably in the Mala Fatra region. Moravia and Silesia form a geological and structural borderland, made up in the main of thick Miocene deposits.

The demand for water is directly linked to population density and industrial and agricultural development. In recent years; there has been a significant growth in the population around important economic and industrial centres, although a substantial part of the population is still dispersed in small rural settlements. The increase in demand has been met by an increase in the construction of public water facilities and supply of mains water. Table 1 shows the extent of this development since 1970.

Table 1. Development of public water mains

Indicator	1970	1975	1980
Municipalities with public water mains	3 709	4 259	4 730
Public water mains	3 405	4 057	4 608
Length of water network (without supply lines (km))	35 911	44 068	51 606
Amount of drinking-water produced from public water mains (10^6 m^3)	919	1 205	1 488

The sources of supply are also changing, the movement being towards an increase in surface water supplies. In 1980, the percentage of surface water used was 41% for the whole of Czechoslovakia, and only 14% for Slovakia.

Water resources management strategies together with pollution protection policies have been applied for many years. River Basin Regional Boards are in charge of the implementation of the above-mentioned managerial policies including the running of a computerized information network collecting water quality data (216 parameters). This type of automatic systems are gradually being introduced in the country to rationalize the use of water resources and to develop the capacity to respond to emergency situations. Simulation models have been developed and are being used in training courses given to water managers.

At the moment, a hydrogeological survey of Czechoslovakia is being carried out and will be completed soon. Using the information from the survey, it is hoped that water management will become more effective and that aims such as optimum utilization and protection of water resources may be achieved without detriment to the environment.

General statistics

Population

Population in urban areas	64.1%
Population in rural areas	35.9%

Drinking-water supply

Total piped supply for drinking purposes	1265 Mm^3/y[a]
Total population served by a piped public water supply	77.1%
Urban population served by a house connection (public network)	89.0%
Urban population served by a house connection (private installation)	11.0%
Urban population without house connections but with reasonable access to public standposts	0.0%
Rural population served by a house connection (public network)	86.0%
Rural population served by a house connection (private installation)	24.0%
Rural population without house connections but with reasonable access to public standposts	0.0%

Drinking water supply uses

Water supplied for domestic and commercial use	69.5%
Water supplied for industrial use	27.7%
Other uses	2.8%

Industrial water supply: direct abstractions

Total supplied from inland waters for industrial use	3674 Mm^3/y
Used for industrial cooling water	41.7%
Usage as industrial process water	58.3%
Total coastal water used	0.0%

Agricultural use: direct abstrations

Total amount abstracted for irrigation	170 Mm^3/y
Other agricultural uses including fish ponds	91 Mm^3/y

[a] Mm^3/y = Million cubic metres per year

Wastewater disposal services

(a)	% of urban population served by a sewerage network (public)	75.0%
(b)	% of urban population served by other adequate means	25.0%
(c)	% of urban population lacking adequate disposal means	0.0%
(d)	% of rural population served by a sewerage network (public)	45.0%
(e)	% of rural population served by other adequate means	55.0%
(f)	% of rural population lacking adequate disposal means	0.0%

Sewage treatment

(g)	% of sewerage systems receiving primary treatment only	3.0%
(h)	% of sewerage systems receiving secondary treatment	72.7%
(i)	% of sewerage systems receiving tertiary treatment	0.3%
(j)	% of sewerage systems receiving no treatment (raw discharge)	24.0%

Discharge of treated sewage

(k)	% discharged into the sea	0.0%
(l)	% discharged into surface water bodies	98.3%
(m)	% discharged onto farmland	1.7%

Discharge of untreated sewage

(n)	% discharged into the sea	0.0%
(o)	% discharged into surface water bodies	85.0%
(p)	% discharged onto farmland	15.0%

Sludge disposal

(q)	% of sludge disposed into the sea	0.0%
(r)	% of sludge disposed into surface water bodies	0.0%
(s)	% of sludge disposed onto farmland	69.0%
(t)	% of sludge disposed as landfill	30.0%
(u)	% of sludge incinerated	1.0%

Responsible agencies

Operation	Carried out by			
	CSSR	SSR	Regions (KNV)	Districts (ONV)
Water resources survey		Slovak Geological Office, MLVH,[a] VUVH,[b] Slovak Planning Commission (PC)	Regional national committees (RNCs), waterworks and sewage works	
Water management policy		MLVH, Ministry of Construction, Industry and Engineering	RNCs	District national committees (DNCs)
Drinking-water production	National PC	Slovak PC, MLVH, production	RNCs, waterworks and sewage works	
Drinking-water distribution		Slovak PC, MLVH	RNCs, waterworks and sewage works	
Drinking-water quality surveillance		MLVH, Ministry of Health, Slovak Water Pollution Inspection Board (WPIB)	RNCs, Regional Hygienic Service, Regional Water Inspection	ONV, District Hygienic Service
Agricultural irrigation		Ministry of Food and Agriculture, State Reclamation Board	KNV, Regional Reclamation Board, Regional Agricultural Board	ONV, District Agricultural Board
Industrial water supply	State PC	Involved branches MLVH	KNV	
Groundwater protection		MLVH, Slovak WPIB	KNV, Regional Water Inspection	ONV
Surface water protection monitoring		MLVH, Slovak WPIB	KNV, Regional Water Inspection, river authorities	
Water pollution control		MLVH, Slovak WPIB	KNV, Regional Water Inspection	

[a] MLVH: Ministry of Forestry and Water Management of the Slovak Socialist Republic.

[b] VUVH: Water Research Institute of the Slovak Socialist Republic.

Useful addresses

Governmental

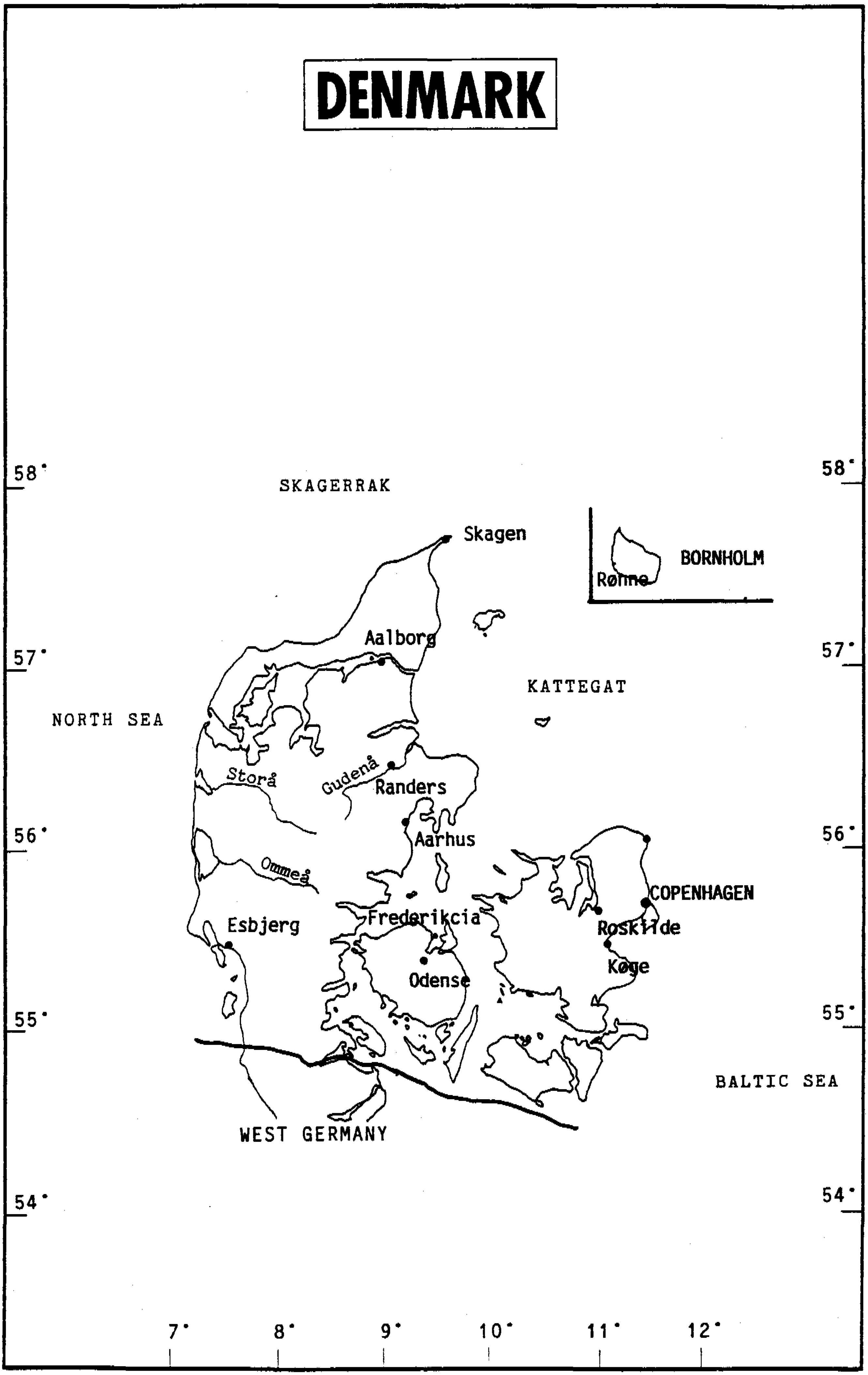
Ministry of Forestry and Water Management of the Slovak Socialist Republic (MLVH)
Tr. L. Novomestokeho 2
84218 Bratislava

Tel. 32 53 03

Water research

Water Research Institute of the Slovak Socialist Republic (VUVH)
Nabr. arm. gen. L. Svobodu 5
81249 Bratislava

Tel. 33 45 52
Telex 092 13


DENMARK
58°
SKAGERRAK
Skagen
BORNHOLM
Rønne
Aalborg
57°
KATTEGAT
NORTH SEA
Storå
Gudenå
Randers
Aarhus
56°
Ommeå
COPENHAGEN
Esbjerg
Frederikcia
Roskilde
Køge
Odense
55°
BALTIC SEA
WEST GERMANY
54°
7°
8°
9°
10°
11°
12°

DENMARK

The Kingdom of Denmark consists of the Jutland peninsula and 482 islands, the most important ones being the islands of Zealand, Funen and Bornholm. The Faroe Islands and Greenland also form part of the Kingdom, but are not covered by the text below. Denmark is almost an archipelago with a total coastline of 7400 km.

In 1987, the population was just over 5 million distributed over an area of 43 069 km^2, giving an average density of about 119 inhabitants per km^2. Four-fifths of the population live in towns and suburban areas.

Government

Legislative authority is held by the single-chamber Parliament (Folketing). There are three levels of government:

- Central government
- Regional councils (14)
- Local councils (275)

Administrative organization of water services

Central level

The Ministry of the Environment consists of a department and the following five agencies:

- National Agency for Forests and Nature;
- National Agency for Environmental Protection;
- National Agency for Physical Planning;
- National Food Institute;
- Geological Survey of Denmark.

Administration of water services at government level is mainly carried out by the National Agency for Environmental Protection, which is responsible, inter alia, for the legislation on environmental protection, water supply and watercourses, the disposal of oil and chemical wastes and pollution of the sea.

However, some other agencies are involved in water services, e.g. the Geological Survey of Denmark which is responsible for the geological mapping of Denmark and the surveying of water resources and raw materials.

County level

Denmark is divided into 14 counties (amtskommuner), each governed by a county council (amtsråd). In the area around Copenhagen, the three surrounding counties and the city itself are in certain aspects governed by the Greater Copenhagen Council (Hovedstadsrådet). The county councils and the Greater Copenhagen Council are, inter alia, responsible for the planning of water resources, the approval of sewerage and wastewater treatment plans with special regard to heavily polluting enterprises, the planning of water quality of receiving waters, water quality control, and the approval of water abstraction for agricultural irrigation, industrial use and water supply.

District level

The counties are subdivided into municipalities (275 in total), each governed by a local council. Local councils are responsible for the planning of water supply and sewerage and wastewater treatment, the operation of public waterworks and wastewater treatment plants, industrial water pollution control and minor groundwater allocation.

Technical staff, laboratories

The Minister and members of county and district councils are elected politicians, whereas the department, the agencies and the administration of regional and local councils are staffed by civil engineers, sanitary engineers, chemists, biologists, hydrologists, geologists, etc., and administrative staff. Furthermore, laboratories at central and local levels assist the Administration.

Water industry

The water supply in Denmark (approximately 97-98% is extracted from groundwater sources) is delivered by 4000 waterworks. Two thirds of the water is supplied from approximately 300 municipal plants and one third from approximately 3700 private cooperative waterworks. In addition, the country has approximately 150 000 private borings or wells. Most wastewater treatment plants are operated by local councils, but a number of the larger industrial enterprises have their own plants.

Role of the health department with regard to water quality

The National Board of Health under the Ministry of the Interior is responsible for the health aspects of water supply, such as epidemic diseases related to water. State-employed regional medical officers of health supervise the health aspects of water uses and can recommend the local authorities to introduce restrictions for health reasons on the use of water for drinking-water purposes, for bathing in certain polluted waters, or other uses.

Water and related legislation

The most important item of legislation is the Environmental Protection Law No. 85 of 8 March 1985.

The Water Supply Law No. 337 of 4 July 1985 requires the Minister of Environmental Protection to take account of environmental protection as well as health when implementing the law. The law makes the local authorities responsible for monitoring water quality in water supply systems. They report the results to the regional councils and to the regional medical officers. A series of orders issued under the earlier Water Supply Act of 1978 set standards for surface water quality, drinking-water quality, water planning, water abstraction and how to get licences, and for well construction and their protection.

Law No. 130 of 9 April 1980 (IDHL, 31: 795) on the protection of the marine environment replaces earlier laws implementing international conventions on the pollution of the Baltic and the high seas. The law contains provisions regarding all types of waste discharge and detailed annexes listing different types of poisonous material. It makes the National Agency for Environmental Protection, the State Shipping Inspectorate, the Fishing Inspectorate and the National Defence Forces jointly responsible for supervising compliance with the law.

The location of buildings and any discharges of effluent to inland waters from the proposed development are regulated by the National and Regional Planning Law and by two orders concerning urban and rural areas. This legislation does not, however, provide for any detailed control of effluents.

A more specific regulation of the location of plants that can pollute water is found in the Environmental Protection Law. Permission is needed for any new point of discharge into inland or coastal waters, and for discharge onto the ground or into any liquid that could pollute underground waters. Discharge on surface soil is permitted by regional councils if the effluent contains only easily degradable organic substances and nutrient salts in reasonable amounts. The quantity of sewage on grassland etc. is often limited to max. 3500 m^3/ha annually.

Storage of polluting substances in the ground to prevent them entering inland waters is subject to control. Containers for substances that could pollute underground waters may not be buried in the ground without permission. There are regulations by orders for oil storage (tanks, pipelines), for sewage containers and for manure heaps, liquid fertilizers and silage tanks.

Where the regional council gives licences for abstraction of water from underground or surface sources, a protected area should be established around the water intake. To protect underground waters, cesspools and similar installations are forbidden; other activities, e.g. industrial processes, camping, can be prohibited or regulated.

There is a general regulation governing the discharge of domestic effluent through a cesspool. Other discharges into inland waters require permits, and there may be conditions as to pre-treatment. Consents to discharge are subject to conditions as to composition, concentration, quantity and temperature. For discharge into watercourses, the conditions are based on the effect on the receiving waters. Regional councils set requirements for waters in their areas. Although no orders of general application have been issued, the National Agency for Environmental Protection has issued guidelines containing some standards for receiving waters and providing guidance on licences to individual discharges. The aim is to achieve a quality of water in which salmon can live and breed. Licences to discharge into sewers are given with regard to the effect on the purification plant. There are guidelines stating that the pH value of industrial discharges should be between 6 and 10 and that, as a general rule, concentrations of pollutants should not be more than five times higher than those required for the discharge from the purification plant into surface waters.

Sanitation of recreational facilities is the responsibility of the local authorities, in cooperation with the medical officer of health, according to regulations laid down by the National Agency for Environmental Protection. Beaches may be blacklisted by this Agency if they are found to have excessive bacteria counts, but it is up to the local authorities to close the beach if necessary.

If the amount of pollution or if the rate of discharge from a factory is very irregular, the use of an equalization tank may be required. Licences to discharge may be given on condition that the effluent be sampled and analysed. The monitoring data are submitted to the local authorities who supervise and inspect private treatment plants and their effluents.

The legislation on national and regional planning and on the protection of the environment is administered by the regional authorities. Regional councils provide for the inspection of public effluent treatment plants and act as the protecting authorities for inland waters. Orders govern the nature and extent of inspection and, in particular, provide that when there is a large private or public treatment plant or a plant for the treatment of industrial effluents, the receiving area around the outfall should be inspected twice a year.

Dumping into inland waters requires a licence from the regional council. It is rarely given. Dumping at sea requires a licence from the Agency for Environmental Protection. This is likewise rarely given, apart from disposal at sea of dredged spills.

Drinking-water regulations have been revised in 1987. They are in accordance with the guidelines set by the European Community.

Water research

Research is carried out by the following agencies.

Ministry of the Environment

- The Geological Survey of Denmark is, inter alia, responsible for the geological mapping of Denmark and collection of geological data on soil and groundwater quality.

- The Freshwater Laboratory and The Marine Pollution Laboratory are attached to the National Agency for Environmental Protection. The Freshwater Laboratory deals with ecological matters relating to the use and the protection of fresh waters. The Marine Pollution Laboratory carries out inland sea control and environmental research and collects and processes oceanographic data.

The Danish Academy of Technical Sciences

- The Danish Isotope Centre collects, processes and disseminates results on the use of isotope and other techniques in the field of the environment. It also undertakes research on dangerous substances in groundwater and surface water.

- The Water Quality Institute is concerned with research and investigations related to water quality, water analyses and treatment processes for authorities and private companies. The Institute is reference laboratory to the National Agency of Environmental Protection in relation to water analyses.

- The Danish Hydraulic Institute, among other activities, carries out studies on currents and water-level variations in large water areas and comprehensive investigations on the transport, dispersion and mixing of pollutants in seawater.

Ministry of Agriculture

A number of State research stations are involved to some extent in research of use of water for irrigation.

- The Danish Soil and Water Conservation Society, a private self-governing organization supported by the Ministry of Agriculture, is also involved in water research. The Society collects monitoring data of flow in the majority of Danish rivers.

Finance

Revenue income

The local councils derive their finance from charges to householders, business firms, industrial undertakings and farmers for water supplied by public waterworks and for other services such as public wastewater treatment. Private waterworks derive their finance on similar terms. Charges are subject to local conditions and can vary between D.kr. 1.00-6.60 per m^3 for water supply and D.kr. 1.00-5.00 per m^3 for treatment of wastewater of "normal" composition.

Water charges

Potable water supply

Water charges are based on either metered volumes or on rateable values of properties, subject to local conditions.

Sewage charges

Sewage charges are based either on metered volumes or on rateable values of properties. Heavily polluted industrial wastewater discharged to public sewage treatment plants is, in some cases, charged on the basis of metered volumes as well as BOD/COD and sludge. The volume of wastewater is often considered equal to that of the water supplied unless the consumer can claim that there are differences due to evaporation, etc.

Industrial effluents

As above.

Responsible agencies

Operation	Carried out by:
Water resources survey	National Agency for Environmental Protection; regional councils
Water management policy	National Agency for Environmental Protection
Drinking-water production	Municipalities and private waterworks
Drinking-water distribution	Municipalities and private waterworks
Drinking-water quality surveillance	Municipalities
Licences for agricultural irrigation	Regional councils
Licences for industrial water supply	Regional and local councils
Underground water protection	National Agency for Environmental Protection; regional councils
Surface water protection monitoring	National Agency for Environmental Protection; regional councils
Water pollution control	Regional councils
Water resources storage and allocation	Regional councils

Water resources availability and management

Rainfall

The mean annual long-term rainfall for Denmark is 760 mm equivalent to 33×10^9 m^3 per year. The actual evapotranspiration as a mean annual value for the country as a whole is 410 mm.

Topography

Denmark is a relatively flat country dominated by morainic, modulated landscapes. The average elevation is about 30 m above sea level, the highest peak reaching 173 m.

Population/water resources

The population centres are in the eastern part of Jutland, with a few exceptions on the west coast, scattered along the coast of Funen and Zealand, and concentrated in the Greater Copenhagen area. Water resources are plentiful in the sparsely populated, rainy part of western Jutland while water resources are restricted in the relatively densely populated eastern part of Jutland, Funen, and on the densely populated Zealand. On the many small islands and on the island of Bornholm, water resources are generally limited.

For the country as a whole, the total volume of water from water supply plants for domestic and industrial purposes is about 550 million m^3 per year (1985 estimate) while 30 million m^3 per year of water for domestic purposes and 125 million m^3 per year for industrial purposes was pumped up by individual abstraction plants (1985 estimate). Apart from this, about 460 million m^3 per year (1977) is used for field irrigation and other purposes in agriculture, and for fish pond farming.

Future trends of water resources

Under average conditions, water resources in Denmark are expected to be sufficient for a long time to come, but as the location of water resources is different from that of the population, distribution problems may arise. Furthermore, in dry years, the demand for irrigation in agriculture may exceed the water available in some parts of the country, and adverse effects on the aquatic environment may occur.

General statistics

Population

Population in urban areas	84.0%
Population in rural areas	16.0%

Drinking-water supply

Total piped supply for drinking purposes	1500 Ml/d[a]
Total population served by a piped public water supply	88.0%
Urban population served by a house connection	100.0%
Urban population without house connections but with reasonable access to public standposts	- %
Rural population served by house connections (public and private)	99.98%
Rural population without house connections but with reasonable access to public standposts	0.02%

Drinking water supply uses

Water supplied for domestic and commercial use	77.0%
Water supplied for industrial use	23.0%
Other uses	0.0%

Industrial water supply: direct abstractions

Total supplied from inland waters for industrial use (freshwater: surface and groundwater)	350 Ml/d
Used for industrial cooling water	40.0%
Usage as industrial process water	60.0%
Total coastal water used	NA[b]

Agricultural use: direct abstractions

Total amount abstracted for irrigation and for other agricultural uses including fish ponds	460 Mm^3/y[c]

Wastewater disposal services

(a) % of urban population served by a sewerage network	99.0%
(b) % of urban population served by other adequate means	1.0%
(c) % of urban population lacking adequate disposal means	0.0%
(d) % of rural population served by a sewerage network	1.0%
(e) % of rural population served by other adequate means	99.0%
(f) % of rural population lacking adequate disposal means	0.0%

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[a] 1 Ml/d = 1 million litres/day
[b] NA = Not available
[c] 1 Mm^3/y = 1 million cubic metres per year

Sewage treatment

(g)	% of sewerage systems receiving primary treatment only	25.0%
(h)	% of sewerage systems receiving secondary treatment	65.0%
(i)	% of sewerage systems receiving tertiary treatment	5.0%
(j)	% of sewerage systems receiving no treatment (raw discharge)	5.0%

Discharge of treated sewage

(k)	% discharged into the sea	NA[a]
(l)	% discharged into surface water bodies	NA
(m)	% discharged onto farmland	NA

Discharge of untreated sewage

(n)	% discharged into the sea	NA
(o)	% discharged into surface water bodies	NA
(p)	% discharged onto farmland	NA

Sludge disposal

(q)	% of sludge disposed into the sea	0.0%
(r)	% of sludge disposed into surface water bodies	0.0%
(s)	% of sludge disposed onto farmland	50.0%
(t)	% of sludge disposed as landfill	25.0%
(u)	% of sludge incinerated	25.0%

[a] NA = Not available

Useful addresses

Governmental

National Agency for Environmental Protection (Miljøstyrelsen (MST))
Strandgade 29
1401 Copenhagen K

Tel: (01) 57 83 10
Telex: 31209 Miljoe dk

Water industry

Danish Water Supply Association (Dansk Vandteknisk Forening)
Vilhelm Becks Vej 60
8260 Viby J

Tel: (06) 11 23 33

Water research

Water Quality Institute (Vandkvalitetsinstituttet)
Agern Allé 11
2970 Hørsholm

Tel: (02) 86 52 11
Telex: (Public booth) 16600 fotex dk, attn: Water quality hoersholm

Freshwater Laboratory (Ferskvandslaboratoriet)
Lysbrogade 52
2600 Silkeborg

Tel: (06) 81 07 22

Marine Pollution Laboratory (Havforureningslaboratoriet)
Kavalergården 6
2920 Charlottenlund

Tel: (01) 61 14 00

Geological Survey of Denmark (Danmarks Geologiske Undersøgelse)
Thoravej 31
2400 Copenhagen NV

Tel: (01) 10 66 00

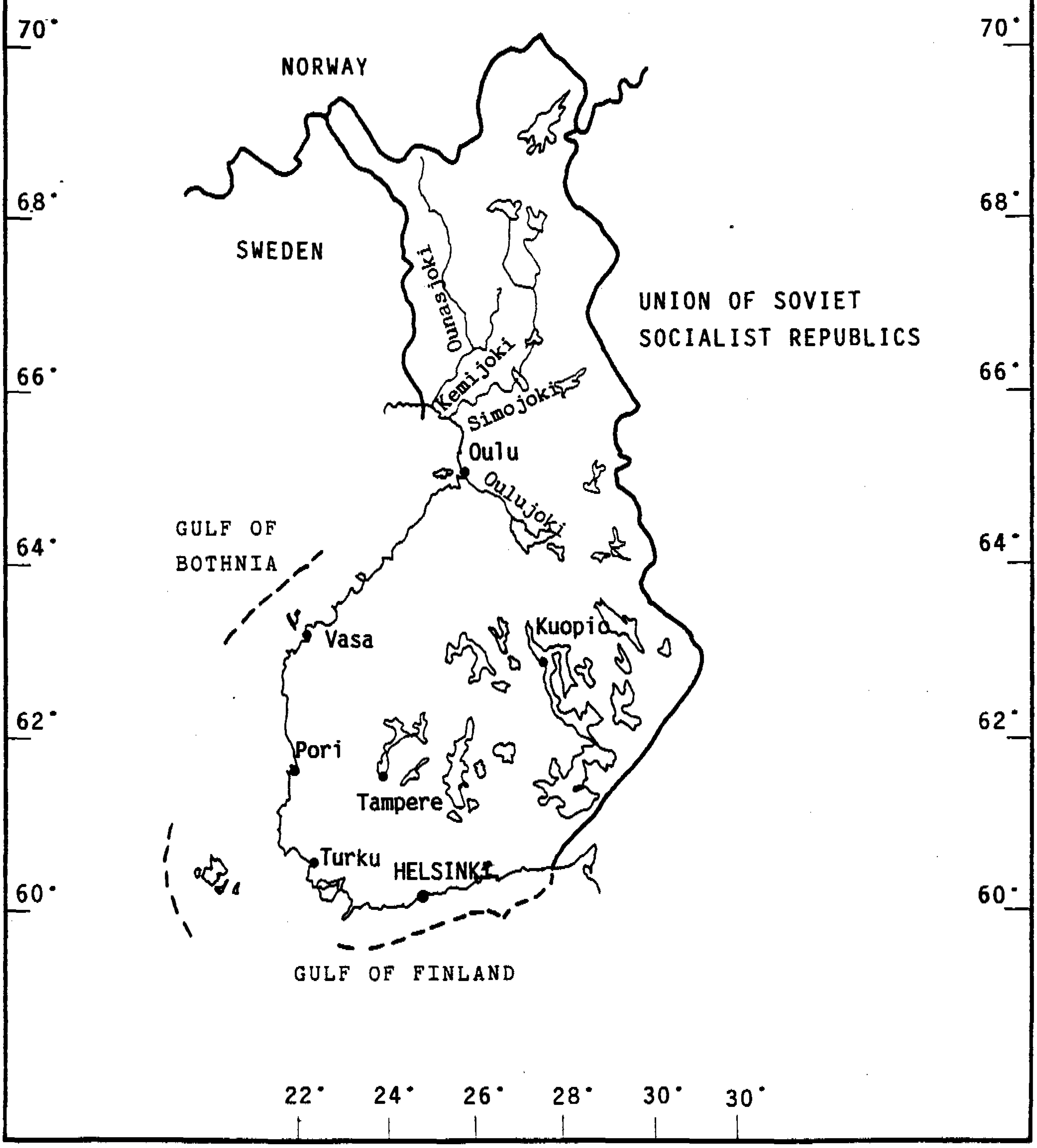
Danish Isotope Centre (Isotopcentralen)
Skelbaekgade 2
1717 Copenhagen V

Tel: (01) 21 41 31

Danish Hydraulic Institute (Dansk Hydraulisk Institut)
Agern Allé 5
2970 Hørsholm

Tel: (02) 86 80 33

FINLAND



NORWAY
SWEDEN
UNION OF SOVIET
SOCIALIST REPUBLICS
Ounasjoki
Kemijoki
Simojoki
Oulu
Oulujoki
GULF OF
BOTHNIA
Vasa
Kuopio
Pori
Tampere
Turku
HELSINKI
GULF OF FINLAND
70°
68°
66°
64°
62°
60°
22°
24°
26°
28°
30°
30°

FINLAND

Situated in northern Europe, Finland has borders with Norway in the far north, Sweden in the north-west, and the USSR in the east. The southern and western shores lie along the Gulfs of Finland and Bothnia and the Baltic Sea. Finland is a land of vast forests covering 19.7 million hectares (58.4%) and with many lakes (188 000) and rivers occupying 9.9% of the total surface. There are 2.4 million hectares (7.1%) of cultivated land. The total area of the country is 338 145 km^2 with a population in 1984 of 4.89 million, giving an average density of 14.5 inhabitants per km^2.

Government

Finland has a republican constitution with a single-chamber Parliament and a Presidency. The President has supreme executive power, but legislative power is exercised by Parliament in conjunction with the President. A Council of State, headed by the Prime Minister, is responsible to Parliament.

The country is divided into 12 provinces, each administered by a governor. The provincial administration has departments that are subordinate to their corresponding national boards. The provinces are subdivided into 461 municipalities, each of which has an elected council that appoints local boards for various services, including water.

Administrative organization of water services

The Water Administration comprises the National Board of Waters and the Environment and its 13 district offices. The National Board of Waters and the Environment was founded in 1970. Since 1 October 1986, it has been placed under the responsibility of the Ministry of Environment. The Ministry of the Environment is now responsible for the activities of this institution. The geographical areas of the water districts conform mostly to administrative areas (counties).

The task of the Water Administration is to promote the utilization and management of all national water resources and water areas and research in this field. It supervises the use of waters and the prevention of damage and accidents. The Water Administration also manages State-owned surface waters. Most surface waters are privately owned.

According to law, the duties of the National Board of Waters and the Environment include:

- promoting the reconciliation of the objectives and needs related to water use, management and protection;
- supervising water protection and prevention of oil damage;
- participating in tasks related to waste management and other aspects of environmental protection;
- developing of water supply and sewerage;
- supervising flood control, drainage and land reclamation;
- supervising and maintaining public water areas;

- promoting the use of waters for recreational purposes;
- drawing up plans concerning use, management and protection of waters;
- promoting and carrying out environmental research and monitoring of the state of the environment;
- controlling and supervising the watercourses and their use as well as the activities influencing watercourse quality;
- maintaining and developing of information systems related to waters and environmental protection.

Water supply and sewerage are undertaken by municipalities and by private institutions. At the end of 1985, there were 789 water supply plants and 616 sewer systems supplying communities of more than 200 inhabitants.

In addition to the National Board of Waters and the Environment, a number of other State bodies are concerned with the water industry.

- The National Board of Health deals with environmental health including water hygiene.
- The Finnish Game and Fisheries Research Institute is responsible for fisheries management.
- The Institute for Marine Research manages biological, chemical and physical marine research and services.
- The Roads and Waterways Administration is in charge of planning, construction and maintenance of waterways, channels, flumes, harbours and water traffic.
- The Geological Survey of Finland deals, inter alia, with investigations concerning groundwater.

Each municipality has an environment board. Its duties are to act as a local supervisory authority and to resolve minor problems regarding drainage, water supply and wastewater. It can also make proposals for the operation and development of water resources within its area. Environment boards have the right to address and advise the Water Rights Courts concerning applications for projects affecting water. Responsible for water pollution control is, inter alia, the Ministry of Environment, which started its function in October 1983.

Role of the Health Department with regard to water quality

The National Board of Health is responsible to the Ministry of Social Affairs and Health. Its duties are, among other things, to manage, supervise and develop the maintenance of public health. One of the goals of its activities is the improvement of environmental health, including water hygiene; for example, the national standards for drinking-water quality in the municipalities. The National Board of Health issues instructions and directives for this control.

The National Board of Health does not have a district organization of its own. The provincial governments have departments of social affairs and health that supervise the activities of the municipal authorities.

The National Board of Health supervises the National Health Institute, which, with its seven regional institutes, is responsible for research in public health administration.

Water and related legislation

The Water Act of 1961 (No. 264) legalizes the use of waters for various purposes and, with its amendments (No. 453 of 1963, No. 427 of 1970, No. 469 of 1976, No. 299 of 1979, No. 69 of 1982, No. 287 of 1982, No. 605 of 1982, No. 606 of 1982, No. 414 of 1984, No. 467 of 1987 and No. 468 of 1987), lays down rules for compensation, punishment of violations, water courts, water boards and administrative details. It is one of the most comprehensive acts currently in force in Finland.

A number of ordinances have been published under the authority of the Water Act. The Ordinance on precautionary measures for preventing water pollution, No. 283 of 6 April 1962 (IDHL, 14: 253), amended by Ordinance No. 429 of 26 June 1970 (IDHL, 23: 702) and Ordinance No. 499 of 27 June 1980 (IDHL, 32: 302), contains regulations for preventing water pollution and obliges those in charge of installations discharging effluents to notify the water authorities thereof.

The original law on the prevention of marine pollution, No. 146 of 1965, was replaced by Law No. 298 of 1979 (IDHL, 31: 303), which takes into account international treaties binding on Finland with regard to the prevention of marine pollution. This law makes special provision for the control of discharges of radioactive substances, including the deliberate abandonment of vessels at sea. Law No. 300 of 1979 (IDHL, 31: 304), with its amendments (No. 739 of 1985, No. 154 of 1986, No. 733 of 1986 and No. 207 of 1987), supplements Law No. 298 of 1979 with regard to the prevention of water pollution from ships. It empowers the National Board of Navigation to restrict navigation in Finnish waters if this is necessary to avert a manifest risk of water pollution. Other provisions restrict or prohibit the discharge of oil, hazardous liquids, solid waste and untreated sewage in Finnish waters.

The Public Health Act of 1965 and the corresponding Implementing Regulations of 1967, together with their amendments, include requirements for the use of water for domestic purposes, waste management and sewerage.

The country is divided into three special Water Rights Court districts that deal with legal matters concerning the distribution and disposal of water and the effects of hydrological constructions. They are administrative courts that depend heavily on expert opinions. In addition to these, there is a Water Rights Appeal Court. The Supreme Administrative Court and the Supreme Court of Justice also act as courts of appeal in water affairs.

The "Protection Commission" of the Baltic Sea has adopted (Feb/86) recommendations related to the prevention of pollution from land-based sources (agriculture discharges, municipal domestic discharges and urban stormwater discharges). There is a joint Finnish-Norwegian Boundary Water Commission (agreement of 5 November 1980). The Commission controls all rivers and lakes along the border line between the two countries. The work of the Commission has already started, especially along the Teno (Tana) River, and it covers subjects such as water pollution control, recreational use of waters, waste management and environmental conservation. An agreement concerning frontier rivers was signed in Stockholm on 16 September 1971 for the prevention and control of transboundary water pollution.

Water research

Water research is carried out by the following institutions.

The Water and Environment Research Institute which has the status of an administrative department within the National Board of Waters and the Environment. The scope of its tasks, as defined by the statutes, is very broad. Its activities are divided among the hydrological office, the water and environment research office, the technical research office and a research laboratory.

The Water and Environment Research Institute collects data concerning Finland's water resources and carries out investigations and research for different departments of the Water and Environment Administration and for customers outside the administration. It cooperates with national and foreign research bodies.

Hydrological observations have been collected since 1852, and a hydrological yearbook has been published since 1910. Information on the quality of watercourses has been collected regularly in long-term and detailed monitoring and published since 1962. The Institute as well as the water and environment district offices possess modern laboratories that carry out water analyses and develop and standardize research methods.

The Institute currently employs about 150 persons; the district offices employ about 190 persons in research activities.

The Fisheries Research Department of the Finnish Game and Fisheries Research Institute is concerned with research and experiments to develop fisheries management. State fish-farming management is part of its duties. Studies are being carried out with respect to potential euthrophication of some watercourses resulting from intensive fish farming.

The Institute of Marine Research collects data concerning the Baltic Sea and its gulfs. It carries out biological, chemical and physical marine research and provides information on water levels and the ice situation in winter, for example.

The Finnish Meteorological Institute administers meteorological activities in the whole country. It provides a meteorological service and carries out meteorological and geomagnetic investigations.

The Geological Survey of Finland is concerned with the geological, geophysical and geochemical mapping of the ground, especially in support of the mining industry. Its activities include groundwater investigations.

National Institute of Public Health (Department of Environmental Hygiene and Toxicology) carries out research on the health aspects of the quality of drinking water.

Finance

Revenue income

Regional water authorities derive almost all their finance from charges to real estates. A very small part is financed by municipal taxes. Financial support for investments through subsidies or loans by central state increased from 5.9% of total investments in 1980 to 8.2% in 1988.

Water charges

Potable water supply and sewage

Water charges and sewage charges for real estates are based on a fixed payment and on the amount of clean water supplied. Within the real estates, the charges can be divided on different bases. In some cases there are meters for individual apartments. If the real estate does not use the public water supply, charges are based on water consumption estimates. The disposal of paper and pulp industry discharges still remains the main wastewater problem in Finland.

The water and sewage charges are usually billed together. On 31 December 1985, the mean water charge was Fmk. 2.75 per m^3, and the mean total water and sewage charge was Fmk. 5.76 per m^3.

Used water is returned to watercourses. The level of municipal effluent treatment in 1985 was 99%. The watercourse quality depends on the size, the pollution absorbing capacity and the original quality of the water body acting as a recipient of the treated wastewater. A great proportion of wastewater recipients consist of shallow lakes and shallow bays on the Baltic Sea. Approximately 90% of the total organic loading is derived from industry and, therefore, the country pays a great deal of attention to the quality of purification of industrial effluents (chemical, metal and textile industries).

Industrial effluent

Industrial effluent charges are also based on the amount of clean water supplied. There might be a minor coefficient when determining the charges if the quantity or quality of the effluents differs greatly from normal. In some cases the discharge of trade effluents into sewers is allowed only at specified times.

There is also an annual "water protection charge" to be paid by an industrial establishment when it is relieved from the measures designed to prevent the pollution of the recipient water. The maximum charge is 2% of the annual economic benefit on which the charge is based. The charge has to be paid to the State, in practice to the National Board of Waters and the Environment to cover water protection expenses, especially in connection with water research.

Responsible agencies

Operations	Carried out by
Water resources survey	National Board of Waters and the Environment
Water management policy	National Board of Waters and the Environment
Drinking-water production	Communes
Drinking-water distribution	Communes
Drinking-water quality surveillance	National Board of Health National Board of Waters and the Environment
Drinking-water quality control	Communal Health Board National Board of Waters and the Environment
Agricultural irrigation	National Board of Waters and the Environment
Industrial water supply	Industry
Underground water protection	National Board of Waters and the Environment
Surface water protection monitoring	National Board of Waters and the Environment
Water pollution control	Ministry of Environment
Water resources storage and allocation	National Board of Waters and the Environment

Water resources availability and management

Rainfall

In spite of Finland's northern location (between the 60th and the 70th parallels), the climate is more favourable than that of most other areas at the same latitudes. The annual mean temperature in the southern parts of the country is 3.5-5°C and in the north about 0°C. The annual average precipitation is 630 mm, the average evapotranspiration 330 mm, and the average runoff 300 mm. Precipitation falls as snow for about five months in the south and for seven months in northern parts of the country. Regionally, precipitation is fairly evenly distributed throughout the year. Seasonal variations, primarily the long winter, have the greatest effect on the availability of water in Finland.

Topography

Most of Finland is low-lying, with elevations averaging between 60 m and 120 m. The rather flat topography is due to the glacial period, which levelled and eroded the ground. Soil layers covering the bedrock are thin in Finland. Peatlands cover about 30% of the country. An abundance of watercourses, lakes and rivers is a typical feature of Finland. The number of lakes is about 188 000 (area more than 0.05 hectares), and they cover almost 10% of the country's total area. The mean depth of lakes is 7 m and the total volume about 220 km^3. The accumulated shore length is 130 000 km. The greatest part of Finnish waters is in a natural, unpolluted state. In the 1980s, only 2%, or 640 km^2, of the lakes were badly polluted. Besides this, about 18%, or 5900 km^2, were in a satisfactory state. The remaining 80%, or 25 000 km^2, could be considered excellent or good.

The southern and western coasts of the country lie along the Gulfs of Finland and Bothnia and the Baltic Sea, which have a permanent ice cover each winter for 1-6 months.

Population/water resources

Nearly half of the population lives in the south and southwest of the country, where water resources are most limited and where the worst polluted water areas lie. In 1985, the average figure for the whole country showed that 49% of public water supplies were drawn from groundwater and 51% from surface water. To solve the problems posed by the raw water quality and quantity, a water supply tunnel was built from Lake Päijänne in Central Finland to Helsinki. With a length of 120 km and a cross-section of slightly more than 17 m^2, this rock tunnel is the longest in the world. It serves Helsinki and the surrounding municipalities. The discharge with gravity flow is 9 m^3/s and when pumped 18 m^3/s.

Future trends of water resources

The trend is to use more groundwater for water supply. This is borne out by the figures for water consumption which rose from an average of 803 Ml/d in 1970 to 1121 Ml/d in 1985, while over the same period the proportion of groundwater rose from 31% to 49%. The total per capita water withdrawal in 1980 was 774 m^3 per inhabitant. The public water supply accounted for 10.5% (81 m^3 per inhabitant) of this amount. The daily water consumption per capita has been gradually reduced since 1978, i.e. 319 l/c/d in 1978, 297 in 1980, 283 in 1982 and 279 l/c/d in 1984, but 286 l/c/d in 1985. Groundwater resources for water supply in areas where groundwater sources are being used are estimated to have a capacity of 2000 Ml/d. The yield from aquifers can be increased by recharging them artificially by pumping surface water into eskers. Goals for the future are to improve the water quality of surface waters, to improve the situation of private rural water supply systems as 20% of them still have water quality problems, and to develop the recreational use of waters. Watercourses quality in Finland is divided into three classes: recreational class, raw water class and fishing water class. Each class has a group of variables used as quality indicators permitting the establishment of category subdivisions such as excellent, good, satisfactory, poor and bad.

General statistics

Population

Population in urban[a] areas	60.0%
Population in rural[a] areas	40.0%

Drinking-water supply

Total piped supply for drinking purposes	1121 Ml/d[b]
Total population served by a piped public water supply	80.0%
Urban population served by a house connection	96.0%
Urban population without house connections but with reasonable access to public standposts	4.0%
Rural population served by house connections (public networks 27%, private installations 58%)	85.0%
Rural population without house connections but with reasonable access to public standposts	15.0%

Drinking water supply uses

Water supplied for domestic and commercial use	86.0%
Water supplied for industrial use	14.0%
Other uses	0.0%

Industrial water supply: direct abstractions (1980)

Total supplied from inland waters for industrial use	6240 Ml/d
Used for industrial cooling water (1980)	39.0%
Usage as industrial process water (1980)	61.0%
Total coastal water used (1980)	10 200 Ml/d

Agricultural use: direct abstractions

Total amount abstracted for irrigation	NA[c] Ml/d
Other agricultural uses including fish ponds	NA Ml/d
Fish farming	4100 Ml/d

[a] Urban areas = urban communes. Rural areas = rural communes. Some urban communes have large areas that can be considered rural. In true urban areas 100% of the population are served by a piped water supply.

[b] 1 Ml/d = 1 million litres/day.

[c] NA = Not available

Wastewater disposal services

(a)	% of urban population served by a sewerage network	91.0%
(b)	% of urban population served by other adequate means	9.0%
(c)	% of urban population lacking adequate disposal means	0.0%
(d)	% of rural population served by a sewerage network	10.0%
(e)	% of rural population served by a water closet and a septic tank	60.0%
(f)	% of rural population served by other adequate means	30.0%
(g)	% of rural population lacking adequate disposal means	0.0%

Sewage treatment*

(h)	% of sewerage systems receiving primary treatment only	0.1%
(i)	% of sewerage systems receiving secondary treatment	0.5%
(j)	% of sewerage systems receiving tertiary treatment	98.7%
(k)	% of sewerage systems receiving no treatment (raw discharge)	0.7%

Discharge of treated sewage

(l)	% discharged into the sea	49.0%
(m)	% discharged into surface water bodies	51.0%
(n)	% discharged onto farmland	0.0%

Discharge of untreated sewage

(o)	% discharged into the sea	3.0%
(p)	% discharged into surface water bodies	97.0%
(q)	% discharged onto farmland	0.0%

Sludge disposal

(r)	% of sludge disposed into the sea	0.0%
(s)	% of sludge disposed into surface water bodies	0.0%
(t)	% of sludge disposed onto farmland	50.0%
(u)	% of sludge disposed as landfill	21.0%
(v)	% used for soil improvement in sport fields and parks	20.0%
(w)	% disposed into temporary storage places	9.0%

* primary treatment: mechanical
secondary treatment: biological
tertiary treatment: biological plus chemical

Useful addresses

Governmental

National Board of Waters and the Environment
P.O. Box 250
SF-00101 Helsinki

Tel: 40 281

National Board of Health
P.O. Box 220
SF-00531 Helsinki 53

Tel: 77 231

Water industry

National Board of Waters and the Environment
P.O. Box 250
SF-00101 Helsinki

Tel: 40 281

Water research

Water and Environment Research Institute
P.O. Box 436
SF-00101 Helsinki

Tel: internat. +378-0-19 291

National Institute of Public Health
Mannerheimintie 199
SF-00280 Helsinki

Tel: internat. +378-0-418 355

THE FINNISH GOVERNMENT ADMINISTRATIVE STRUCTURE

PARLIAMENT with its TECHNICAL COMMITTEES

CENTRAL GOVERNMENT	Technical/Professional Ministries Departments/Directorates (Monitoring, Supervision, Protection of consumer rights) National institutions - for research - for services Central Government representatives in countries

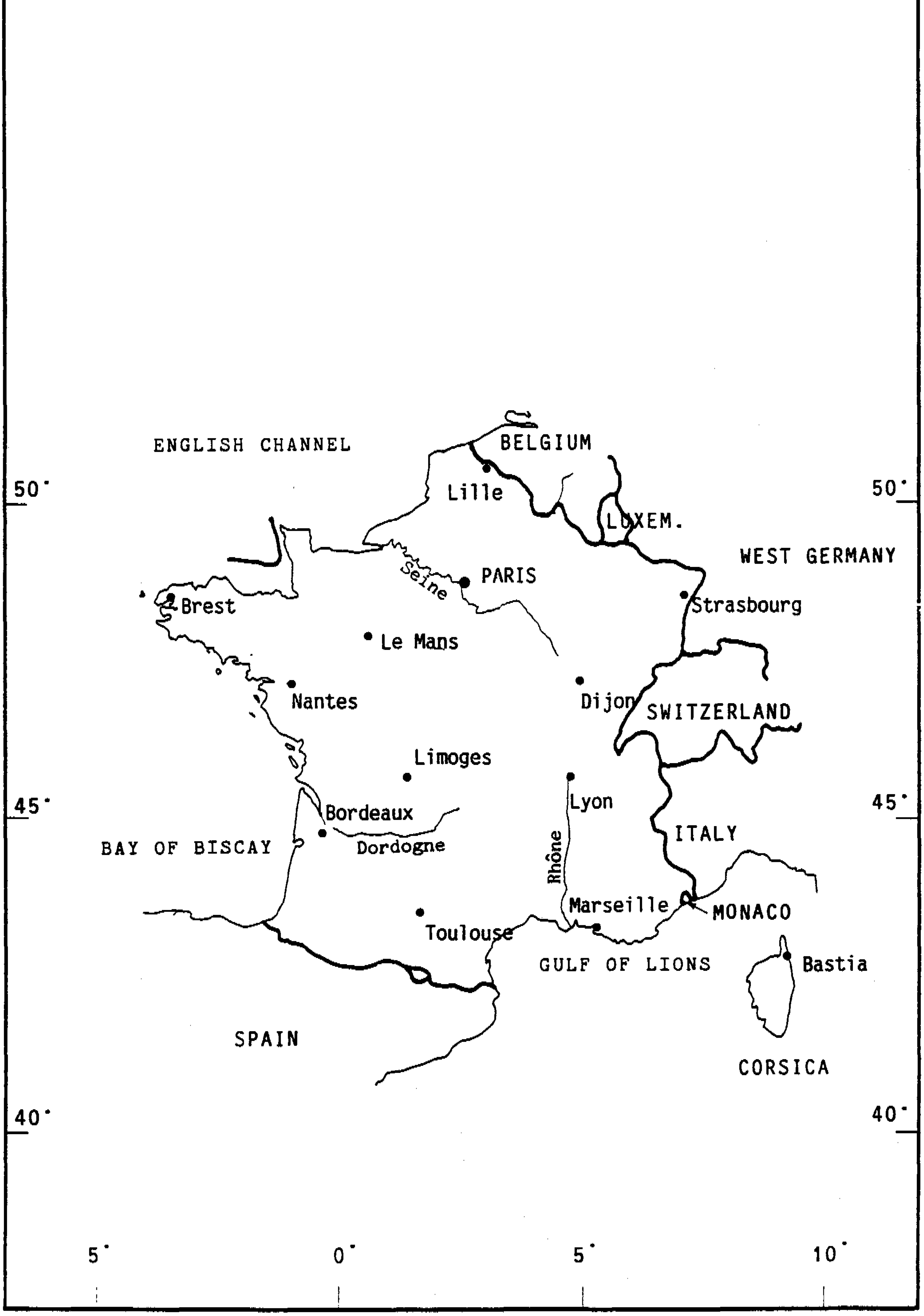
	COUNTY MUNICIPALITIES (19)	PRIMARY MUNICIPALITIES (over 450)
LOCAL GOVERNMENT (MUNICIPALITIES)	Technical committees	Technical committees (e.g. for health and social services)
	Technical/Professional Administration	Technical/Professional Administration
	Service institutions	Service "institutions"

Examples of division of labour between county and primary municipalities

Secondary schools Health care institutions, specialists, transport Power/energy supply County roads For certain tasks, regional cooperation, e.g. 5 health regions.	Primary schools Primary health care, Water, sewage, waste ... engineering Municipal roads Area planning ....

The NATIONAL ASSOCIATION OF MUNICIPALITIES provides a forum for consultation, policy development, staff training, research and evaluation, economic negotiations with central and municipal government.

FRANCE


ENGLISH CHANNEL
BELGIUM
Lille
LUXEM.
WEST GERMANY
PARIS
Seine
Brest
Strasbourg
Le Mans
Nantes
Dijon
SWITZERLAND
Limoges
Lyon
Bordeaux
Dordogne
BAY OF BISCAY
ITALY
Rhône
Marseille
MONACO
Toulouse
GULF OF LIONS
Bastia
SPAIN
CORSICA
50°
45°
40°
5°
0°
5°
10°

FRANCE

France is situated in western Europe, with coastlines on the North Sea, the English Channel, the Atlantic Ocean and the Mediterranean Sea. It is bordered to the north by Belgium and Luxembourg, to the east by the Federal Republic of Germany, Switzerland and Italy, and to the south-west by Spain. The island of Corsica which is part of metropolitan France, lies to the south.

The population in 1985 was 55 173 000. The area is 547 026 km^2 giving a population density of 100 inhabitants/km^2.

France also consists of five overseas departments (French Guiana, Martinique, Guadeloupe, the Reunion, Saint-Pierre and Miquelon) and four overseas territories (Mayotte, New Caledonia, French Polynesia, Wallis and Futuna).

Government

The Republic of France has a Parliament with two chambers, the Senate and the National Assembly. The President holds executive power mainly for external affairs and matters involving national security. He appoints the Prime Minister according to parliament results, and the Prime Minister selects the Council of Ministers, which govern the country and are responsible to Parliament. Metropolitan France has 21 administrative regions comprising 96 départements, each administered by an elected general council (conseil général). Since 1982, the powers of the presidents of the general councils have been greatly extended to take over local administration from the former prefects. For the purposes of planning and national development, the départements are grouped in regions, which are governed by elected regional councils (conseils régionaux). The Director of Health and Social Welfare of the Department (Directeur Départemental des Affaires Sanitaires et Sociales), under the authority of the prefect, is responsible for sanitary affairs that fall within the competence of the Sate, especially control of environmental sanitation. The President of the General Council and the Director of Health and Social Welfare are advised by a Departmental Council of Hygiene (Conseil Départemental d'Hygiène).

The departments are subdivided into about 37 000-communes, which vary greatly in size and population. Each commune has an elected municipal council and an executive organ, the municipality, headed by the mayor, who acts as an agent both of the State and of the commune. The commune has wide powers for running municipal services and ensuring public order, security and health. For some purposes the smaller communes combine to form more efficient management units. The communes can decide on the possibility of establishing their own communal hygiene and health services.

Administrative organization of water services

Water supply, sewerage and sewage disposal are the responsibility of municipalities. However, the municipalities may either manage directly their own services, or join a union of municipalities running common services (syndicat de communes) or sub-contract to a private corporation such as the CGE (Compagnie Générale des Eaux), the SLEE (Société Lyonnaise de l'Eau et de L'Eclairage), the SAUR (Société d'Aménagement Urbain et Rural), etc.
Water resources management is under the responsibility of the Ministry of the Environment. At country level this responsibility is implemented by the

"Prèfet" and, under his supervision, by "directions départementales de l'agriculture", "directions départementales de l'équipement", "services de la navigation" and "directions interdépartementales de l'industrie et de la recherche" according to the different water bodies.

Six river-basins agencies (Artois-Picardie, Seine-Normandie, Loire-Bretagne, Adour-Garonne, Rhone-Méditerranée-Corse and Rhin Meuse) play an equally important role in the management of water resources. Their strength ensues from their ability to reinvest the services charges collected from the communities for the water and sanitation facilities provided. This capital is invested in the improvement of the quantity and quality of services and in the protection of water sources.

Rural water supply and sanitation planning at central level is under the Directorate of Rural Engineering in the Ministry of Agriculture.

The river basin agencies are supervised by the Ministry of the Environment, which has to keep contact with other ministries involved:

- The Ministry of Interior (audit of municipal services management);
- The Ministry of Industry and Energy (hydro-energy, water supply for industry, control of industrial liquid wastes, underground water surveys);
- The Ministry of Transport (water-ways, surface water survey);
- The Ministry of Housing (urban water supply and sewerage);
- The Ministry of Agriculture (rural water supply and sanitation and agricultural irrigations);
- The Ministry of Health (drinking and recreational waters quality monitoring).

Role of the Ministry of Health with regard to water quality

The State Secretariat for Health is responsible for:

- drinking-water quality monitoring
- water processing and treatment monitoring
- water resources quality monitoring
- recreational waters quality monitoring
- wastes (including liquid waste), sewage treatment and disposal monitoring
- swimming pool control

In order to ensure the responsibility for the control of the quality of water, the Ministry of Health avails itself of the environmental hygiene services of the "Directions Départementales et Régionales des Affaires Sanitaires et Sociales". These services are carried out by sanitary engineers who have been trained at the National School of Public Health in Rennes. There are about 1500 agents who have often received superior technical training.

The Ministry receives advice from the "Conseil Supérieur d'Hygiène Publique de France" on matters relating to water.

The Ministry appeals to the authorized hydrogeologists for help in matters related to the protection of water intakes, and for carrying out special water analyses imposed within the framework of the control of groundwater and surface water sources quality. The analyses are conducted by authorized laboratories.

More than 200 000 analyses are thus carried out every year with the purpose of controlling the quality of drinking water.

Since 1985, all environmental hygiene services have been carried out in a homogenous way, which has already made it possible to issue national reports on the quality of recreational waters and will permit from the end of 1988 the centralization at national level of data on drinking-water quality.

Within the framework of a bilateral agreement with the Ministry of the Environment, this collection of information will also permit the establishment of a centralized information system on the quality of water resources. The system will cover the national level and the hydrographic basins.

Studies carried out by the Ministry of Health (1985) have shown that 5% of the population under control use water of inappropriate bacteriological quality and that 2% of this population was supplied with water with nitrate concentrations above 50 mg/litre.

Thanks to the combined efforts of the Ministries of Environment, Agriculture and Health the number of people with access to waters with high nitrate concentration, (above 100 mg/l), has been reduced. In 1981 this figure reached a total of 32.000 persons which has now been reduced to 7000 in 1986.

Water and related legislation

Two quite different sets of laws originally controlled water pollution. The Dangerous or Polluting Premises Act of 1917 (IDHL, 27: 734), revised in 1976, established a system of licences for operating commercial and industrial establishments. This covered the location and permissible levels of pollutants. These laws are administered by communal officers. The Public Health Code, Book 1, Title 1, Chapter 3 deals with the sanitary aspects of drinking water, swimming pools, and bathing areas.

The control of drinking water is implemented by Decree 61-859 of 1 August 1961 and Order of 10 August 1961 (IDHL, 13: 521). These texts have been amended in order to include the recommendations of the European Community Directive concerning drinking water (15 July 1980) by a decree of 4 January 1989. The Directions Départementales des Affaires Sanitaires et Sociales have nevertheless started to introduce these recommendations.

The control of swimming pools and bathing areas has been specified in Decree 81-324 of 7 April 1981.

The first set of laws attempts to control the pollution of waters that may become sources of drinking-water; the second establishes limits for toxic substances, some of which could only come from industrial discharges.

The Control of Water Pollution Law of 16 December 1964 (IDHL, 16: 528) revised the Public Health Code with regard to the protection of water catchment areas, and provided for regulations that overrided existing discharge licences. The prefects retained responsibility for the licensing and approval of technical plans, while the State determined standards and codes of practice and could prohibit the use of certain products capable of causing dangerous discharges. Conditions for granting and withdrawing licences for discharges are laid down in Decrees No. 73-218 and No. 73-219 (IDHL, 24: 785). The authority to regulate different aspects of water is divided among several departments (those responsible for the environment, health, industry, agriculture), but the basic responsibility for pollution control lies with the Secretary of State for the Environment. To coordinate their activities, the National Committee for Water was established, with wide representation at all levels from ministries to communes and users.

The provision of water supplies is assigned to departments, communes and groups of communities. They may undertake the construction of public works for water management, or grant concessions to semi-public utilities set up for that purpose. In each river basin there is a consultative committee to review plans and conflicts of interest regarding implementation of the Water Law (see Girardot, P.-L. Aqua, 2: 7-10 (1981)).

Under the "polluter pays" principle all discharges, public or private, are taxed on the basis of the quantity of pollutants discharged. The river basin committee must agree to the assessment of pollution fees. In principle, funds received from pollution taxes are used to abate pollution by the construction of treatment works. In certain cases these funds may be used to subsidize a less polluting, but more costly, industrial process.

In many communes sewage treatment is managed on a contract basis by firms specializing in the service.

A number of decrees and orders regulate specific aspects of pollution, including directives of the European Communities. A substantial body of legislation governs the protection of groundwater. Discharges to wells are prohibited, and all wells drawing more than 8 m^3 per hour must be registered.

Water research

The BRGM (Bureau de Rècherches géologiques et minières) is *inter alia* in charge of underground water research.

The Hydrological Service and the Meteorologic Service are in charge of surface water surveys.

There is no central agency for water technology research, but many research institutes and laboratories, either public or privately owned, undertake water research. The list of these institutes and laboratories is given in the *Guide de l'Eau*, published by Degrémont.

Finance

Revenue income

No data available

Water charges for:

Potable water supply. Usually there is a flat rate per cubic metre plus a standard charge per connection. Charges may vary from 1-10 ff/m^3 from one municipality to another.

Sewage charges. They are decided upon by the municipalities and then charged against the consumers' water bills.

Industrial effluents. They are either treated in industrial treatment plants or discharged to municipal sewers. Taxes collected by the river basin agencies on polluters actually permit the investment of the capital collected in the construction of new effluent treatment plants.

Wastewater pollution is measured through three main parameters:

- oxydable matters (O.M.)
- suspended solid matters (S.S.)
- inhibiting matters (I.M.).

In 1984, the total industrial and domestic pollution produced in France reached 8800 tons per day of O.M., 17 700 tons/day of S.S. and 117 000 kilo/equitox/day of I.M.

The natural environment was receiving 4000 tons/day of O.M., 4800 tons/day of S.S., and 42 900 kilo/equitox/day of I.M., which shows that O.M. were being reduced by 54%, S.S. by 73% and I.M. by 63%.

The financing of industrial pollution control activities is ensured by the industries themselves. In 1985, FF 4.92 billion were spent on these activities, of which FF 1.25 billion were used for investments and the remaining FF 3.67 billion were used to ensure the functioning of the systems.

Responsible agencies

Operation	Carried out by
Water resources survey	Ministry of the Environment and its Commissary Services Departments Surface water: Hydrological Service Underground water; BRGM
Water management policy	Ministry of the Environment
Drinking-water production	Municipalities and their sub-contractors
Drinking-water distribution	Municipalities and their sub-contractors
Drinking-water quality surveillance	Ministry of Health and its external services
Recreational waters quality surveillance, (sea, lakes, rivers, pools, thermal baths, etc.)	Ministry of Health and its external services
Agricultural irrigation	Ministry of Agriculture
Industrial water supply	Ministry of Industry
Underground water protection	Ministry of the Environment and its Commissary Services Departments River basin agencies Ministry of Health and its external services
Surface water protection monitoring	Ministry of the Environment and its Commissary Services Departments River basin agencies
Water pollution control	Ministry of the Environment and its Commissary Services Departments River basin agencies
Water resources storage and allocation	Ministry of the Environment and its Commissary Services Departments River basin agencies

Water resources availability and management

Rainfall

The climate is temperate in most of the country, but in the south it is of the mediterranean type with warm summers and mild winters. France has an average rainfall of 850 mm/year, the lowest falls being recorded on the Bas-Languedoc coast (500 mm/year), and the highest in the Savoie region and the Alps (4000 mm/year). Rainfall is quite evenly distributed throughout the year, with generally slightly more precipitation in winter than summer. Evapotranspiration varies from about 500-600 mm in summer, slightly higher in the south (800 mm).

Topography

France is a compact geographical unit presenting a coherent landscape. Almost 2/3 of the country is at an elevation below 250 mt, and 7% of the land rises above 1000 mts. In spite of this uniformity, the country is divided into eight regions having different characteristics:

- The Alpes and Jura Region, dominated by the Mont Blanc, the highest peak in Western Europe.
- The Rhone Valley and Mediterranean Lands
- The Pyrenees, forming the border between Spain and France
- The Massif Central, in south-central France
- The Aquitaine basin, dominated by the River Garonne basin
- The West, constituted mainly by the large peninsula of Brittany
- Eastern France, dominated by the Alsace and Lorraine plains, and
- The Paris basin and the North, occupied by the big plains of the Seine, Loire, Brie, Valois, Flanders at the north, etc.

The island of Corsica, except for a narrow coastal plain at the east is constituted by a range of hills and mountains.

One can identify three types of geological formations, corresponding to similar structures elsewhere in Europe, as follows:

(a) the Hercynian Massifs, composed largely of ancient crystalline and compacted sedimentary rocks and represented by the Massif Central, the Armorican massif, the Vosges, the Ardennes and parts of Corsica;

(b) The Great Basins, composed mainly of sedimentary rocks, such as the Paris Basin, the Aquitaine Basin and the Rhône-Saône basins;

(c) Recently-folded and overthrust rocks comprising the Pyrenees, the Alps and the Jura.

Population/water resources

France is well provided with water and it can be divided into 5 hydrographic basins; the Loire in the west; the Seine in the centre; the Rhine to the north-east; the Rhône to the south-east, and the Garonne in the south-west. Population is reasonably well distributed, the most densely inhabited places being the Paris region, the Rhône-Alps region and the area around the Pas de Calais. Areas of low population density include the Bourgogne plateaux and the Alps in the south. Generally speaking France has no serious water supply problems.

Future trends of water resources

A national water policy was presented to the Council of Ministries by the Ministry of the Environment in October 1986. This policy will be developed on the basis of four fundamental principles.

a. Modernization of the water rights

Water legislation will be modified in order to allow local communities to have a more active role in the management and protection of water resources.

b. Rationalization of the administrative structures in charge of water management

- Coordination under the Ministry of the Environment of the different water uses: navigation, energy, domestic and industrial uses, irrigation, etc). However, the responsibilities of each institution will remain unchanged.
- Water resources management and pollution control will be oriented at central level by the Ministry of the Environment.
- There will be, for each of the six hydrographic basins, one "Prèfet", in charge of the coordination. He will be assisted by a "Basin delegate".
- In each Region, there will be a "Prèfet de région" in charge of the coordination and assisted by the regional water services.

c. Valorization of French Technology

All national institutions dealing with the development of water technologies (Government, Basins Agencies, Water Societies, Water Industries, etc) will be called to collaborate with the National Water Institute in order to promote national know-how.

d. Protection of national water resources

The Government, the Six Basin Agencies and all local communities are called to complete the national network for the disposal of liquid wastes, so as to protect water sources from pollution. Engineering works to protect surface waters will be undertaken. Flood control and river protection will be reinforced.

In summary, the newly adopted water policy considers water as an essential economic national resource that needs to be managed with the maximum efficiency and at a minimum cost, making use of the most simple methods of exploitation and protection.

The principal objectives of this policy are:

- rehabilitation of existing wastewater networks
- completion of the national wastewater network by the year 1990
- treatment of 50% of domestic wastewater
- promotion of autonomous wastewater services when appropriate
- protection of water-catchment structures
- protection and control of distribution networks
- water pollution control (bacteriological quality, nitrates, micro-organic pollutants, etc.)
- implementation of the European Community Directives
- implementation of a computerized network of water quality control.

While there are sufficient quantities of water available at the moment, lack of good quality water in highly industrialized areas has led to problems, particularly in the Artois-Picardie basin. The aspects of this policy concerning control of drinking water and recreational waters undertaken on the initiative of the Ministry of Health forms the subject of interministerial information which enables the Ministry of the Environment to coordinate the distribution and management of water resources.

General statistics

Population

Population in urban areas[a]	59.0%
Population in rural areas	41.0%

Drinking-water supply

Total piped supply for drinking purposes	4.1×10^9 m^3/y[b]
Total population served by a piped public water supply	98.0%
Urban population served by a house connection	100.0%
Urban population without house connections but with reasonable access to public standposts	0.0%
Rural population served by house connections (public and private)	95.0%
Rural population without house connections but with reasonable access to public standposts	5.0%

Drinking water supply uses

Water supplied for domestic and commercial use	? %
Water supplied for industrial use	? %
Other uses	? %

Industrial water supply: direct abstractions

Total supplied from inland waters for industrial use	Ml/d[c]
Used for industrial cooling water	? %
Usage as industrial process water	? %
Total coastal water used	? Ml/d

Agricultural use: direct abstrations

Total amount abstracted for irrigation	5×10^9 M^3/d
Other agricultural uses including fish ponds	? Ml/d

[a] Population having rural characteristics in France, is defined as communes with less than 2000 inhabitants, plus some peripheral and scattered settlements around communities with a population of between 2000 and 5000 people.

[b] m3/y = cubic metres per year

[c] Ml/d = millions of litres per day

Wastewater disposal services

(a)	% of urban population served by a sewerage network	100.0%
(b)	% of urban population served by other adequate means	0.0%
(c)	% of urban population lacking adequate disposal means	0.0%
(d)	% of rural population served by a sewerage network	63.0%
(e)	% of rural population served by other adequate means	27.0%
(f)	% of rural population lacking adequate disposal means	0.0%

Sewage treatment

(g)	% of sewerage systems receiving primary treatment only	40.0%
(h)	% of sewerage systems receiving secondary treatment	? %
(i)	% of sewerage systems receiving tertiary treatment	? %
(j)	% of sewerage systems receiving no treatment (raw discharge)	? %

Discharge of treated sewage

(k)	% discharged into the sea	20.0%
(l)	% discharged into surface water bodies	? %
(m)	% discharged onto farmland .	? %

Discharge of untreated sewage

(n)	% discharged into the sea	25.0%
(o)	% discharged into surface water bodies	? %
(p)	% discharged onto farmland	? %

Sludge disposal

(q)	% of sludge disposed into the sea	? %
(r)	% of sludge disposed into surface water bodies	? %
(s)	% of sludge disposed onto farmland	? %
(t)	% of sludge disposed as landfill	? %
(u)	% of sludge incinerated	? %

Useful contact points

Governmental

Ministère de l'Environnement
Direction de Contrôle des Pollutions & Nuisances
Service de la Qualité des Eaux
14, Boulevard du Général Leclerc
92521 Neuilly-sur-Seine

Tel: (1) 758-12-12

Ministère de la Santé
Sub-Directorate for the Environment
1, place Fontenoy
F-75700 Paris

Tel: (1) 47 65 25 00

CEMAGREF, Centre national du Machinisme
agricole du Génie rural des Eaux et des Forêts
Groupement de Lyon
3, Quai Chaveau
F-69009 Lyon

Water Industry

National Federation of Public Health Enterprises and Industries
(Chambre Syndicale nationale des Entreprises et Industries de l'Hygiène publique)
22 rue du Général Foy
75008 Paris 8

Tel: (1) 522-33-44

Water research

Centre International de l'Eau Nancy
149, rue Gabriel-Péri
F-54500 Vandoeuvres-les-Nancy

Tel: (8) 35 66 433

French Association for the Study of Water
(Association française pour l'Etude des Eaux)
21 et 23 rue de Madrid
F-75008 Paris 8

Tel: (1) 522-14-67

National Institute of Applied Chemical Research
(Institut national de Recherche chimique
appliquée)
B.P.1
F-91710 Vert-le-Petit

Tel: (6) 493-24-75

Compagnie Générale des Eaux
52, rue d'Anjou
F-75384 Paris Cédex 08

Tel: (1) 266 91 50

Société Lyonaise des Eaux
52, rue de Lisbonne
F-75008 Paris

Tel: (1) 45 61 93 57

Société Degremont
183, Avenue du 18 juin 1940
F-92508 Rueil-Malmaison Cédex

Tel: (1) 77 22 505

Bureau de Recherches geologiques et minières
Avenue de Concyr
B.P. 6009
Orleans-la-Source (Loiret)
F-45060 Orléans Cedex

Tel: (38) 63 80 01

Fig. 1 Wastewater pollution control in 1984

Oxydable matters - tons/day

		Pollution total	Pollution discharged
Industries	Isolated	4 337	1 371
	Connected	1 479	
Local collectivities		2 980	2 593
T O T A L		8 796	3 964

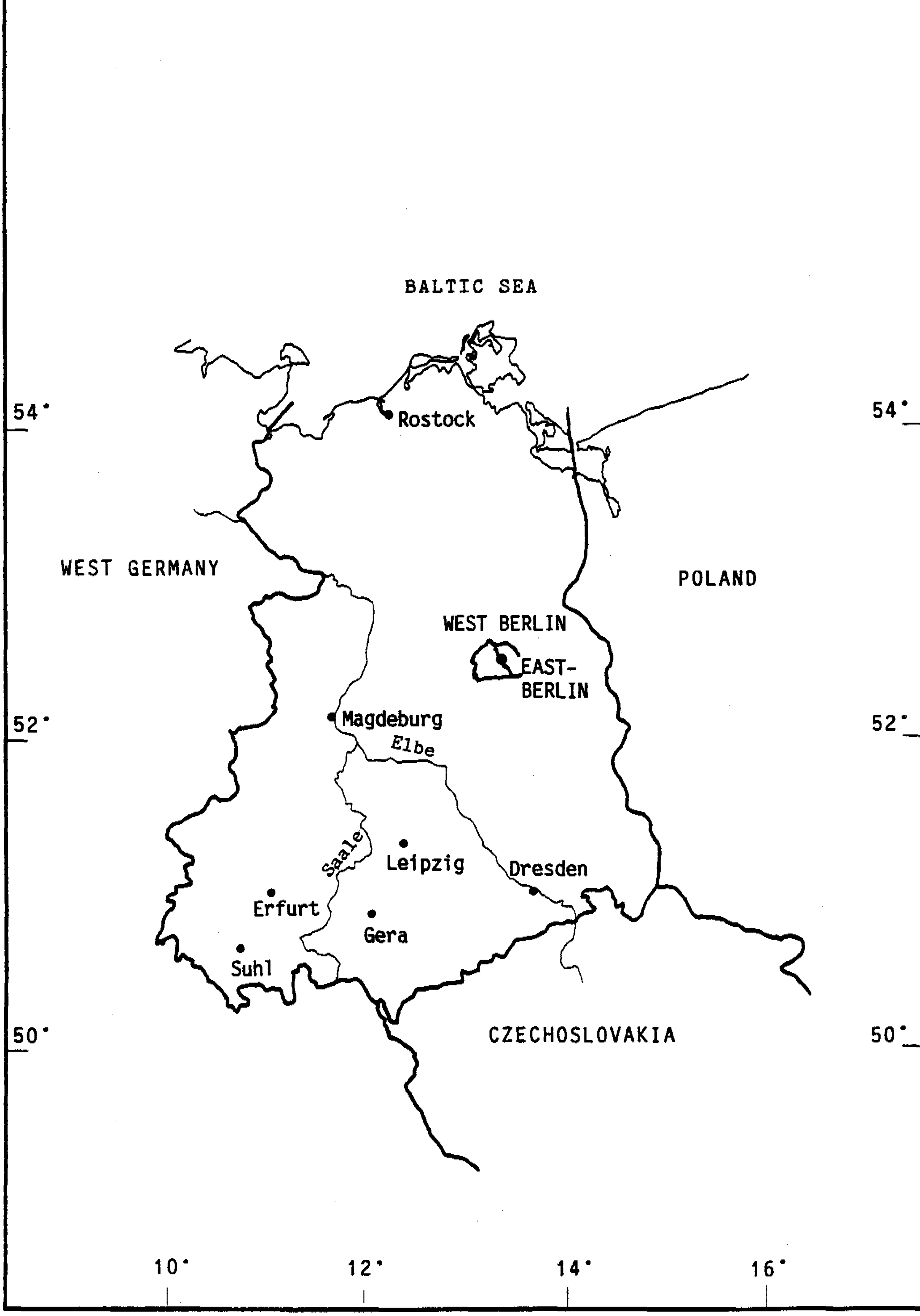
Suspended solid matters - tons/day

		Pollution total	Pollution discharged
Industries	Isolated	11 847	1 347
	Connected	1 134	
Local collectivities		4 700	3 488
T O T A L		17 674	4 835

Toxic matters (inhibitory matters)

	Pollution total	Pollution discharged
Industries	117 168	42 885

GERMANY DEMOCRATIC REPUBLIC



GERMAN DEMOCRATIC REPUBLIC

The German Democratic Republic (hereinafter called GDR) has an area of 108 178 km^2. In 1985, the population was 16 640 000, giving an average population density of 154 inhabitants per km^2. To the north of the GDR is the Baltic Sea; to the west, south-west and south is the Federal Republic of Germany; to the south-east Czechoslovakia; and to the east Poland.

The GDR is an industrialized country with a highly developed agriculture. The greatest share in the national income is taken by chemical industry, vehicle construction and light industries. Major exports articles are chemicals, machinery and equipment; fuel and raw materials are imported. The principal crops are potatoes, sugar-beet, wheat and rye. Food is not exported in substantial quantities.

Government

Under the 1968 Constitution, the supreme organ of state power is the People's Chamber (Volkskammer). The Chamber elects the Council of State (Staatsrat) as its permanent organ. The Chairman of the Council of State is the Head of State of the Republic. The executive branch of government is the Council of Ministers (Ministerrat), the chairman of which (Minister-President) is appointed by the People's Chamber. For local government, the country is divided into 15 districts (Bezirke) including the capital of the GDR, Berlin.

Administrative organization of water services

The responsibility for the management of water resources lies with the Ministry of Environmental Protection and Water Resources and its subordinate organs at district level.

The majority of all water supply facilities is run by the district water works (VEB water supply and wastewater treatment), who have also established their own facilities for monitoring water quality.

Role of the Ministry of Public Health with regard to water quality

According to the Foodstuff Act of 30 November 1962 drinking water is a foodstuff. Consequently, the exploitation of new water resources, erection, reconstruction or alteration of water works or supply systems has to be approved of by the State Sanitary Inspectorate. Only those chemicals that are included in the Order on Foreign Substances in Foodstuffs (18 October 1981) are allowed to be used for treatment of drinking water.

The responsibility for water quality (especially drinking water, water for irrigation and recreational waters) lies with the State Sanitary Inspectorate, a subdivision of the Ministry of Public Health.

Local control, collection and examination of samples are carried out by the organs of the State Sanitary Inspectorate at district and local levels.

Water and related legislation

The Ministry of Environmental Protection and Water Resources was established by Notice of 3 January 1972 (IDHL, 24: 802) and revised by the Decision of 23 October 1975 (IDHL, 28: 518). It operates under the Environmental Culture

Law of 1970 (IDHL, 22: 282) and administers the Water Law of 2 July 1982. It is responsible for planning in the broad field of environmental protection, in collaboration with the Ministry of Public Health. It has special responsibilities in the field of water management, particularly in relation with member states of CMEA (Comecon). It has issued many ordinances concerned with licences for the appropriate abstraction of water and treatment and disposal of wastewater.

Nationalized undertakings (VEB) responsible for water supply and wastewater treatment were set up in each district by Order of 13 May 1963.

The State Water Inspectorate was established by an Ordinance of 15 December 1977 (IDHL, 30: 543) to work in close cooperation with the State Hygiene Inspectorate. The State Water Inspectorate issues licences, imposes fees for polluting discharges and is the principal authority in case of pollution arising from accidents.

Conservation of water resources was addressed by the Order of 1 December 1976 (IDHL, 29: 76) in which a 20% reduction of industrial water requirements during the course of the 1976-1980 Five Year Plan was mandated. Water officials (Wasserbeauftragte) are to be appointed in each undertaking to assist the directors in making economical use of water.

In 1982, all laws and legal provisions in the field of water management were revised and replaced by a uniform Water Law of 2 July 1982.

The responsibility of the State Sanitary Inspectorate for water is regulated in the Ordinance on the State Sanitary Inspectorate of 11 December 1975 and the Ordinance on Sanitary Surveillance of Water and Wastewater of 6 August 1953. In the Ordinance on Sanitary Surveillance of Wells of 23 August 1951 and the Ordinance on Sanitary Surveillance of Central Water Supply Systems of 23 August 1951 specific regulations are given with regard to the responsibility for drinking-water quality.

The criteria for drinking-water quality are laid down in the GDR Standard TGL 22 433 (Drinking-water, Quality Requirements), and all waters that are supplied for drinking purposes must come up to that standard. The water supply agencies have the responsibility of ensuring that the standard is met and are obliged to carry out bacteriological and chemical examination of both raw waters and, especially, the supplied drinking waters. They also have to observe general and special public health regulations for operating the water treatment plant.

Catchment areas for drinking water have to be protected by protection zones or prospective drinking-water protection zones. The basis for prohibitions and restrictions in these zones is the GDR Standard TGL 24348 (drinking-water protection areas) and the Branch-Standard TGL 43271 (prospective drinking-water areas). The State Water Inspectorate and the State Sanitary Inspectorate are responsible for the enforcement of these regulations.

In drinking-water protection zones the industrial use of toxic chemicals is prohibited. Various agricultural activities are also under control in order to reduce the potential hazards of contamination of drinking water by pesticides and herbicides. Only approved pesticides and herbicides may be used. These approved agents are included in a list which is continuously being up-dated (the National PSM-Register). Representatives of the Public Health Care System are involved in the preparation of this list. Prior to each agricultural season, the cooperatives have to submit requests for applying agrochemical products in areas near drinking-water protection zones to the local authorities of the State Sanitary Inspectorate for approval.

In order to protect the quality of recreational waters, the GDR Standard TGL 37 780/01 (sanitary requirements for bathing water) requires regular tests in public swimming pools, public bathing lakes and sets quality requirements.

Furthermore, there are quality standards for the classification of surface waters of lakes (TGL 27 885/01 Stagnant Inland Waters, Classification), and rivers (TGL 22 764 Classification of Water Quality of Flowing Waters). There are also quality standards for groundwater resources (TGL 34 334 Groundwaters, Classification).

The quality of water used for irrigation of agricultural crops, vegetables and fruits is regulated in the GDR Standard TGL 6466/01 (Irrigation of agricultural land; quality requirements for irrigation water).

Marine pollution comes under the Helsinki Convention on the Protection of the Marine Environment of the Baltic Sea (IDHL, 28: 121). The enforcement of ordinances regarding marine pollution, at the local and district levels, is the responsibility of the State Water Inspectorates. A standard for the protection of estuaries is under preparation.

Water research

Research in the field of water technology and management is carried out by Institutions of Water Management which are subordinated to the Ministry of Environmental Protection and Water Resources. The Ministry of Public Health has established and manages a complex research programme dealing with environmental health aspects. One of its main components is research in the field of water and its relevance to the protection of public health.

The research areas are outlined below:

Microbiological research

1. Further development of detection methods for pathogenic and nonpathogenic bacteria found in water with a view to incorporating such methods in the State Control and Monitoring System for Public Health.

2. Ecological problems related to the virulence and resistance to chemotherapy and the virulence coded in plasmids.

3. Detection and distribution of viruses in water and their elimination during water treatment.

Environmental-toxicological research

1. Further development of detection methods for organic and inorganic micropollutants in water with a view to incorporating such methods in the State Control and Monitoring System for Public Health.

2. Experimental toxicity testing and evaluation of the effect of selected, synergistic substances contained in water with the object of developing a standard test for the assessment of public risk.

3. Testing and evaluation of mutagenic, embryotoxic and organ-specific effects of selected water pollutants.

Epidemiological research

1. Studies on the influence of environmental factors on public health.

2. Methods for detecting and assessing long-term biotoxic effects of micropollutants in water, in order to establish water quality parameters permitting the safeguard of population's health.

Finance

Revenue income

The Annual Statistics Report gives for 1985 a total of 233 620 billion Mark.

Services charges for:

- Potable water supply ....0,35 Mark/m^3

Sewage charges

- Industrial effluents ....between 0.8 to 3.2 Mark/m^3 (depending on degree of pollution)

Responsible agencies:

Operation:	Carried out by:
Water resources survey	Ministry of Environmental Protection and Water Resources (MEPWR) Ministry of Geology
Water management policy	MEPWR
Drinking-water production	MEPWR
Drinking-water distribution	MEPWR
Drinking-water quality surveillance	District Waterworks (MEPWR) and State Sanitary Inspectorate (Ministry of Public Health)
Agricultural irrigation	Ministry of Agriculture
Industrial water supply	MEPWR, Ministry of Industries
Underground Water Protection	MEPWR, Ministry of Geology
Surface water protection monitoring	State Water Inspectorate (MEPWR) and State Sanitary Inspectorate (Ministry of Public Health)
Water pollution control	State Water Inspectorate (MEPWR) and State Sanitary Inspectorate (Ministry of Public Health)
Water resources and allocation	MEPWR, Ministry of Geology

Water resources availability and management

Rainfall

The GDR climate corresponds to the central European type of climate with cold winters and hot summers, but with snow remaining at the top of high peaks for a long time. The range of temperature is narrower near the Baltic coast than in the south. The average temperature in January is between -2.2°C and -1.1°C, while the average temperature in July is from 17.2°C to 19.4°C.

Rainfall can occur any time during the year but precipitation reaches its maximum in summer. The mean annual precipitation is 662 mm with variations between 510 to 760 mm annually.

This equals 72 billion m^3 of water, of which 17.4 billion m^3 are subjected to surface water or groundwater reflux. The major proportion evaporates. out of the potential water influx of 17.4 billion m^3 only 8.7 billion m^3 can be used in practice, since the rest has to be considered as flood water flowing off.

Topography

The River Elbe runs through the GDR from southeast to northwest. It receives the drainage of about nine tenths of the total hydrographic basin of the country. The rivers Oder and Neisse are also important because they form the boundary with Poland.

The country is topographically divided into four main regions: (1) the Northern Plain extending around 400km south of the Baltic Sea and partly irrigated by the River Elbe; (2) the northeastern region, made up by the territories of Mecklenburg and Brandenburg and ending at the Pomeranian Bay in the Baltic Sea; (3) the southwestern region, comprising the Thuringian Basin and the Magdeburg-Saxony areas, drained principally by the Mulde and the Saale, tributaries of the Elbe, and by the River Unstrut; (4) the Southern Hills, comprising a range of mountains and ringed hills which are intercalated by valleys and small plains.

Population/water resources and future trends

Water reservoirs in the GDR have a capacity of about 940 m^3/inhabitant. In dry years, this amounts to only 450 m^3/inhabitant. Water resources are subjected to very intensive use and, therefore, different raw water sources have to be utilized for supply of drinking water. Approximately 70% of the demand for drinking water is covered by groundwater sources. The rest is provided by surface water from areas where drinking-water reservoirs have been constructed, but also from direct abstraction from rivers. River water is taken mainly from river bank filtration wells.

The GDR has 265 dams and storage reservoirs, of which 145 have been constructed after 1949. In all these facilities, a total of 143 billion m^3 of water can be stored. Of these reservoirs, 28 are basins for drinking water with a total storage capacity of about 430 x 20^6 m^3.

Due to the increasing living standard, and the construction of new blocks of flats, the demand for drinking water for the population has increased by 2.5% to 3% per year.

Consequently, the increase in drinking water production is covered, up to 80-85%, by the use of groundwater. This includes also pit water from lignite mines. As a result of the drainage conditions of several mineral exploitation mines, large quantities of water collected in this way are also available. About 3-5% of the required increase in capacity is to be achieved through more intensive use of drinking-water reservoirs. In order to supply the required amount of drinking water, more polluted surface waters from rivers have to be used as raw waters as well. In such cases purification methods through bank filtration or artificial groundwater recharge have to be used, whenever this is possible.

The growing number of newly constructed wastewater treatment plants resulted in a decrease in the organic load in waters by about 10% from 1980 onwards. Until 1990 a further decrease by at least another 10% is planned.

Since 1981 about 190 biological plants for wastewater purification have been built in towns and villages. The rural sanitation programme envisages a drastic increase in the number of wastewater treatment facilities in rural areas and small towns to be achieved during the period 1986-1990.

In 1986 in Berlin a new purification plant with a third purification stage was put into operation and two existing purification facilities were equipped with a third stage. By 1990 two new purification plants with a tertiary treatment stage will be put into operation.

Attention is focused on the protection of groundwater resources against each type of potential contamination. Nearly all water catchment areas are protected by drinking-water protection zones. In these zones, activities such as production, storage and spreading of agrochemicals, fertilizers and other hazardous substances, are prohibited. A guideline for agricultural use of drinking-water protection zones is under elaboration, which besides recommendations on balanced fertilizer application will also contain information on cultivation of the appropriate type of plantation and on the most convenient rotation of crops. Plants which require intensive use of agrochemicals should not be grown in drinking-water protection zones. An optimal rotation of crops reduces the wash-out of nitrogen compounds.

GDR policies are directed towards an ever increasing number of citizens being connected to a central water supply system, since it is easier to protect central systems against contamination. Treatment is also safer, and it is easier to comply with stipulated hygienic conditions. By 1990 nearly all households will be connected to a central drinking-water supply system.

General statistics

Population

Population in urban areas (1985)	76.1%
Population in rural areas (1985)	23.9%

Population in urban areas is distributed as follows:

27.8% in settlements..........	between	2 -	20 000	inhabitants
14.7% in towns................	"	20 -	50 000	"
7.8% in towns................	"	50 -	100 000	"
25.8% in cities...............	over		100 000	"

Population living in rural areas:

23.9% in villages ....up to 2 000 inhabitants

Drinking-water supply

Total piped supply for drinking purposes	NA[a]
Total population served by a piped public water supply	95.0%
Urban population served by a house connection	99.5%
Urban population without house connections but with reasonable access to safe water	0.5%
Rural population served by house connections (public and private)	69.6%
Rural population without house connections but with reasonable access to safe water	30.4%

Drinking water supply uses

Water supplied for domestic and commercial use	16.0%
Water supplied for industrial use	64.0%
Other uses	20.0%

Industrial water supply: direct abstractions NA

Total supplied from inland waters for industrial use	%
Used for industrial cooling water	%
Usage as industrial process water	%
Total coastal water used	%

[a] NA = Not available

<u>Agricultural use: direct abstrations</u>	NA
Total amount abstracted for irrigation	NA
Other agricultural uses including fish ponds	NA
<u>Wastewater disposal services (total, 1985)</u>	70.6%
(a) % of urban population served by a sewerage network	NA
(b) % of urban population served by other adequate means	NA
(c) % of urban population lacking adequate disposal means	NA
(d) % of rural population served by a sewerage network	NA
(e) % of rural population served by other adequate means	NA
(f) % of rural population lacking adequate disposal means	NA
<u>Sewage treatment</u>	
(g) % of sewerage systems receiving primary treatment only	NA
(h) % of sewerage systems receiving secondary treatment	NA
(i) % of sewerage systems receiving tertiary treatment	NA
(j) % of sewerage systems receiving no treatment (raw discharge)	NA
<u>Discharge of treated sewage</u>	
(k) % discharged into the sea	NA
(l) % discharged into surface water bodies	NA
(m) % discharged onto farmland	NA
<u>Discharge of untreated sewage</u>	
(n) % discharged into the sea	NA
(o) % discharged into surface water bodies	NA
(p) % discharged onto farmland	NA
<u>Sludge disposal</u>	
(q) % of sludge disposed into the sea	NA
(r) % of sludge disposed into surface water bodies	NA
(s) % of sludge disposed onto farmland	NA
(t) % of sludge disposed as landfill	NA
(u) % of sludge incinerated	NA

<u>Note from the editor</u>

It is estimated that if 99.5% of the urban population is connected to a water supply network, they are probably also connected to a sewage network. With regard to the rural population, if 69.6% of the houses have water at home (a private or public system), the wastewater disposal system is most likely connected to either a sewage network, a septic tank or another adequate disposal system. Figures were not available.

Useful contact points

Governmental

Ministry of Public Health of the
German Democratic Republic
International Relations Division
Rathausstrasse 3
DDR-1020 Berlin

Telephone: (2) 23 34 661
Telex: 069-1152353z dd

Ministry of Environmental Protection
and Water Resources
Hans-Beimler Strasse 70-72
DDR-1020 Berlin

Telephone: 233 6714
Telex: 11 52 347

Water Industry

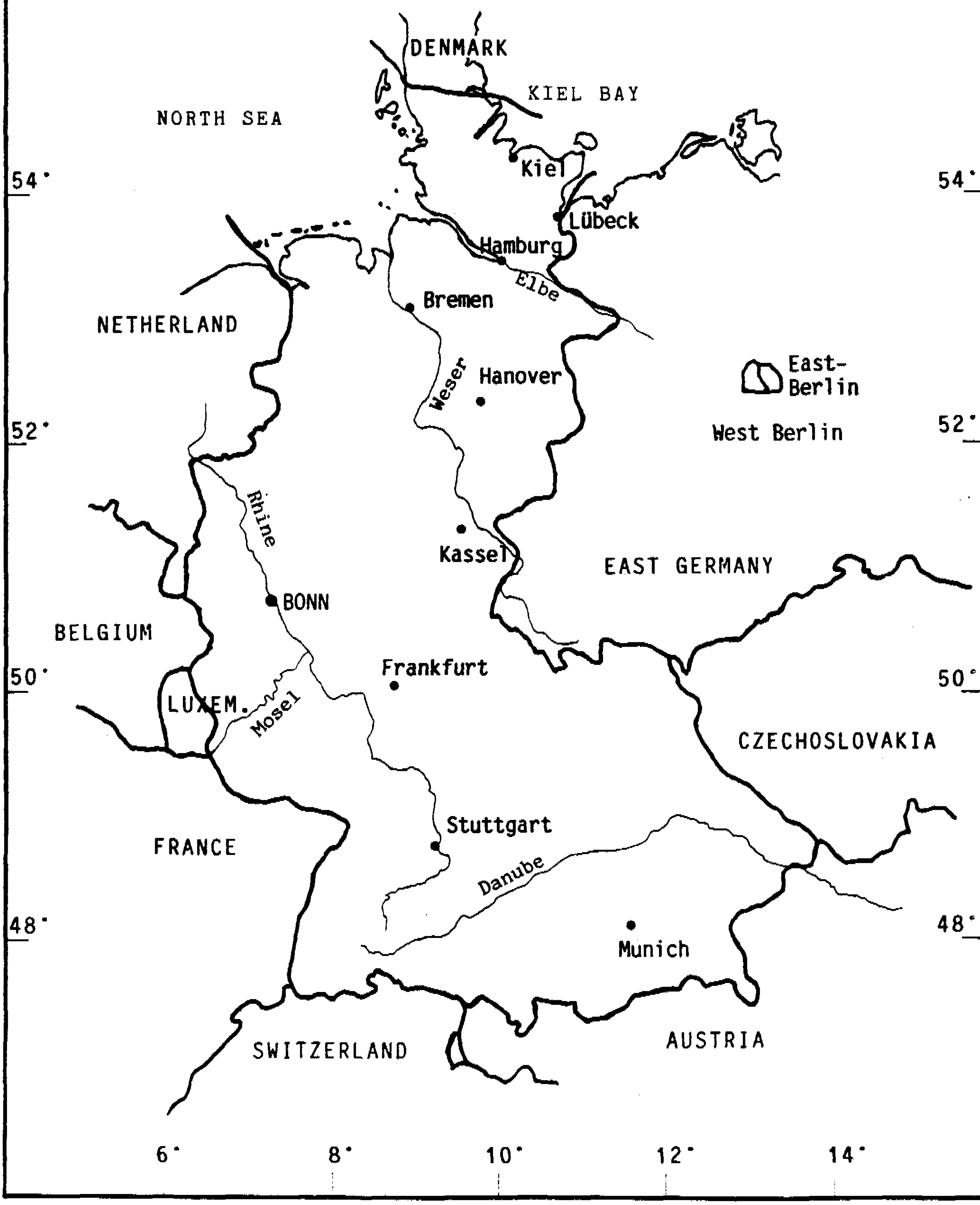
Ministry of Environmental Protection
and Water Resources
Hans-Beimler Strasse 70-72
DDR-1020 Berlin

Water Research

Research Institute of Hygiene and
Microbiology
c/o Ministry of Public Health

Research Center of Water Technology
c/o MEPWR

FEDERAL REPUBLIC OF GERMANY



FEDERAL REPUBLIC OF GERMANY

To the north of the Federal Republic of Germany are Denmark, the North Sea and part of the Baltic Sea, to the east lie the German Democratic Republic and Czechoslovakia, to the south are Austria and Switzerland, and to the west Belgium, France, Luxembourg and the Netherlands.

The regional distribution of the population is marked by heavy concentrations in certain areas. Of the total population of 61 015 300 (30 June 1985) living in a land area of 248 600 km^2, some 32.7% live in areas with over 100 000 inhabitants (65 towns with a total of approximately 20 million people). In addition, almost 25 600 000 people were in conurbations (communities with a population of between 50 000 and 100 000 inhabitants) covering approximately 7% of the total area of the country. In certain areas (e.g. the Ruhr and the Rhine-Main area) the population density reaches approx. 1000 inhabitants per km^2, whereas in rural areas the density is frequently less than 100 per km^2.

Government

The Federal Republic of Germany is a federal state consisting of *Länder* that include both city and territorial states. The *Länder* have national status but are integrated into the Federal Republic as a whole. They have their own legislative powers and also participate in federal legislation. They similarly implement not only their own laws but also federal laws. Local responsibility for the execution of federal and state laws rests with the city and county (Landkreis) authorities.

The Federal Parliament has two chambers: the *Bundestag*, which has legislative authority over the Federal Republic as a whole, and the *Bundesrat*, which consists of representatives of the *Länder*, but which is also involved in the federal legislation process (by means of consents, initiatives, and participation, etc.)

Administrative organization of water resources

In 1969 there were approximately 15 000 water supply undertakings in the Federal Republic but this has now been reduced to approximately 7 000 as a result of municipal reorganizations and mergers of hitherto independent companies. During the same period, numerous regional and supraregional water procurement associations were formed.

The water undertakings supply water to 59.6 million inhabitants (approximately 98% of the population) as well as trade and industry. A few large undertakings (approximately 1% of the total) produce about 55% of the water supplied. Most of the undertakings are in the public sector. They supply about 52% of the consumers. The remaining 48% are supplied by undertakings under private law and are either joint stock companies (*AG*) or companies in *GmbH* form (similar to private limited companies). The proportion of undertakings in the private and public sectors varies from one part of the Federal Republic to another: in the *Land* of Baden Würtemberg the majority of undertakings are in the public sector, whereas in the *Land* of North Rhine-Westphalia most are in the private sector.

An increasing shortage of good quality water resources close to the consumers has led to cooperation among undertakings in the field of water procurement. This takes place in the form of cooperation between neighbouring undertakings (horizontal cooperation) and through supraregional long-distance water suppliers. The relationship between a local water supply undertaking and a long-distance water supply organization may be determined by a water purchase contract or by participation in the long-distance water supply organization (vertical cooperation). The proportion of water obtained under purchase arrangements is greater than that obtained from the undertakings' own resources.

Cooperation is often, and increasingly, in the form of water boards (Wasserverbände). These boards are associations bound by legal orders and regulations and are generally subject to state (Land) control. They number more than 16 200, of which 10 500 are organized in accordance with the legal provisions for water boards and soil associations, i.e. they deal chiefly with agricultural problems. However, the importance of the associations dealing with the supply of drinking-water and industrial water and with the discharge and treatment of waste water is constantly increasing. Some boards are organized on the basis of laws and regulations other than those mentioned previously but they are similarly autonomous. Some of these were established in accordance with special laws because they have regional or supraregional functions for water supply or wastewater treatment.

The autonomous organizations are most active in the regions with a high level of industrial and economic development, where the demand for water exceeds the natural resources and where large quantities of wastewater are produced.

Coordination of new national water legislation and the formulation of the international policy of the Federal Republic takes place in Federal Government Länder committees, and in advisory boards and committees of experts in Federal matters, Land representatives and similar officials. The main tasks of these bodies are to conduct preliminary talks on problem areas, to discuss alternative solutions and to issue recommendations. They make use of the scientific knowledge of various federal institutes.[a]

In summary, the structure of water supply, disposal of residual waters and the control of pollution is based on the administrative structure of the country. At the lowest level, we find the municipalities, followed at the next level by the county authorities, with a water authority office usually supported by a technical department (Wasserwirtschaftsamt). Activities related to water supply are located in one department whereas wastewater and pollution control are in another department. Although there is no actual coordination between the two departments, it actually does take place depending on local conditions.

The next administrative level is the "Regierungsbezirk" (Regions). Integration of water supply, wastewater and pollution control is possible within a water authority which is supported by technical agencies "Wasserwirtschaftsämter" or the "Landesamt".

The State, or "Länder", is the upper level, and here water supply, wastewater and pollution control are usually integrated within a single ministry.

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[a] See Annex 1.

Role of the health department with regard to water quality

The Federal Ministry for Youth, Family and Health is responsible for monitoring public health and all related questions. As part of this responsibility the Ministry has to monitor foodstuffs in relation to environmental health and for this purpose drinking-water is classed as a foodstuff.

The following legislation is relevant to this topic:

Section 11 of the Law on communicable diseases, 18 July 1961 (IDHL, 13: 100), last amended in 1979, provides that water supplied for domestic, commercial or industrial purposes must be treated so that it may not endanger public health, especially with regard to viruses. To enforce this regulation the Federal Ministry issued the Ordinance of 31 January 1975 on drinking-water and water for use in the food industry, which came into effect in 1980 (IDHL, 27: 543).

The ordinance specifies the limits for the parameters affecting health and the frequencies of sampling. The local health authorities are responsible for the sampling and analysis of drinking-water. It is the responsibility of each Land to provide itself with the powers necessary to ensure compliance with the ordinance in its own area.

Section 12 of the reformed Law on foodstuffs, 15 August 1974 (IDHL, 26: 524), enables the Federal Ministry to authorize the use of certain additives in general or for specific purposes. This law was followed by the ordinance on synthetic additives to drinking-water, which came into effect in May 1975.

Both the ordinance on drinking-water and water for use in the food industry and the ordinance on drinking-water treatment are being revised so that the European Community directives concerning the quality of water for human consumption may be incorporated in the national legislation.

The Federal Ministry for Youth, Family and Health, in common with other agencies concerned with health services, can obtain professional advice, information and documentation from the Federal Health Office in Berlin (West). The Federal Health Office incorporates a number of research institutes, one of which is the Institute for Water, Soil and Air Hygiene, which carries out research on matters such as water quality, toxicological assessment of pollutants, hygienic properties of materials used in water supply systems and chemical and microbiological analytical methods.

Water and related legislation

With a view to achieving the management objectives in the Federal Republic of Germany concerning the protection of inland surface waters, groundwater and coastal waters, particular importance is attached to

- the Federal Water Act as amended in 1986,

- the Wastewater Charges Act of 1976 and the pertinent rules for implementation adopted by the Länder.

Water protection is an important aim also of the following legislation:

- the Detergents Act of 1975 (amended in 1986)
- the Waste Management Act (in the version as amended in 1986)
- the Nature Conservation Act of 1976 (amended in 1986)
- the Chemicals Act of 1980
- the Plant Protection Act as amended in 1986
- the Drinking Water Ordinance of 1986.
- the EC Directive of 15 July 1980 for drinking-water quality.

The above-mentioned water laws make it quite clear that the protection of the aquatic environment is essentially based on the emission principle. This approach consistently puts the principle of prevention into practice and furthermore allows for the application of the "polluter-pays" principle.

Since the emission principle, which is based on the generally acknowledged rules of technology (i.e. best practicable means), is not alone sufficient to ensure adequate protection of waters, this principle should be applied on a case-to-case basis in order to consider whether additional requirements have to be imposed for discharges into water bodies.

The Federal Water Act

The Federal Water Act as promulgated on 23 September 1986 plays a central role and therefore should be considered in more detail. The Act contains fundamental provisions governing the use of water bodies. They also include the discharge of substances (wastewater) into waters.

According to the regulations governing the use of water bodies any discharge of wastewater is subject to a permit by the competent authority. The necessary conditions for use and other requirements have to be laid down in a notification. In cases where this is deemed insufficient in the interest of the public weal, no permit will be granted. If necessary, there is a possibility to restrict or repeal a permit. In the interest of water protection it is furthermore possible to impose subsequent requirements which have to be fulfilled by the discharger.

The relevant provision in Art. 7a of the Federal Water Act lays down minimum requirements for discharges (emission standards) applicable in all federal states (Länder), which have to be complied with in any case and irrespective of the water quality of the receiving water body.

According to this provision, the quantity and noxiousness of the wastewater have to be kept as low as possible if the best practicable means are applied. If the wastewater contains certain harmful substances, the emission standards must be in accordance with the best available technology.

This means that a permit for wastewater discharge may only be granted if the minimum requirements are complied with. This can only be achieved by appropriate wastewater treatment.

With the consent of the Federal Council of Constituent States (Bundesrat), the Federal Government issues the minimum requirements in the form of administrative regulations. The term "minimum requirements" makes it clear that the water authorities may impose stricter requirements on effluent discharges.

The new Art. 7a para 3 extends the stricter requirements on wastewater discharges containing hazardous substances to include the users of the public sewerage systems, the so-called indirect dischargers.

The Wastewater Charges Act

Apart from the Federal Water Act, the 1976 Wastewater Charges Act is another cornerstone in the present water legislation. A charge is levied on those who discharge effluents into water bodies. The payment of wastewater charges levied for the first time in 1981 does not exempt from the obligation to purify wastewater according to the provisions of the Federal Water Act.

The wastewater charge is designed to provide incentives for those who discharge effluents into water bodies

- to build treatment plants,

- to improve wastewater purification technologies,

- to operate treatment plants with optimum efficiency, and

- to introduce production processes generating either no or a minimum quantity of wastewater.

Furthermore, the wastewater charge is to offset the advantage which dischargers of more noxious wastewater have over dischargers who put more emphasis on pollution control. This is a consistent application of the polluter-pays principle. The potential polluter has to prevent or reduce a harmful impact on the environment. The wastewater charges are calculated with a view to the quantity and noxiousness of the effluents. The charges are levied on those who discharge wastewaters directly into the water bodies, i.e. mainly on municipalities and industrial firms. Municipalities and functional associations then have to apportion the costs to the indirect dischargers.

The Detergents Act

According to this act of 1975, washing and cleansing agents may only be marketed by manufacturers, importers or distributors in compositions which will, as far as possible, prevent deterioration of the quality of water bodies - especially with a view to the abstraction of drinking water - as well as disturbances in the operation of wastewater plants. The objective of the amended Detergents Act of 1986 is particularly to minimize deterioration of the quality of water bodies and of the operation of wastewater plants by washing and cleansing agents. This deterioration will depend on their kind and amount. The main purpose of the law is to improve the compatibility of the products with the environment according to the technical progress made, and to gear the consumption of these products to what is really necessary for cleaning purposes.

The second phase of the above-mentioned ordinance entered into force on 1 November 1984. As a result, the use of phosphates in washing and cleansing agents was reduced significantly.

Use of phosphates in washing and cleansing agents

Year	Phosphate consumption in tonnes	corresponding quantity of phosphorus in tonnes	Reduction %
1975	267 000	69 000	approx. 50%
1985	140 000	35 000	

Wastewater, waste and protection of the marine environment

The national policy concerning waste disposal and reduction of pollution in wastewaters is directly connected with the protection of the marine environment against pollution by dumping and discharging substances and wastes. The principles of prevention applied in the Federal Republic of Germany, aim at reducing, as far as possible, pollution of maritime waters by means of emission standards. The Federal Republic of Germany will phase out dumping by the end of 1989 at the latest.

Discharges from land-based sources

The national act on the ratification of the Paris Convention on Marine Pollution entered into force on 18 September 1981. As regards the treatment of discharges into rivers, estuaries and coastal waters of wastewater containing substances referred to in the Convention, responsibility rests with the Länder. This responsibility is exercised by the Länder to the extent that they enforce the Federal Water Act. This is why the national act pertaining to the Paris Convention only had to provide a supplementary regulation for discharges through pipelines into the high seas; the German Hydrographic Institute and other federal authorities participate in the licensing procedure.

Drinking Water Ordinance

Based on the Federal Act on Contagious Diseases of 18 December 1979, the Federal Act on Foodstuffs and Commodities of 15 August 1974 and the EC Directive on the quality of water for human consumption of 1980, an amendment of the Drinking Water Ordinance was put into effect on 22 May 1986 which establishes standards for the quality of drinking water.

The Chemicals Law of 16 September 1980 (IDHL, 32: 515) creates the means of controlling ecologically hazardous substances as early as possible in the production process, in some cases going as far as prohibiting the manufacture or use of certain substances.

Other relevant legislation relating to water includes the Water Board Law of 1937, the Waste Oil Act of 1968, the Environment Statistics Law of 1974 and the Notice of 1976 consolidating the Atom Law of 1959.

The Federal Government is signatory to conventions for the protection of the North Sea and the Baltic, and for the prevention of pollution on the high seas. There are also international agreements concerning the protection of the Rhine, the Mosel and Lake Constance, and regarding the Danube, an agreement with riparian countries is under study.

Water research

A complex system of water research exists in the country. As previously stated, potable water supplies and sewage handling are dealt with by separate authorities. This also applies in the field of water research.

Water research is sponsored through three main sources:

1. The Ministries of the Federal Government. These include the Federal Ministry of Research and Technology and the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, which make funds available to sponsor research in universities, institutes and polytechnics and certain projects directly. The research projects of the Ministry of the Interior are supported and organized by the Federal Environmental Agency. In addition, the Federal Ministries of Youth, Family and Health make funds available to support the Federal Health Office in Berlin (West). In turn, the Federal Health Office sponsors research at its own research institute, the Institute for Water, Soil and Air Hygiene (Institut für Wasser-Boden-Lufthygiene (WaBoLu).

2. Industry. A considerable part of research and development in the water sector is sponsored by water companies themselves. They can do this directly by funding research at appropriate institutions, or indirectly through membership of research associations. In the case of potable supplies, the German Association of Gas and Water Experts (Deutscher Verein des Gas und Wasserfaches, (DVGW)) is the appropriate body for funding research into water supply and related waters, and in the wastewater field it is the Association for Sewage Technology.

   In addition to funding research, the research associations have their own research establishments. For example, DVGW funds a research station at the Engler Bunte Institute at the University of Karlsruhe.

3. Water Companies. Several water supply companies have set up their own research institutes, important examples being Dortmunder Stadtwerke AG and Stadtwerke Wiesbaden AG.

4. The German Research Association (Deutsche Forschungsgemeinschaft, (DFG)) plays a special role. It receives funds primarily from the Federal Government and also from industry and, in turn, sponsors research of interest both to industry and the Government.

Finance

In 1975, overall investment in public water supply totalled approximately 1.8 billion Deutschmarks, and in 1981, 2.6 billion DM. Federal support for water supply companies is conditional upon their charging an appropriate price for water.

The cost of water supply varies from region to region as a result of the different costs of water production which are related to the existing differences in hydrological, topographic and demographic conditions. In 1981, the lowest cost was found in Illertissen/Bavaria (DM 0.35 per m^3) while the highest cost was found in Helgoland/Schleswig-Holstein (DM 4.50 per m^3).

The costs of cleaning up the surface waters in the Federal Republic in line with the environmental programme over a period extending to 1985 and based on 1970 prices have been estimated at:

13 billion Deutschmarks for constructing public sector wastewater treatment plants;

30 billion Deutschmarks for constructing sewer networks;

22 billion Deutschmarks for constructing industrial wastewater treatment plants.

This implies an annual investment of 1 billion Deutschmarks for public sector wastewater treatment plants. In 1971, 630 million Deutschmarks were invested, increasing to 1.075 billion Deutschmarks in 1975, to 1.84 billion Deutschmarks in 1980, and to 1.59 billion Deutschmarks in 1983. From 1970 to 1984 a total of 19 billion Deutschmarks was invested in wastewater treatment plants and 34 billion Deutschmarks for construction of sewer networks.

The amount of charge payable under the provisions of the Wastewater Charges Act is based on the number of pollution units contained in the annual volume of wastewater discharged. The pollution units are calculated according to the settleable solids, the chemical oxygen demand, the toxicity to fish and the mercury and cadmium contents if these exceed 1 and 10 kg per annum respectively.

In 1981, the charge was levied at the rate of DM 12 per pollution unit; this will rise to DM 40 per unit by 1986.

Responsible agencies

Operation	Carried out by:
Water resources survey	Länder water administration
Water management policy	Länder water administration
Drinking-water production	Water undertakings
Drinking-water distribution	Water undertakings
Drinking-water quality surveillance	Federal Ministry for Youth, Family and Health
Agricultural irrigation	Water boards and soil associations
Industrial water supply	90% own production control by tender administration
Underground water protection	Water protection areas fixed by Länder order
Surface water protection monitoring	Federal Government and Länder
Water pollution control	Länder water administration
Water resources storage and allocation	Länder water administration

Water resource availability and management

Rainfall

The climate is intermediate between the oceanic and continental climates of western and eastern Europe respectively. The differences in the temperature range and the rainfall are accentuated by the mountains and high plateau in the south and the low-lying plains of the north. Mean annual temperatures range from 12°C in the south-west to 8°C in the north. The highest rainfalls are in the summer, but there is some precipitation at all seasons. Average annual precipitation is highest in the Alps (approximately 2500 mm) and lowest in the Rhine and Main valleys (approximately 450 mm).

Topography

The country can be divided up into four distinct physical units.

The North German Plain

In the north and west of this area the land is flat and low-lying. To the south, where the plain borders on the mid-German highlands, there is a belt of rolling country. The larger rivers of the plain such as the Elbe, the Ems and the Weser are naturally navigable and need few locks. The main ports are on these rivers.

The Mid-German Highlands
This west-east belt of highland blocks is crossed from north to south by the Rhine, the Weser and the Leine. The western plateau is composed of predominantly impervious rocks, slates, sandstones and quartzites, though there are more productive and closely settled areas on limestone and loess deposits. The river valleys cut through horizontal strata of the Triassic series forming wooded sandstone uplands and rolling plateau of cultivated limestone. The valleys connect Frankfurt-am-Main, Kassel, Hannover and other intermediate cities and have been a most important factor in their historical development.

The South
This is the area between the mid-German highlands and the Alps in the south and from the Vosges in the west to the Bohemian forest in the east. The largest rivers are the Main and the Neckar, both right bank tributaries of the Rhine. Their basins consist of rolling limestone uplands, wooded sandstone hills and cultivated plains on marls and clays. There are extensive areas of fine loess.

Bavarian Alps and plateau
The plateau is bordered on the south by Lake Constance and the Alps, on the north by the Swabian-Franconian Jura and the Bohemian massif. It is drained by the Danube, which rises in the Black Forest and flows eastwards near the northern side of this area. A canal linking the Danube and the Main is under construction.

Population/water resource availability

There is sufficient rainfall to meet the overall demand but it is necessary to use bulk transfer schemes to overcome shortages in some regions. However, the relatively favourable water supply situation in terms of quantity contrasts with serious quality deficiencies in many waters despite considerable efforts to improve the situation in the 1970's. This is as a result of the high population density in some areas and rapidly increasing per capita consumption, as well as increasing industrial demand. Many surface waters can be used for drinking-water supply only after substantial expenditure on treatment, and part of the groundwater resources are also affected.

The total water resources available have been estimated as follows:

- Surface waters — 37×10^9 m^3/year
- Surface waters "usable" — 26×10^9 m^3/year
- Groundwater — 27×10^9 m^3/year
- Groundwater "usable" — 16×10^9 m^3/year

Water balance

Element	Volume (10^9 m^3)
Precipitation	208
Evapotranspiration	129
Runoff	79
Inflow from other countries	82
Total water supply (including thermal power stations)	39

Dams with a reservoir capacity of 2 X 10^9 m^3 are available for drinking-water, power production and supplementing low river flows.

The sources of water abstracted for public water supplies are:

- groundwater	62%
- springwater	9%
- bank filtered water	6%
- enriched groundwater	12%
- river water	1%
- lake water	3%
- impounded water	7%

The total annual production of the water supply industry is approximately 5 X 10^9 m^3. This represents roughly 250 litres/head/day. In 1960, the total production was approximately 3.3X10^9 m^3, representing roughly 190 litres/head/day. The consumption of households and small-scale businesses increased almost continuously from year to year (+36% 1970 to 1979) but industrial consumption fluctuated considerably with economic development (-25% 1970 to 1979).

During the last decade the proportion of groundwater has increased. In urban areas, however, this development is necessarily limited and there the tendency is for the proportion of surface water to increase. In Bavaria, for example, the proportion of surface water is less than 10% whereas in North Rhine-Westphalia approximately 60% is surface water.

The largest increases in water consumption by households and small businesses are mainly in the medium-sized towns and are probably linked to the rising standards of living.

In addition to water taken from the public water supply, industry abstracted 10.7X10^9 m^3 in 1975 and 11.3 billion m^3 in 1979 (latest available figures). Most of this was surface water. Two thirds of the water was abstracted by a few large industrial concerns and since these plants are concentrated in congested areas there tends to be competition between them and the public water supply undertakings for the use of the water resources in certain regions.

Future trends of water resources

Owing to the favourable climatic situation of the Federal Republic of Germany there are generally no problems with regard to quantitative water supply. Sufficient water resources are available for both public and industrial water supply; it is, however, necessary to solve problems of safeguarding water supply in the regions where the demand arises. For purposes of good husbandry of the resources available and preventing detrimental effects, increasing attention is focused on the rational use of water. The industry, in particular, is called upon to use water-saving production and cooling processes and to adapt old plants to these new processes.

In contrast to the generally favourable situation as regards water quantity, the problem of water quality is a critical one. Despite considerable efforts made in water pollution control, in particular in the field of sewage purification, there remain a few areas in the water industry that are still endangered. Above all the supply of drinking water for the population. Hydraulic engineering carried out in earlier years, such as the development of river beds and water courses, but also the sealing off of the surface, has accelerated the water runoff and thus reduced the performance of the water regimen.

It is therefore the aim of water management in the Federal Republic of Germany to conceive a long-term water management policy so as to

- conserve or restore the ecological balance of water bodies,
- safeguard the supply of the population and the economic sector with water of appropriate quality,
- ensure that all other uses of water which serve the common weal are possible also in the long run.

Policy tools to this end are precautionary planning, bans and limitations on discharges of pollutants, wastewater charges and agreements with industry. The cornerstones in the Federal Government's environmental policy are the principle of prevention, the "polluter-pays" principle and the principle of cooperation.

In conclusion, it can be said that the present overall demand can be met using all available resources. Groundwater extractions do not reach 50% of available resources. However, the quality of surface waters main used for industrial purposes is being endangered by the resulting industrial residual waters.

General statistics

Population

Population in urban areas	14.5%
Population in rural areas	85.5%

Drinking-water supply

Total piped supply for drinking purposes[a]	17 871 Ml/d[b]
Total population served by a piped public water supply	97.8%
Urban population served by a house connection	100.0%
Urban population without house connections but with reasonable access to public standposts	0.0%
Rural population served by piped public water supply at home	97.0%
Rural population served by private systems at home or having reasonable access to public standposts	3.0%

Drinking water supply uses

Water supplied for domestic and commercial use	71.4%
Water supplied for industrial use	18.8%
Other uses	9.0%

Industrial water supply: direct abstractions[c]

Total supplied from inland waters for industrial use(1983)	30 762 Ml/d
Used for industrial cooling water	79.3 %
Usage as industrial process water	18.2 %
Total coastal water used	NA Ml/d[d]

Agricultural use: direct abstractions

Total amount abstracted for irrigation[e]	238 $M/m^3/y$
Other agricultural uses including fish ponds	NA $M/m^3/y$

[a] In recent years consumption by private households has only risen slightly; in 1983 it was 147 litres per head per day. Overall consumption has been declining slightly; in 1983 it was 197 litres per head per day.

[b] 1 Ml/d = 1 million litres/day.

[c] Tends to fall in recent years owing to recycling, but fluctuates with economic cycle.

[d] NA = Not available

[e] $M/m^3/y$ = million cubic metre per year

Wastewater disposal services

(a)	% of urban population served by a sewerage network	97.0%
(b)	% of urban population served by other adequate means	3.0%
(c)	% of urban population lacking adequate disposal means	0.0%
(d)	% of rural population served by a sewerage network	93.7%
(e)	% of rural population served by other adequate means	6.4%
(f)	% of rural population lacking adequate disposal means	0.0%

Sewage treatment

(g)	% of sewerage systems receiving primary treatment only	11.2%
(h)	% of sewerage systems receiving secondary treatment	81.1%
(i)	% of sewerage systems receiving tertiary treatment	7.7%
(j)	% of sewerage systems receiving no treatment (raw discharge)	0.0%

Discharge of treated sewage

(k)	% discharged into the sea	NA %
(l)	% discharged into surface water bodies	NA %
(m)	% discharged onto farmland	NA %

Discharge of untreated sewage

(n)	% discharged into the sea	0.0%
(o)	% discharged into surface water bodies	0.0%
(p)	% discharged onto farmland	0.0%

Sludge disposal (1.69 M tonnes dry per year) (1983)

(q)	% of sludge disposed into the sea	1.77%
(r)	% of sludge disposed into surface water bodies	NA %
(s)	% of sludge disposed onto farmland	31.95%
(t)	% of sludge disposed as landfill	56.20%
(u)	% of sludge incinerated	10.06%

Useful addresses

Governmental

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
(Bundesministerium für Umwelt, Naturschutz and Reaktorsicherheit))
Kennedyallee 5
5300 Bonn 1

Tel. (228) - 305-0
Telefax 305-1-68

Federal Statistical Office
Postbox 5528
Gustav-Stresemann-Ring 11
6200 Wiesbaden

Tel. (6121) 75-0
Telex 4 186 5 11 stb d
Telefax 75 34 25

Water industry

German Association of Gas and Water Experts
(Deutscher Verein des Gas- und Wasserfaches e.V.)
(DVGW)
Postfach 5240
Frankfurter Allee 27-29
6236 Eschborn 1

Tel. (6196) 44059
Telex 417420

Sewerage and sewage treatment

Association for Sewage Technology
(Abwassertechnische Vereinigung (ATV))
Markt 1
5205 St. Augustin

Tel. (2241) 232-0

Water research

Umweltbundesamt
Bismarckplatz 1
1000 Berlin 33

Tel. 030-8903-1

German Association of Gas and Water Experts
(Deutscher Verein des Gas- und Wasserfaches e.V. (DVGW))

Association for Sewage Technology
(Abwassertechnische Vereinigung) (ATV)

Annex 1

FEDERAL INSTITUTES

Federal Statistical Office
(Statistisches Bundesamt)

Federal Institute of Hydrology
(Bundesanstalt für Gewässerkunde)

Institute for Water, Soil, and Air Hygiene of the Federal Health Office
(Institut für Wasser-Boden-Lufthygiene des Bundesgesundheitsamtes)

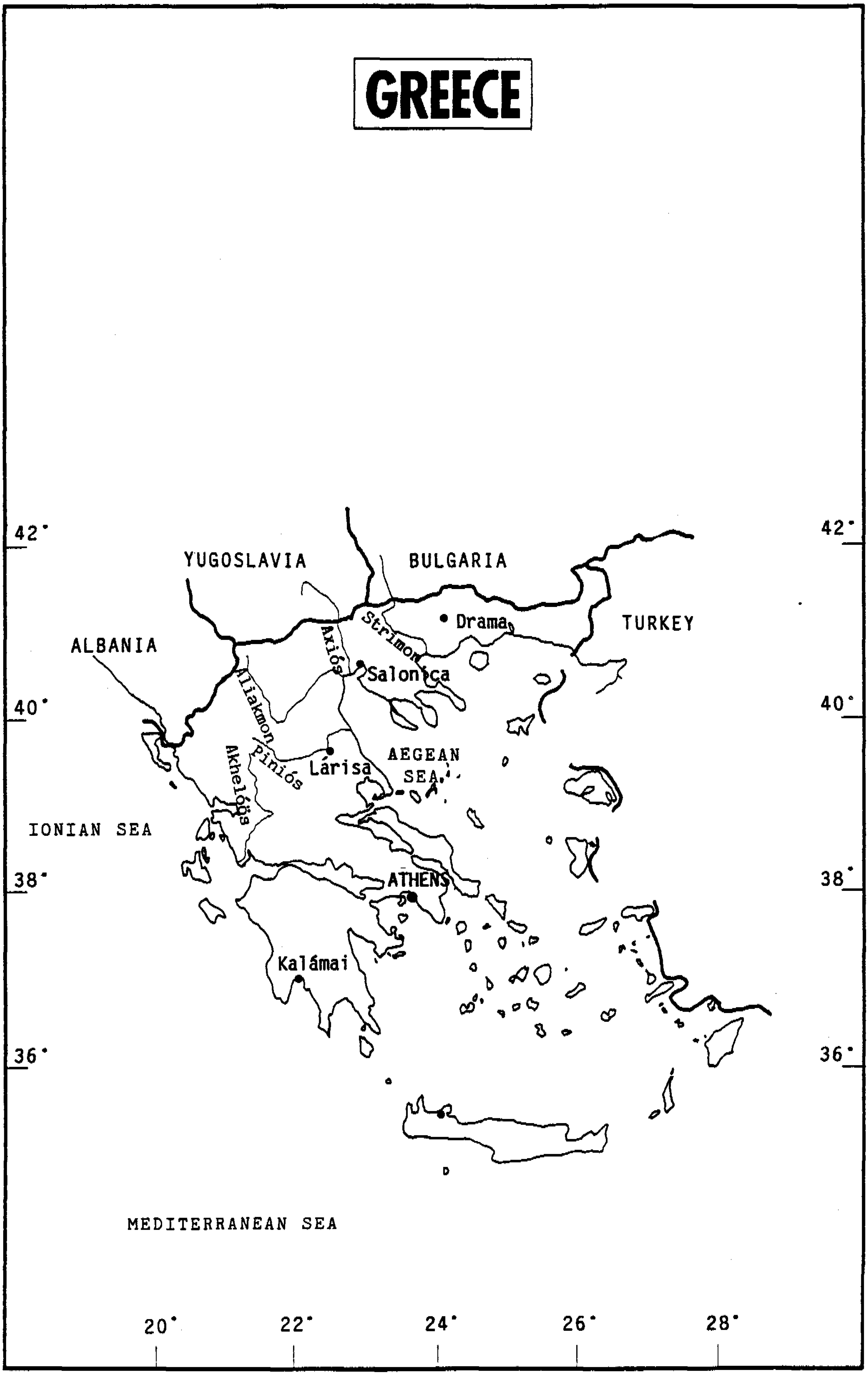
Federal Institute for Hydraulic Engineering
(Bundesanstalt für Wasserbau)

German Hydrographic Institute
(Deutsches Hydrographisches Institut)

Council of Experts on Environmental Problems
(Sachverständigenrat für Umweltfragen)

Federal Environmental Agency
(Umweltbundesamt)

Also involved are other large-scale institutions, individual land institutes, independent institutes and engineering consultancy offices.


GREECE
42°
YUGOSLAVIA
BULGARIA
ALBANIA
Drama
TURKEY
Strimon
Axiós
Salonica
Aliakmon
40°
AEGEAN
SEA
Akhelóos
Piniós
Lárisa
IONIAN SEA
38°
ATHENS
Kalámai
36°
MEDITERRANEAN SEA
20°
22°
24°
26°
28°

GREECE

The mainland of Greece is a mountainous peninsula bordering the Ionian, Libyan and Aegean Seas with numerous islands to the south, east and west. It has frontiers with Albania, Bulgaria, Turkey and Yugoslavia. Greece is divided into 10 regions: Greater Athens, Central Greece and Euboea, Peloponnessos, Ionian Islands, Epirus, Thessaly, Macedonia, Thrace, Aegean Islands and Crete. Greece has an area of 131 944 km^2 and in 1982 had a population of 9 789 000, giving a population density of 74 inhabitants per km^2.

Government

The Hellenic Republic has a single-chamber Parliament. Under the Constitution of June 1975 the President is Head of State and is elected by Parliament for five years; Members of Parliament are elected every four years. The President appoints the Prime Minister and, on the latter's recommendations, the other members of the Government. For administrative purposes Greece is divided into 52 prefectures (departments), which form the administrative arm of the national Government. There are 147 eparchies, 264 municipalities and 5774 communes.

Administrative organization of water services

The administrative organization of the public sector and consequently the water supply sector is decentralized to the 52 Departments (Prefectures-Nomi) of the country. The Prefect is the head of all political, police and port authorities of the prefecture and also acts as the representative of the Central Government, responsible for the implementation of the Government policy. The Prefects are appointed by a Presidential Decree, following recommendations by the Minister of the Interior and the decision of the Council of Ministers.

All the regional services of the Ministries of Interior, City Planning and Environment, Public Works, Health and Welfare, etc., have been passed on to the Prefecture level by Law 3200/55 and P.D.532/70.

The Prefect is assisted by the Prefectural Council, the role and responsibilities of which have been enforced by recent legislation (Law 1235/82). The Prefectural Council consists of the Prefect acting as president, the mayor of the capital city, representatives of the Prefecture Eparchies, two representatives of the local authorities and a number of representatives of local professional, scientific societies or chambers, cooperatives, etc.

The Council is mainly responsible for the following:

- to draw up and approve the annual programme of public investment for the Prefecture and to allocate funds to the local authorities;

- to prepare long-term planning programmes of major projects for local and regional development;

- to propose measures for the improvement of the administration, the decentralization policy and the reinforcement of the role of the local authorities;

- to study and advise on political, socioeconomic and cultural matters arising in the area.

The implementation of programmes and construction of works at the Prefectural level is administered mainly by two offices: the Directorate of the Technical Services of the Prefecture and the Prefectural Funds.

The Directorate of the Technical Services consists of the regional technical services of the Ministry of Public Works, the Technical Services of Municipalities and Communes (TYDK) of the Ministry of the Interior and the Housing and Planning Services. Of these, the TYDK is mainly responsible for the supervision of water supply and sewerage projects carried out by the local authorities and for the preparation of technical designs for such projects.

The Prefectural Funds were established in 1956 by Law 3620 and are responsible for the administration of the Programme of Public Investment in the Prefecture, i.e. the distribution of funds to local authorities and also the financing of other public entities for the implementation of regional projects.

The Prefectural Funds are governed by a council consisting of the Prefect as president, the mayor of the capital city of the Prefecture, the Directors of the regional services of Interior, Agriculture, Finance and TYDK and two representatives of the local authorities. The Prefectural Funds may have private financial resources, i.e. receipts from duties and dues arising from the exploitation of projects.

The Technical Services of Municipalities and Communes operating at the Prefectural level and responsible for supervising and assisting the local authorities in the construction of water supply and sewerage works, are adequately staffed with engineers who are university graduates and also technical personnel, i.e. sub-engineers and technicians. The engineers and other technical personnel in service today cover about 85% of the officially allocated places.

Local authorities

According to the Greek Constitution, the administration of local matters is entrusted to local authorities which, during their early stages, consist of municipalities and communities. Later stages are to be set by special law.

The Constitution also stipulates that unified associations of local governments can be assigned the performance of works or the supply of services, provided it is administered by a board of representatives of each municipality or each community and that it is selected in proportion to the population.

The administration of water supply and sewerage works required to cover the basic needs of regions with specified boundaries is a matter which according to constitutional dispositions is entrusted to local governments.

For purposes of implementation of the above constitutional disposition, the Code of Municipalities and Communities - which has been ratified by Law 1065/80 - provides that the construction, the maintenance and operation of water supply and sewerage systems are the exclusive function of the local authorities (municipalities, communities or associations of municipalities and communities). The implementation of the activities of these sectors is to be accomplished through the creation of municipal and communal services, organizations or enterprises, or under certain conditions, by entrusting such functions to the State or other legal entities.

The water supply and sewerage systems are considered as a single public service and therefore must be administered or implemented by the same body.

In the region of Athens, the above functions have been entrusted by Law 1068/80 to a non-profit Public Corporation which takes the form of a company operating as a private enterprise. Similar enterprises have also been established in 40 other cities. The role of the local authorities and the communal enterprises in the water supply and sewerage sector is described analytically in the following sections.

The control of planning and construction of works in the regions of Athens other than those carried out by EYDAP, Thessaloniki and Volos is the responsibility of the Ministry of Public Works. For all other towns and settlements throughout the country, these functions are the responsibility of the Ministry of Interior.

Large municipalities have at their disposal technical departments in order to deal with studies and works on water supply and sewerage. Smaller municipalities and communities are assisted by the TYDK.

The basic local authority bodies are the municipalities and communities or associations thereof. A municipality is a city or town with a population of 10 000 people or more, whereas a community is a town or village with a population of 1000 or more. The capital of the Prefecture is always a municipality regardless of the population. The municipalities and communities are governed by a local council, the members of which are directly elected in general elections every four years, according to the provisions of Law 1065/80

The local authorities are responsible for the construction, maintenance and exploitation of water supply and sewerage works in their area. Usually the construction of works is entrusted to private contractors, following a national call for bids, since most local authorities do not have the necessary facilities or competent personnel for the job.

The contractual agreement is drawn between the contractor and the local council and payments are made through the Prefectural Funds. Before the end of each year, the local council prepares and submits to the Prefecture the list of projects of the community for the following year to be included in the Programme of Public Investment drawn up and approved by the Prefectural Council.

The main financial resources of the local authorities are:

- revenues from movable and immovable properties
- receipts from duties and dues
- regular state subsidies
- loans arranged with the State, public institutions and public and private enterprises.

Regular State subsidies are granted to the local authorities through the Prefectural Funds.

The local authorities are assisted in every matter by the Ministry of the Interior.

The creation of Communal Enterprises of Water Supply and Sewerage (DEYA) was ratified by Law 1069/80. The DEYA are public utility corporations, operating as private enterprises with the function to perform all the activities associated with water supply and sewerage including the treatment and disposal of wastes in their area of responsibility. The DEYA can be created by every municipality or commune or by their associations provided that the total population exceeds 10 000. The cities of Athens and Salonika are covered by special legislation.

The DEYA are governed by a council consisting of the major as president and four to ten members coming equally from the local authority council and the public. The council is responsible for the internal organization of the DEYA, the formation of the personnel and the scales of salaries to be paid. In charge of the DEYA services is a managing director who should be a university graduate.

The main financial resources of the DEYA are:

- State subsidies through the Programme of Public Investment, covering up to 35% of the total cost of the project;

- receipts from duties, dues and tariffs;

- loans granted by the Consignation and Loans Fund;

- contributions, donations, inheritance, etc.

The DEYA can also be financed from the Regional Development Fund of the EEC and the European Investment Bank. The loan cannot exceed 45% of the total cost of the project.

More specifically the various forms of duties collected are:

- duties for private connections to the water supply and sewerage networks collected once only;

- duties for the use of the water supply and sewerage facilities, collected with the water bill;

- special duty imposed for a period of ten years amounting to 80% of the price of water used to cover the expenses of design and construction of new works and collected with the water bill;

- special tax, also imposed for a period of ten years, on all revenue from immovable properties and collected with the income tax;

- the value of the water used.

The revenue collected from the above duties, taxes and tariffs must cover all the administrative expenditures as well as the necessary expenses for the operation and maintenance of the networks, interests and amortization.

The DEYA are ultimately responsible for the control of discharges to the sewerage networks, i.e. the setting of effluent standards to specific consumers, the issue of permits and the infliction of fines, subject to the issue of a Presidential Decree. They are not, however, responsible for the control of drinking water quality which is the responsibility of the Directorate of Hygiene.

Role of the health department with regard to water quality

During the first years following the Second World War, the water supply situation in Greece was poor. Less than 30% of the population was serviced by a piped water supply system through house inlet connections. Immediately after the war (1949) the health services took measures to improve the situation and by 1961 the above percentage had risen to 38.02%, while by 1971 it had reached 85.8% in Greek cities.

The factors responsible for this achievement were:

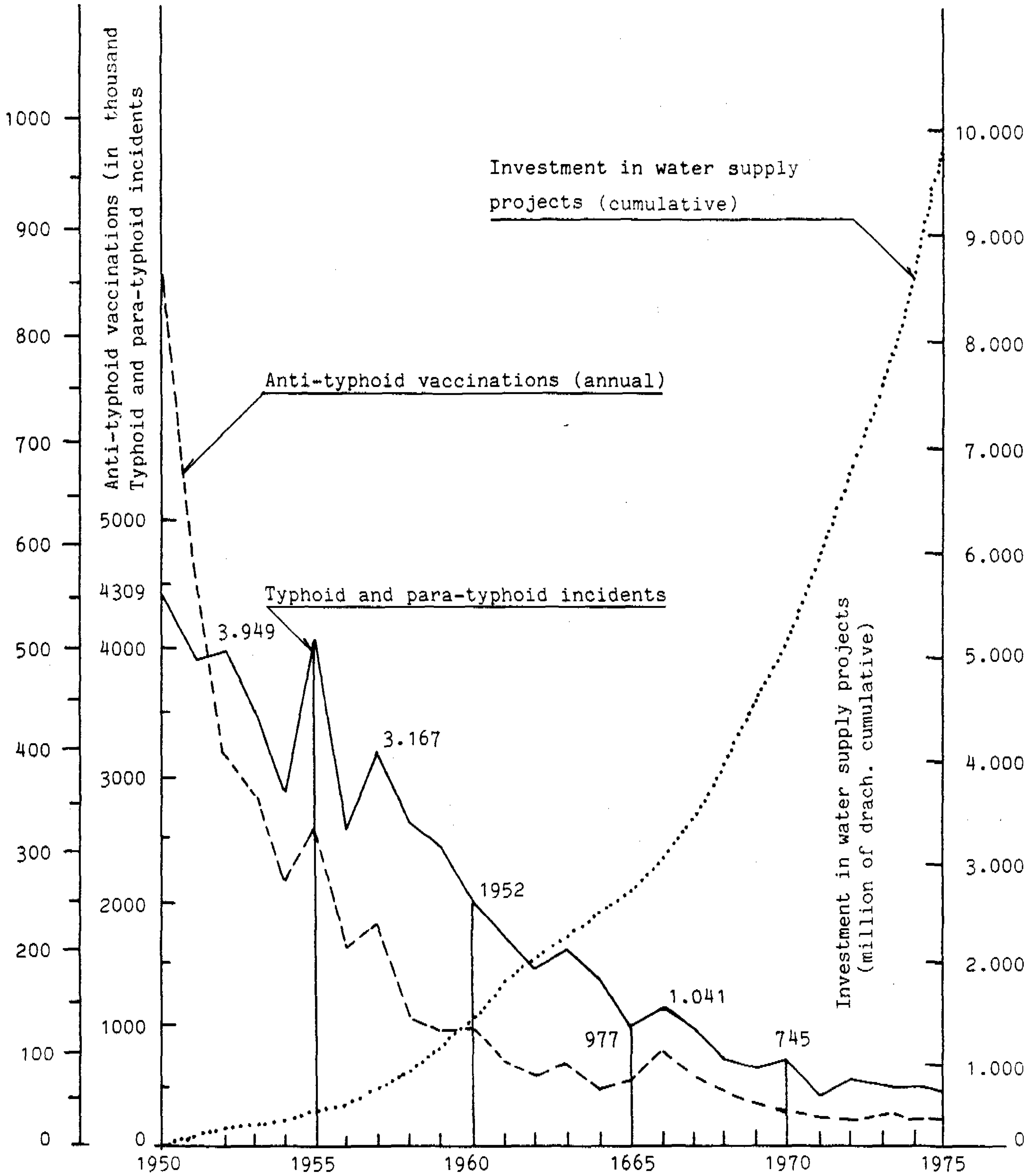
- the enforcement of an appropriate national policy
- the decentralization of the responsibilities towards the prefectures and local authorities
- the incentives given for the construction of collective works, capable of serving more than one settlement
- the reduction of construction costs, through the collective handling of piping supplies by the Ministry of the Interior.

This substantial improvement resulted in a sharp decrease of the rate of waterborne diseases as illustrated in Fig. 1.

Water quality surveillance is carried out by the health services in accordance with the Sanitary Regulations G3a/761 (the Water Law) of 5 March 1968 (IDHL, 27: 572) as amended in 1974, and the Interministerial Decree A5/288 of 23 January 1986, by which articles 4, 5, and 6 of Sanitary Regulation G3a/761 have been replaced. These regulations set the drinking-water standards, the type and the frequency of sampling, and describe the responsibilities of the competent authorities. Concerning undesirable and toxic substances, the standards specify the organoleptic, physiochemical and bacteriological characteristics to be met.

The municipal or communal authorities, or the authorized water enterprises or the water organizations that may exist, are responsible for the study, construction, operation, and maintenance of water supply systems. They are also responsible for carrying out laboratory tests, keeping records and diaries and taking all measures designed to ascertain the sufficiency and wholesomeness of water supplies within their areas.

Fig. 1



Registered incidents of typhoid and para-typhoid fever, anti-typhoid vaccinations and investment in water sypply projects
(Greater Athens area is excluded)
(1950 - 1975)

For isolated houses or installations, such as industries, institutions, etc. that are served by private systems, the owner of the water supply or the director of the installation is responsible for the quality of the water services.

The water authorities should provide the Public Health Services with all the information concerning the above-mentioned responsibilities in order to permit a proper evaluation of the water supply conditions. They are also supposed to report immediately to the health authorities any incident that may jeopardize the safety of water supplies, and the measures taken to control such incident. In this respect, the water authorities are supposed to follow the instructions received from the Public Health Services who will decide on the exploitation of the water sources and the frequency of laboratory tests of the water in accordance with existing conditions.

In case of contamination and danger of transmission of waterborne diseases or any other relevant incident, the public health authorities intervene immediately and implement the measures which are necessary for the protection of the public health.

In practice and given the fact that many Municipalities and Communities do not have specialized staff, the public health services carry out both the sanitary identifications - i.e. the detection of pollution sources through adequate sampling for water quality control - and the sanitary protection of the water supplies. Laboratory analyses are carried out in state laboratories.

A survey concerning the quality of water supply services was carried out in 1982 and classified the quality of water as

- good, where it complies with the requirements of the 761/5.3.68 and A/288/23.1.86 sanitary regulations on "the quality of the drinking water";

- average, when some water quality parameters are exceed but otherwise the water is suitable for human consumption;

- bad, in all other circumstances and when the water is contaminated.

On the basis of the above definitions, the analysis of the results of the survey showed that:

- The localities supplied with water of good quality amounted to 9479 or 81.7% of the total, corresponding to 82.2% of the population. If Athens were included, the respective figure for the population would be 91.6%.

- About 8.0% of the localities (9.3% of the population) are supplied with water of average quality (excluding Athens).

- Finally only 2.0% of the localities and 1.4% of the population are supplied with bad quality water (excluding Athens).

A total of 966 localities (8.3% of the total) did not give any information.

The communal and municipal authorities also have the responsibility for the disinfection of drinking water. This is compulsory for water supplies serving 3000 inhabitants and above. However, depending on local conditions and on appropriate analyses carried out by the health services, disinfection may not be required for water supplies serving up to 15 000 inhabitants, and conversely, in other circumstances it can be imposed for water supplies serving less than 3000 inhabitants. The most common method is chlorination. Disinfection of water is carried out according to the sanitary instructions in force concerning "Water supplies disinfection".

The above-mentioned survey made in 1982 covered 10 780 localities (93.0% of the total) with a population of 6 197 176 (96.9% of the total), excluding the Athens area.

The survey showed that 3811 localities (35.35% of the total) with a population of 3 878 052 (62.75% of the total) use chlorinated water.

In 1370 localities out of the 3811 (35.95%) with a population of 2 529 493 (65.22%) chlorination is continuous whereas for the remaining part, chlorination is intermittent. In 641 localities (16.81%) with a population of 1 396 000 (36.0%) analysis of free available chlorine is made daily. Periodical control of chlorination is carried out in 779 localities (20.44%) representing 945 959 people (24.39%); whereas in the remaining 2391 localities (62.75%) with a population of 1 535 889 (39.51%) analysis of chlorine is never made.

Local health services come under the Ministry of Health and Welfare and are to be found in every Prefecture of the country. Their head is the public health doctor and their staff consists of physicians working in the rural dispensaries, public health inspectors, visiting nurses and administrative employees.

The adaptation of Greek legislation to the European Community Directive related to the quality of water intended for human consumption is now completed.

Water and related legislation

- Law No. 1065 of 1980 approving the Communal Code and defining the responsibilities of local authorities relating to water supply and sewage systems

- Sanitary Regulation A5/2280/13.12.83 concerning protection against pollution of waters used for water supply in the largest area of Athens

- Sanitary Regulation UM/5673 of 1958 concerning disinfection of water supply systems

- Joint Ministerial Decree 46399/1352/3.7.86 concerning surface waters established for production of drinking water

- Sanitary Regulations G3a/761 of 1968, as amended by Sanitary Regulations G4/1722 of 1974 and Ministerial Decree A5/288/23.1.86, concerning the quality of drinking-water

- Sanitary Regulation G1/443/15.1.73 concerning swimming pools, with instructions for their construction and operation

- Sanitary Regulations Elb/221 of 1965 concerning the disposal of sewage and industrial wastes, as amended by Sanitary Regulation Gl/17831/7.12.71 and G4/1305/2.5.74

- Sanitary Regulation Alb/8181/5.2.87 concerning conditions of founding stock-farm installations and disposal of animal wastes

- Law No. 608 of 1948 concerning the administration and the management of waters used for irrigation

- Sanitary Regulation Alb/4841/21.8.79 concerning the quality of bottled water

- Some other laws and presidential decrees concerning reclamation works, irrigation systems, pollution and quality control of waters used in agriculture.

A Water Law is now being elaborated. It provides for the administrative organization of water resources at the central and peripheral levels and the establishment of competent and responsible services. A draft outline law for the protection of the environment is in preparation at the Ministry of Housing, Physical Planning and the Environment.

Greece is signatory to the international Convention for the Prevention of Pollution of the Sea by Oil. Administrative authority lies with the coastguard under the Ministry of Navigation and Transport. Coastal communes discharging sewage into the sea are responsible for the prevention of oil pollution from their sewage. A number of decisions deal with wastewater discharges from cities, industrial complexes, and oil prospecting. These specific decisions are to be harmonized with the EEC directives on control of pollution.

Water research

In Greece, many institutions are engaged in research referring to water and related matters. These include:

1. Government departments, such as the Ministry of Agriculture (by supporting its own laboratories and institutes), the Ministry of Energy and Natural Resources (by supervising the Institute of Geological and Mineral Exploration, and the Public Power Corporation), the Ministry of Public Works, the Ministry of National Defence (through the National Meteorological Service), the Ministry of the Interior and the Ministry of Physical Planning, Housing and the Environment, and the Ministry of Health, Welfare and Social Security (by supporting the Central Laboratory of Public Health).

2. Universities and other educational institutes.

Finance

Regional policy

Rural and regional water supply and sewerage projects are financed by the Regional Programme of Public Investment which was first introduced in 1956 with the creation of the Prefectural Funds.

Regional imbalance has been for many years a matter of concern to the Greek Government because of its social, economic and political implications. A number of policies have therefore been introduced to redirect the trends. These have found expression in various plans, programmes, laws and documents and have offered a succession of detailed, geographically articulated conceptions of what the future population and development pattern of Greece should be.

The major objectives of regional policy over the past 20 years reflect the concern of successive governments to achieve a more balanced national development, of which six may be cited:

- decentralization from Athens of certain economic, social and administrative activities;
- curtailment of internal migration from the less developed areas to the major cities, and particularly to Greater Athens;
- creation of employment opportunities in less developed regions by promoting industrial, tourist and other economic activities;
- increase of incomes in the less favoured regions so as to close the income-per-capita gap between them and Greater Athens;
- improvement of the standard of living in the less developed regions by expanding basic infrastructure and social services;
- improved exploitation of natural resources in the less developed regions to contribute to the maintenance of a high economic growth rate at a national level.

The percentage of public investment that has been steered to local and regional governments through the regional programme has been between 7% and 13% in the years 1968-1980 and it has proved to be insufficient to secure a satisfactory rate of finance for a great number of projects. Therefore, the Government considered it necessary to review the objectives and the policy instruments of the development plans in order to adopt a more realistic approach. Thus, the current policy seeks "the balanced and uniform developments of several regions of the country through a decentralization policy and a demographic stabilization". In other words the policy embodied in the current five-year plan (1983-1987) aims at the reconstruction and development of the economies of all the regions of Greece.

An immediate result of these policies has been the increase of the percentage of regional public investment to 18-20% of the total for the years 1981-82 and to 26% in 1983 and 1984.

<u>Anticipated investments and policy improvements proposed in the five-year plan for the water supply and sewerage sectors</u>

<u>Policy and measures</u>

- Introduction of new legislation on water resources management and quality control.

- Improvement of quality control of drinking water by means of new analytical laboratories and better exploitation of the facilities provided by regional universities.

- Introduction of special policies of subsidies to solve specific problems or for providing assistance to remote areas.

- Revision of Law 1069/80 concerning the creation of Communal Enterprises for Water Supply and Sewerage (DEYA) on the following points:

  - increase of the contribution of public investment to the total cost of the projects for small municipalities;

  - modification and scaling of the duties imposed to water consumers.

Responsible agencies

Operation	Carried out by:
Water resources survey	Ministry of Industry, Energy and Technology
- Drinking water	Ministry of Interior Prefectures Communities and Municipalities
Water Management policy	Ministry of Industry, Energy and Technology
- Irrigation water	Ministry of Agriculture
- Drinking water	Ministry of Interior Local authorities
Drinking water production	Local authorities
- In Athens and Salonika	Ministry of Public Works
Drinking water distribution	Local authorities
Drinking water quality surveillance	Ministry of Health, Welfare and Social Security
Agricultural irrigation	Ministry of Agriculture
Industrial water supply	Ministry of Interior Prefectures Local authorities (except private systems)
Underground water protection	Ministry of Environment, Natural Planning and Public Works
- Irrigation water	Ministry of Agriculture Institute of Geological and Mineral Exploration
Surface water protection monitoring	Ministry of Health, Welfare and Social Security
- Irrigation water	Ministry of Agriculture
Water pollution control	Ministry of Environment, Natural Planning and Public Works Ministry of Health, Welfare and Social Security Ministry of Interior Prefectures Communities and Municipalities
- Irrigation water	Ministry of Agriculture
Water resources storage and allocation	Ministry of Industry, Energy and Technology
- Irrigation water	Ministry of Agriculture
- Drinking water	Ministry of Interior Prefectures

(c) Five-year plan 1983-1987

c. FIVE-YEAR PLAN 1983-87

Budget allocation for water supply and sewerage

New and continuing projects
(million Drs/Prices 1983)

SECTOR	Total Budget 31.12.82	1983		1984		1985		1986		1987		Financing 1983-87		Remaining after 1987
		P.I.	Other	P.I.	Other	P.I.	Other	P.I.	Other	P.I.	Other	P.I.	Other	
Programme of Public Investment (P.I.)														
Water supply	57194	5467	893	6016	1372	5372	1865	5475	2215	4508	1397	26798	7742	22714
Sewerage	103456	5940	3512	9829	4147	15045	5156	13532	4240	12651	3143	56997	20198	26260
Total	160650	11307	4405	15845	5519	20417	7021	19007	6455	17159	4540	83735	27940	48974
Programme of E.Y.D.A.P.														
Water supply	9573	1646		2405		1895		1387		1590		8923		650
Sewerage	20199	2644		5166		4314		3999		3640		19763		436
Total	29772	4290		7571		6209		5386		5230		28686		1086
Grand total million Drs	190	15.6	4.4	23.4	5.5	26.6	7.0	24.3	6.4	22.3	4.5	112	28	50

Service charges

Potable water supply

Water charges are based on the metered amount of water consumed. In some cases they are paid once per year. The charges cover the expenses for the operation and maintenance of water supply systems.

Sewage

Sewage charges are paid by the users of sewage systems

- by payment of a lump sum; or
- by a special charge corresponding to a percentage of the water quantity consumed, usually 40%.

Industrial effluent

Charges are levied in the same way as those for domestic wastes but in many cases by making a special invoice. Charges for industrial or trade effluents discharged into irrigation or land drainage systems are generally calculated by a special technical committee, which takes into account the volume and the nature of the discharge.

Agricultural use

The cost of administration, operation and maintenance of agricultural reclamation works are covered mainly by charges to farmers. Annual expenses are shared among users, according to the type of reclamation work, the method of irrigation, the species of cultivation, etc. The average bill per acre is 300-1500 drachmae per year (1983).

Water resources availability and management

Rainfall

The climate of Greece is of the Mediterranean type, with hot summers and mild winters. Rainfall is characterized by an uneven distribution both in time and place. The long-term average annual rainfall for Greece is 856 mm, with a maximum of 1567 mm in the western and a minimum of 462 mm in the eastern part of the country. The estimated mean annual rain water volume is 112×10^9 m^3. The mean annual runoff is estimated at 63×10^9 m^3 including part of the runoff originating from neighbouring countries, as well as the water originating from natural springs.

Topography

The country is characterized by a high proportion of mountainous and hilly areas - 70% of the country, while 30% are plains and valleys - and a narrow inland area. As a result small hydrological basins and rivers of short lengths are formed, with a high runoff. Of the total area, 40% is used for pastures, 30% for agriculture and 20% for forestry.

The population living in municipalities or communes totally or mostly situated on a plain or on a slightly sloping area of an altitude not exceeding 800 m above sea-level represents 68.92% of the total population. The population living in communes situated at the foot of mountains or divided between a plain and a mountain, but at an altitude not exceeding 800 m for the greatest part of the area, represents 21.41% and, finally, the population living in communes of an altitude of 800 m or more above sea-level represents 9.67% of the total population.

In the country there are many karstic formations, and priority has been given to their investigation by the competent agencies.

Population/water resources

The principal centres of population are located in the area of the central axis of the country's development (Patras, Athens, Thessaloniki, Kavala), and this area is substantially lacking in natural runoff. So the water needs of the country have to be covered through the construction of major and costly works, in order to store water during the season of high rainfall and runoff and to carry it from water rich areas to water deficient ones.

Except Athens and a few other cities which are using surface water for drinking purposes, the water resources used for drinking-water supplies are mainly underground water and natural springs. Therefore, a large-scale exploration of existing underground water resources is being carried out simultaneously with the exploitation of all existing water sources.

Future trends of water resources

To solve the problems of water supply in dry regions and in islands, use is made of up-to-date technological developments such as the treatment of saline water (desalinization), transport of water by means of underwater pipelines or pipes supported by floating media, use of artificial reservoirs, etc. Comprehensive coverage is obtained through collective works. An evaluation of the water potential to meet the ever-increasing water requirements of the population is being made in order to adopt a national water policy permitting the rational utilization of existing resources.

General statistics

Population

Percentage of the total population in urban[a] areas	58.1%
Percentage of the total population in semi-urban[b] areas	11.6%
Percentage of the total population in rural[c] areas	30.3%

Drinking water supply

Total piped supply for drinking purposes	NA[d]
Total population served by a piped public water supply	86.0%
Urban population served by a house connection	91.0%
Urban population without house connections but with reasonable access to public standposts	9.0%
Rural population served by piped public water supply at home	73.0%
Rural population served by private systems at home or having reasonable access to public standposts	27.0%

Drinking water supply uses

Water supplied for domestic and commercial use	NA
Water supplied for industrial use	NA
Other uses	NA

Industrial water supply: direct abstractions[e]

Total supplied from inland waters for industrial use, except electric power production (1980)	90 000 Ml/y[f]
Electric power production (1980)	65 000 Ml/y
Used for industrial cooling water	NA
Usage as industrial process water	NA
Total coastal water used	NA

[a] Population of those communes in which the largest population centre has 10 000 or more inhabitants.

[b] Population between 2 000 and 10 000 inhabitants.

[c] Population under 2 000 inhabitants.

[d] NA = Not available

[e] The data given for water consumption in the industrial sector are indicative since, due to lack of adequate statistical information, they are based on a theoretical assessment.

[f] Ml/year = million litres/year

Agricultural use: direct abstractions[a]

Total amount abstracted for irrigation and other agricultural uses including fish ponds	5 745 000 Ml/y

Wastewater disposal services

(a)	% of urban population served by a sewerage network	60.0%
(b)	% of urban population served by other adequate means	40.0%
(c)	% of urban population lacking adequate disposal means	0.0%
(d)	% of rural population served by a sewerage network	NA*
(e)	% of rural population served by other adequate means	NA*
(f)	% of rural population lacking adequate disposal means	NA

Sewage treatment

(g)	% of sewerage systems receiving primary treatment only	NA
(h)	% of sewerage systems receiving secondary treatment	NA
(i)	% of sewerage systems receiving tertiary treatment	NA
(j)	% of sewage receiving no treatment (raw discharge)	81.7%

Discharge of treated sewage

(k)	% discharged into the sea	95.0%
(l)	% discharged into surface water bodies	5.0%
(m)	% discharged onto farmland	0.0%

Discharge of untreated sewage

(n)	% discharged into the sea	60.0%
(o)	% discharged into surface water bodies	40.0%
(p)	% discharged onto farmland	0.0%

Sludge disposal

(q)	% of sludge disposed into the sea	0.0%
(r)	% of sludge disposed into surface water bodies	0.0%
(s)	% of sludge disposed onto farmland	15.0%
(t)	% of sludge disposed as landfill	85.0%
(u)	% of sludge incinerated	0.0%

* Note from the editor

It is estimated that if 73% of the rural population disposes of a water supply system at home (public or private), they would most likely also have a water closet connected either to a sewage network, to a septic tank or to another adequate wastewater disposal system. Figures were not available.

[a] Agricultural use includes irrigation, fish farming, animal watering, agricultural industries, etc.

Useful addresses

Governmental

Ministry of Health, Welfare and Social Security,
Directorate of Environmental and Sanitary Protection
17 Aristotelous St.
GR-10187 Athens

Tel: 524 9011
Telex: 216173

Ministry of Interior
Technical Service of Communities and Municipalities
27 Stadiou St.
GR-10183 Athens

Tel: 01/3226507

Ministry of Industry, Energy and Technology
Directorate of Water Potential and Natural Resources
1 Zalokosta St.
Athens

Tel: 01/3615111

Ministry of Environment, Natural Planning and Public Works
Directorate of Environmental Protection
17 Amaliados St.
GR-11523 Athens

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Directorate of Programming and Economo-agricultural
Studies of Reclamation Works
Division of Development and Protection of
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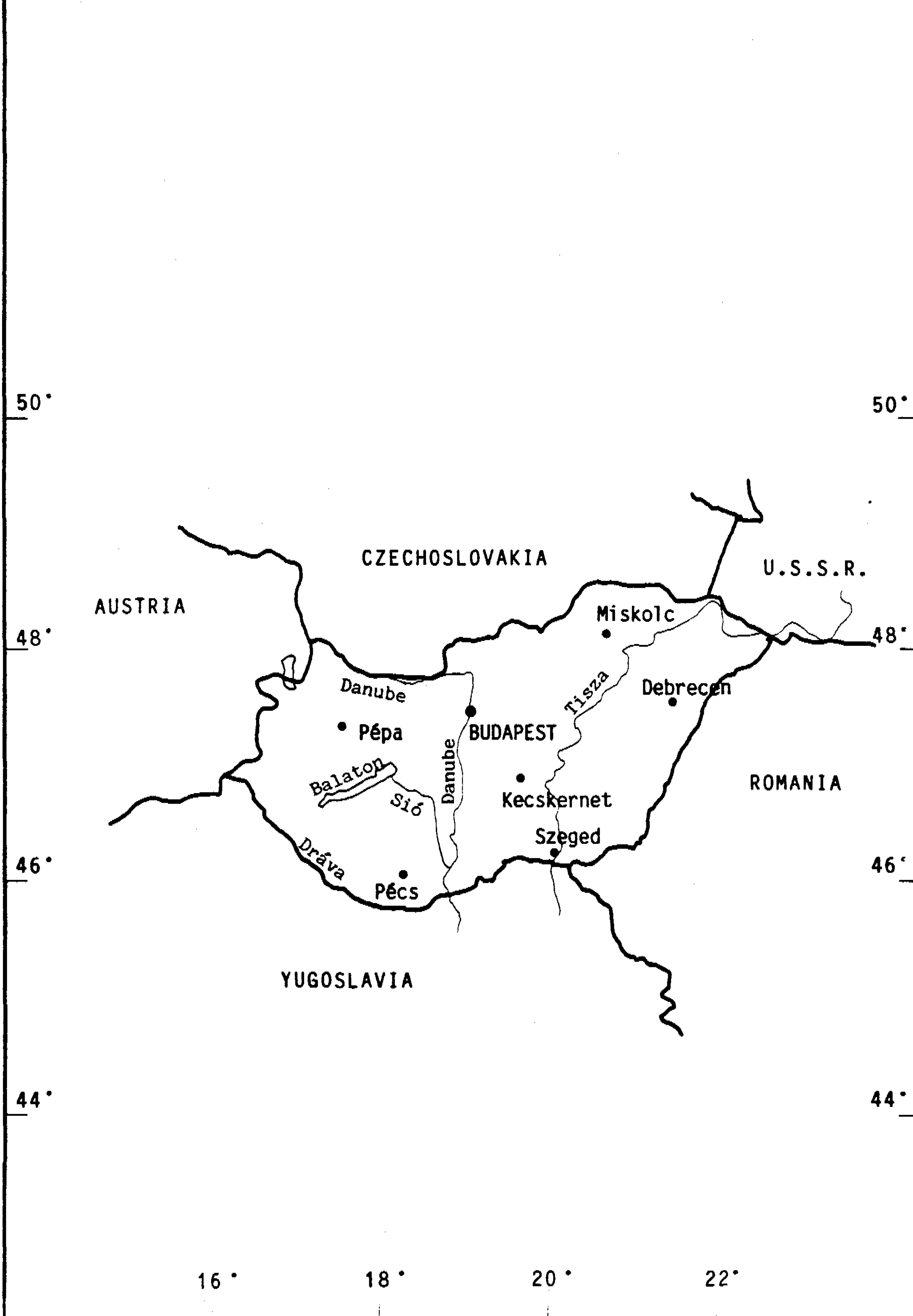
HUNGARY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HUNGARY

The Hungarian People's Republic has an area of 93 033 km^2 and in 1985 it had 10 657 000 inhabitants, giving a population density of 115 persons per km^2. The Republic is bordered on the north by Czechoslovakia, in the east by the USSR and Romania, in the south by Yugoslavia and in the west by Austria.

Just over half the population (56.4% in 1985) lives in towns and the rest (43.6%) in rural settlements. The capital, Budapest, has over 2 million inhabitants (2 071 500 in 1985) and there are five other towns with populations of over 100 000.

Government

Under the 1949 Constitution supreme power is vested in Parliament. The Parliament elects from among its members the Presidium as its permanent legislative body and the executive organ of the State, but the Presidium is responsible to Parliament. The Chairman of the Presidium is Head of State. The Council of Ministers is the supreme administrative body of the State. It is appointed by Parliament on the recommendation of the Presidium. For administrative purposes the country is divided into the capital, Budapest, and 19 counties. There are 108 towns, 149 large villages, and 2184 villages of commune status. All levels of administrative units have councils elected on the same principles as the parliament. The councils draw up their own economic plans and budgets, direct and supervise their enforcement, promote production and levy taxes for local development.

Administrative organization of water services

The organization with responsibility for water services throughout the country is the National Water Authority (NWA), which comes under the direct control of the Council of Ministries. Under the direction and supervision of the NWA, there are twelve district water authorities (DWA), each of which is responsible for water management within its region. Their role is to promote and ensure the effective execution of the national water policy within their own territories. Each water authority region comprises more than one water catchment area.

Water supply is carried out partly by regional water supply works and partly by water works under the supervision of local councils. Regional water supply works are under the direct control of the NWA and are responsible for sewerage as well as water supply within their regions.

The water works under the control of the local councils also operate waste water treatment plants and sewerage systems as well as one or more local water supply systems.

The NWA is composed of seven departments of which three, viz.:

- Water Management
- Flood and Watershed Control
- Water Supply and Sewage

deal with technical and engineering aspects of water management.

Each department of the NWA is subdivided into sections for the various tasks it has to carry out on a national basis. The district water authorities are organized similarly to the NWA and perform the same role on a regional basis.

Regarding flood control, as the downstream courses of rivers flow in plains with low slopes, the channels for the mean-waters are regulated by cutting the overdeveloped curves, and dikes are built along both sides of the channel which are stabilized in this way.

The extent of low-lying areas protected against floods is approximately 21 200 km^2. This area is protected by levees (dikes) whose total length amounts to some 4200 km, out of which 99% consists of earth dikes.

At present in Hungary, the structures of flood control are built to resist floods occurring on an average once every 100 years. This work is in progress and by the end of 1985, 63% of the total 4200 km of dikes was strengthened to the required size. The remaining 37% is able to resist floods occurring on an average once every 60 to 80 years. The strengthening of dikes is expected to be completed by the year 2010.

The drainage of excess water from flat areas, in general from areas behind dikes, can also be ranked among the tasks of coping with natural hazards. To this effect, building of canals, main canals and pumping stations had been started more or less simultaneously with the construction of flood control works.

There are several organizations with special roles under the control and supervision of the NWA, such as research (Research Centre for Water Resources Development (VITUKI)), planning (Consulting Co. for Water Engineering (VIZITERV)), decision-making (Institute for Water Resources (VGI)), flood control (Central Organization for Flood and Runoffs Control (ABKSZ)), construction (Hydraulic Construction Company (VIZEP)) and a number of other institutions with specific or regional tasks.

In order to ensure overall coordination of water management interests, the NWA has rights of supervision over the water-related activities of other organizations in addition to those under its direct control, e.g. the water works controlled by local councils.

The NWA acts in close cooperation with several governmental organizations, first of all the following:

The National Authority for Environmental Protection and Nature Conservation is responsible for overall coordination of environmental protection and acts as a primary authority in special fields, such as air pollution, hazardous wastes, and nature conservation, subjects which in general and occasionally are also related to water quality control.

The Ministry of Agriculture and Food also monitors surface water and sediments for pesticide residues. The Ministry of Transport is responsible for inland navigation and has issued Ordinance No. 8 of 15 May 1979 prohibiting discharges from vessels that could hinder navigation as well as any discharges of oil.

Cooperation with the Ministry of Public Health is of primary interest due to the hygienic safety of water supply and natural water bodies rendered for recreation.

<u>The role of the health department with regard to water quality</u>

The water supply organizations are responsible for the quality of the water supply, but this is subject to supervision by the Public Health Service. Until recently, the Public Health Service was the major monitoring agency, but now nearly all water works have a chemical laboratory. At treatment plants dealing with surface water, the laboratory provides a continuous service; if the source is underground water then the quality is monitored periodically.

The public health laboratories are designated "authority-laboratories". Using the data obtained by the public health laboratories, the public health inspector has the authority to grant permission to start or stop the operation of treatment works, distribution systems, etc.

There are 20 public health laboratories in all, organized in accordance with the county administrations. They collect samples from water supply systems and carry out chemical, microbiological (mainly bacteriological) examinations and toxicity tests. Sampling frequencies are:

- small treatment works (villages), 4 times a year
- medium treatment works (towns), once a month
- large treatment works, twice or more a month depending on the number of consumers.

The total number of samples examined by the public health laboratories is approximately 125 000 per year.

If the results of analyses by the public health laboratories or local inspection by the Public Health Service show some deficiency in water quality, the water works will be notified by the public health inspector and instructed to take appropriate measures. If there is a need for technical measures to be taken, the public health and water authorities will act together.

The public health inspector has the power to impose penalties on water works personnel if necessary, but in most cases appropriate measures are readily taken and there is no need for legal proceedings.

The drinking-water criteria constitute the national standards for water quality. The criteria specify the maximum permissible concentrations for 40 physical and chemical, 10 bacteriological and 2 biological parameters. The General Inspector for Public Health (within the framework of the Ministry of Health) can give permission to deviate from these criteria and to set limits for other parameters.

The Public Health Service deals with all aspects of water pollution that might influence human health, either directly or indirectly, in order to prevent waterborne diseases and other health hazards. This includes monitoring the quality of surface waters as raw water sources of drinking-water supply, for irrigation or recreation, water quality in public swimming pools, wastewater treatment and effluents with special regard to disinfection.

Health problems appear at two poles in Hungary's water sector: one is the nitrification of groundwater resources and the other is the assurance of good bacteriological quality in natural waters.

Nitrification problems appear especially at small settlements where the households have individual water supply facilities.

The assurance of good quality in natural waters in the sense of bacteriology is of great importance especially in regions affected by the interests of recreational and touristic activities, of internal or external origin. For large lakes, Programmes of Water Management Development were and are being prepared (Balaton, Velence). These programmes aim either at a possible displacement of sewage outside the basin after high-grade treatment, or, to a limited extent, at such treatment technology through which the treated sewage can be purified to a suitable quality also in the sense of bacteriology (10 coliform/ml).

Within the domain of pollution control, there has been an ever increasing role of micropollutants: heavy metals, herbicide residues, carcinogenic polycyclic and heterocyclic compounds. For their systematic and efficient analysis, the establishment of two regional laboratories is under way. In addition to these, the creation of a top laboratory is also envisaged where, in addition to the biological routine analyses, systematic bacteriological analyses could be carried out.

The preventive work of the Public Health Service includes participation in the development of guidelines for water and sewage treatment, the design of regional water supply schemes and the drawing up of measures for water and environmental protection. Most of these activities are carried out in close cooperation with the water authorities.

Water and related legislation

Water management legislation in Hungary consists of an integrated set of technical, economic and administrative measures. Legislation is based on the Water Law, which has a relatively long history. The hydrological conditions in Hungary made it necessary for water management legislation to be introduced at an early stage in the country's development. However, the first effective and modern Water Law was not passed until 1964 and, after a series of amendments, reached its present form in 1968. It provides a framework that sets down only the main regulations, prohibitions and obligations and delineates the community's interests in water affairs; nevertheless it contains all the regulations necessary for water management schemes. Implementation of the various interrelated tasks involved in water management is provided for by several executive orders.

The NWA in Regulation No. 3 of 7 February 1984 revised previous ordinances regarding fines for the pollution of water and set six categories of areas assigned for special pollution control.

The most stringent standards (Category I) apply only to the Lake Balaton area; Category II to drinking-water resources and recreation areas; Category III to water resources in industrial areas; Category IV to water used for irrigation; Category V to sections of the River Danube and the River Tisza not specified in the previous categories; and Category VI to other watersheds. For each category, effluent standards of concentration are listed for 32 polluting matters and indices. For each polluting matter, a rate for assessing fines per kilogram of pollutant discharged above the listed concentration is specified.

Ordinance No. 28 of 26 May 1976 of the Council of Ministers and Order No. 2 of 13 December 1970 of the NWA require that only refined sewage may be discharged into surface water and sewage conduits. The degree of efficiency of refinement is also specified. Producers discharging sewage inadequate to these limits will be fined.

Pollution control and water quality protection is becoming increasingly important in Hungary and, in order to reinforce and encourage compliance with the legal requirements, the first scheme for economic incentives was drawn up in 1961 which was modified and amended several times according to the experiences gained. These include financial grants, obligatory investments, and fines for effluents. There are over 50 regulations dealing with different aspects of water pollution control; some of them are concerned solely with a specific aspect of environmental protection.

Under the Water Law, permission must be obtained for all water-related activities. The licenses for these activities are granted by the district water authorities, who specify the conditions relating to various water uses.

Water research

The Scientific Research Centre for Water Resources Development (VITUKI) was established in 1952 to meet the research needs of the NWA and other water-related organizations, and also to serve industrial, agricultural and communal water users. It is the successor to the Hungarian Hydrographic Service, which was established in 1885.

VITUKI carries out basic research in the fields of science related to water management, hydrology, hydrometeorology, hydromechanics, hydraulics, water chemistry, hydrobiology, hydraulic engineering and water pollution control.

It is also concerned with the development and practical application of new technologies for water management, flood control, river regulation, land drainage, agricultural water management, water supply and wastewater treatment.

As a central research organ, VITUKI also coordinates some applied research activities performed in other organizations under the supervision of NWA.

These functions are performed in four institutes of VITUKI:

- Institute of Hydrology
- Institute of Hydraulics
- Institute for Water Pollution Control and
- Institute for Technical Development.

In addition to VITUKI, a number of other organizations are engaged in research into water or related matters, such as departments of technical universities and research institutes of several industrial concerns.

One of these organizations is the National Institute of Hygiene (OKI). Its research programme includes projects on the detection and determination of health-related water pollutants, the effectiveness of water and effluent treatment methods and the health effects of pollutants. These projects are undertaken in cooperation with the Public Health Service, VITUKI, the water supply organizations and the design institutes.

Finance

Revenue income

To fulfil the general tasks of water management, the NWA is allocated a part of the national budget to finance the non-profit activities of organizations under its control. Water supply works derive their revenue partly from charges to consumers. Some charges are based on the principle of recovering part of the costs incurred in managing the water system, others as compensation for any detriment caused to the system. Abstraction from public water resources is chargeable, as an incentive to rational use of water. Fines, for the discharge of wastes into surface or subsurface waters, and also for industrial effluents discharged into sewers are also part of an economic incentive system.

Water charges

Potable water supply

Water charges (for public supplies) are generally based on metered or estimated volumes for industrial users and domestic consumers. The charges vary regionally according to the costs of abstraction, treatment and supply.

Sewage charges

Sewage charges (for the use of the sewerage system) are generally based on the metered or estimated amount of water supplied to the consumers.

Objectives for the development of sewage and wastewater treatment have been formulated but, due to their greater demand for capital, the result is more modest than required. Between 1975 and 1985, the possibility of making connections to public sewers was ensured for 1.2 million inhabitants, thus increasing the saturation ratio from 35% to 46%, and this progress was made in cities and in connection with a housing programme. As a result of the progress made during this period, the capacity of sewage treatment plants rose to some 1.2 million m^3/d, a figure which is somewhat more than half of the total quantity of municipal sewage discharged into public sewers.

According to the development plans, by the turn of the millenium the total amount of sewage discharged into public sewers (3.4 million m^3/d) should be treated and this requires an increment of 2.2 million m^3/d within 15 years. Of this, a quantity of 400 000 m^3/d has been included in the plan covering the period 1986/90.

Charge for the use of water resources

The charges for public water supply and sewage are flat rates (Ft/m^3), differentiating the levels according to the type of user: there are charges applied to the population (consumers) and there are those applied to the producers (plants, enterprises, public agencies).

In the determination and practical use of charges, the intention is that the productive sectors should at least cover the direct expenses and that the charges imposed on the population should gradually approach a level which is proportionate to the real value.

In the last ten years, the charges to be paid by producers have been raised in several instances in order to adhere to the pre-established objectives. For each region, the charges are divided into categories which are approximately proportionate to the prime cost while the differences between the specific individual expenses are smoothed through a balancing budget.

The difference between the consumer's charges - which are kept low due to the country's living standard policy (also in different categories) - and the charges levied on producers is subsidized by the State.

The purpose of creating categories by area is to take into account the existing natural and technical conditions, taking into consideration at the same time the principle of social equity.

Wastewater fines

Any workshops, industrial units, plants, firms, farms or other industrial, commercial, agricultural or servicing enterprises and establishments, or public institutions that cause harmful pollution or contamination of the waters can be subjected to wastewater fines.

The "polluter pays" principle has been fully effective since 1969; the technical basis of fines to be paid is the quantity of pollutants emitted that exceeds certain limit values, quantified by the laboratories operating at the district water authorities, as the product of effluent volumes prescribed in legal provisions. The imposing of fines on factories polluting surface waters through public sewers or endangering the sewerage system or the treatment plant has been the responsibility of country councils since 1971. The fines are based on measurements made by the sewage analysing laboratories of waterworks and sewerage enterprises operating the sewer system.

The fines are put in a central fund (Water Fund). From this Fund, a portion which is a multiple of the sum received in the form of fines, is allocated by the NWA to the solving of important pollution control problems, partly in the form of subsidies to the water protection activity of the factories charged.

Water resource availability and management

Rainfall

The climate of north-western Hungary conforms to the Atlantic continental zone, whereas in the south-east it is a part of the European continental climatic system. In the southern part of Transdanubia, some Mediterranean influence can be observed, whereas its north-eastern part has a continental character, especially in winter. The climate is governed by Atlantic, continental and Mediterranean effects. The average annual precipitation is 620 mm, fluctuating in extreme cases within a range of between 400 and 800 mm. Part of the precipitation falls in winter, often as snow. The annual mean temperature is 9.36°C, while the range of mean absolute fluctuation is between -2.8°C in January and 20.1°C in July. The total annual sunshine hours range between 1700 and 2100 hours.

Topography

The country belongs to the River Danube basin. Two thirds of the territory is made up of plains and nearly one third of hilly regions. Mountains can be found only in 3% of the country, with highest elevation being 1015 m above sea level.

The territory of Hungary is underlain by an ancient shield composed of crystalline shales and granite. This shield is fractured, weathered and eroded, with its greater part buried at great depth. At some locations, the bedrock is near the surface and is divided by several deep faults bearing SW-NE. The Mesozoic limestone and dolomite rocks of marine origin are buried under loose sediments and yield abundant karstic water, whereas the interbedded Palezoic crystalline shales contain little water. The main regional units are the Great Plain, the Small Plain Region, Transdanubia and the Northern Perimeter Range.

Flood waves arriving from steep-sloping foreign sub-catchments endanger an area of some 2.1 million hectares in the low-lying Hungarian Plains. This area is protected against floods by levees of a length of approximately 4200 km. During high-water periods, any excess of rainwater accumulated behind the dikes can be pumped into the rivers by means of pumping plants with a total capacity of 840 m^3/sec.

Population/water resources

The majority of the population live in the Capital and around industrial and agricultural areas. These consist mainly of cities with over 100 000 inhabitants and smaller towns of rural character. The main sources of water supply for drinking purposes are underground water and bank-filtered water along the gravel terraces of the Danube and deep aquifers, whereas individual wells make decreasing use of shallow aquifers. The potentially withdrawable groundwater amounts to 14.5 million m^3/day. The proportion of public water supply relying on surface water is small but is increasing slightly.

According to the Constitution of the Hungarian People's Republic, the water resources represent public property. The amount of precipitation falling on the territory of the country in a normal year is 58.10^9 m^3, a large part thereof (54.10^9 m^3) being lost through evaporation and infiltration. Surface runoff is thus 4.10^9 m^3 only. The surface water resources during Hungary in the critical month of August amount to around 1100 m^3/s, after abstractions in the countries sharing the common catchment.

The water resources situation is unfavourable by European standards, and is made especially difficult by the fact that no more than four per cent of the surface water resources originate in the territory of the country, with 96%

arriving from abroad. The growing demand for water thus calls for an increase in water supplies, mainly through construction of reservoirs. About 300 major dams store 600.10^6 m^3 water. The subsurface water resources intended mainly for drinking water supply have been estimated at 180 m^3/s.

Future trends of water resources

The main source of public water supply is underground water with an increasing use of bank-filtered resources. Because of its qualitative aspects, the water supply based on shallow aquifers will cease by the end of the century and there will be a slightly higher proportion derived from surface sources. Industrial water supplies will mainly be derived/abstracted from surface water sources except where there is a need for drinking water. Groundwater resources are classified in five different categories: "phreatic waters" (called groundwater in Hungary), bank-filtered water, confined (artesian) water, karstic water and thermal water.

In 1984, a new Master Plan of Water Management was prepared. In the Master Plan consideration is given to the economic and political demand for increased efficiency and to the fact that in water management, efficiency can be increased primarily by the rational meeting of water requirements and by the economical management of water resources. The Master Plan defines the options of attaining a higher level of water damage prevention, and outlines complex solutions to the utilization and protection of water resources.

Large-scale water projects are multipurpose structures serving the essential needs of the population, industry, agriculture, navigation and environmental improvement, by maintaining a balance between water resources and water needs and by managing harmful and excess waters. Accordingly, in the preparatory work of large-scale water projects the interests of the economic sectors are taken into account already when the conception is formulated, and the due proportions of the different interests are also indicated in the cost estimations.

The large-scale water projects aimed at realizing the goals of water management as defined by the intention of meeting the social and economic needs. Their secondary facilities (hydropower development, navigation, etc.) also contribute to the development of other economic sectors and at the same time permit the improvement of the natural and artificial environment of man. The improvement of the aquatic environment and of the conditions needed for improved water-related recreation and sports activities appears in perspective as an increasing social and socio-political demand.

The major objectives in connection with future large-scale water projects are:

- multipurpose utilization of the Danube;

- development of water management in the Tisza Valley;

- creating a connection between the watercourse systems of the River Danube and of the River Tisza; and

- starting the multipurpose utilization of the River Dráva.

General statistics

Population

Population in urban areas	56.4%
Population in rural areas	43.6%

Drinking-water supply

Total piped supply for drinking purposes	485.9 Mm^3/y[a]
Total population served by a piped public water supply	84.0%
Urban population served by piped water supply	91.5%
Urban population served by public and private wells	8.5%
Rural population served by piped water supply	74.3%
Rural population served by public and private wells	25.7%

Total water use — 5921.5 Mm^3/y

Water supplied for domestic and commercial use	833.0 Mm^3/y
Water supplied for industrial use	4351.2 Mm^3/y
Other uses	753.5 Mm^3/y

Industrial water supply: direct abstractions

Total supplied from inland waters for industrial use	4351.2 Mm^3/y
Used for industrial cooling water	80.0%
Usage as industrial process water	20.0%
Total coastal water used	None

Agricultural use: direct abstrations

Total amount abstracted for irrigation	753.8 Mm^3/y
Other agricultural uses including fish ponds	46.2 Mm^3/y

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[a] Mm^3/y = Million m^3 per year

Wastewater disposal services

Total wastewater produced	6125 $M/m^3/y$
Total industrial wastewater produced	2972 $M/m^3/y$
Total agriculture (and others) wastewater produced	757 $M/m^3/y$
Total municipal (urban) wastewater	2396 $M/m^3/y$

(a)	% of urban population served by a sewerage network	75.0%
(b)	% of urban population served by other adequate means	24.9%
(c)	% of urban population lacking adequate disposal means	0.1%
(d)	% of rural population served by a sewerage network	4.0%
(e)	% of rural population served by other adequate means	85.0%
(f)	% of rural population lacking adequate disposal means	11.0%

Sewage treatment
(Total number of systems: 288. Serving 46% of the total population)

(g)	% of sewerage systems receiving primary treatment only (28)	10.0%
(h)	% of sewerage systems receiving secondary treatment (236)	82.0%
(i)	% of sewerage systems receiving tertiary treatment (12)	4.0%
(j)	% of sewerage systems receiving no treatment (12)	4.0%

Discharge of treated sewage

(k)	% discharged into the sea	0.0%
(l)	% discharged into surface water bodies	99.0%
(m)	% discharged onto farmland	1.0%

Discharge of untreated sewage

(n)	% discharged into the sea	0.0%
(o)	% discharged into surface water bodies	99.0%
(p)	% discharged onto farmland	1.0%

Sludge disposal

(q)	% of sludge disposed into the sea	0.0%
(r)	% of sludge disposed into surface water bodies	0.9%
(s)	% of sludge disposed onto farmland	27.0%
(t)	% of sludge disposed as landfill	72.0%
(u)	% of sludge incinerated	0.1%

Useful addresses

Governmental

National Water Authority
POB 351
1394 Budapest

Water Industry

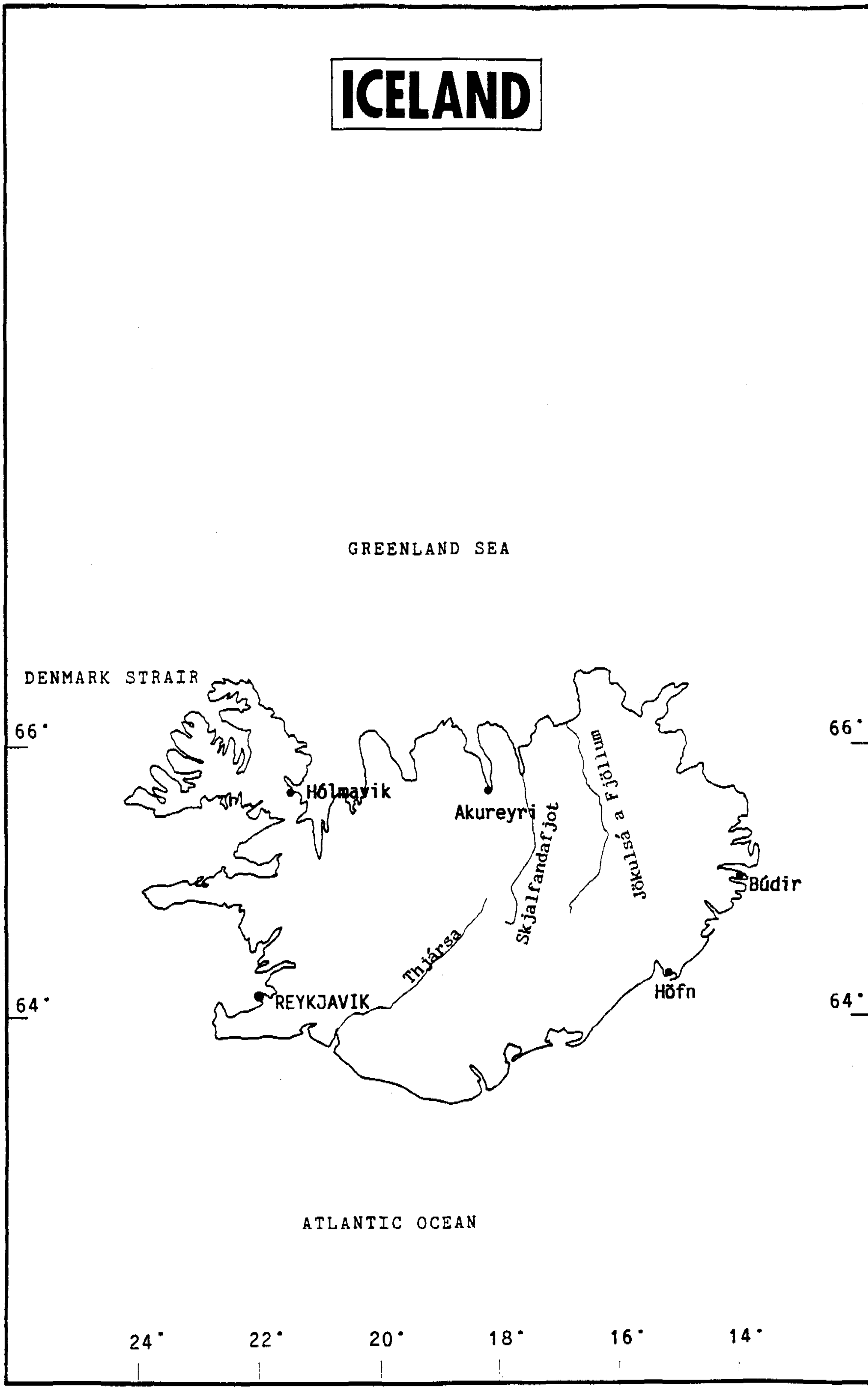
National Water Authority
POB 351
1361 Budapest

Research

Scientific Research Centre for Water Resources Development (VITUKI)
POB 27
1453 Budapest

Engineering

Consulting Co. for Water Engineering (VIZITERV)
POB 527
1397 Budapest


ICELAND
GREENLAND SEA
DENMARK STRAIR
66°
66°
Hólmavik
Akureyri
Skjalfandafjot
Jökulsá a Fjöllum
Búdir
Thjársa
REYKJAVIK
Höfn
64°
64°
ATLANTIC OCEAN
24°
22°
20°
18°
16°
14°

ICELAND

The Republic of Iceland consists of one large island and numerous smaller islands in the North Atlantic lying just below the Arctic Circle, with an area of 103 000 km^2. The main island is 250 km south-east of Greenland, 800 km north-west of Scotland and 1000 km west of Norway.

The population of 242 000 (1985) is concentrated around the coast and there are no inhabitants in the centre of the country. About half of the population lives in the capital city, Reykjavik, and its five suburbs, about 60 000 live in larger towns, another 30 000 in hamlets, with about 25 000 living in rural habitation on approximately 5000 farms. There are 2.35 inhabitants per km^2.

Government

Executive power is vested in the President, who is elected by universal adult suffrage for a term of four years, and the Cabinet, consisting of the Prime Minister and other ministers appointed by the President. In practice, in accordance with the Constitution, the President performs nominal functions only; executive power is effectively held by the Cabinet. Legislative power rests jointly with the President and Parliament (Althingi). The Althingi chooses 21 of its members to form the Upper House and the other 42 the Lower House.

For local government purposes under the Municipal Act (Sveitarstjornarlög No. 58 of 29 March 1961) the State is divided into 202 municipalities, 22 communes (hreppir) and a number of towns (kaupstadir).

Administrative organization of water services and water and related legislation

The basic water law is Law No. 15 of 20 June 1923 on water and water resources (Vatnalög), which prohibits the deposit of anything that can contaminate lakes and streams or become a risk to humans or animals. Fish are given special protection by a number of regulations because the sale of fishing rights is an important tourist industry. Private fishing gear, for example, must be sterilized when brought into the country. The law covers water and sanitation services.

According to the Municipal Law, No. 58 of 29 March 1961 (Sveitarstjornarlög) responsibility for the supply of water and sanitation services lies with the local authorities. The Law stipulates that having set up water services in a particular area the local authority has a monopoly. It also allows for free associations to obtain piped water, which is increasingly being used in rural area, with technical advice and assistance being provided by the Agricultural Society of Iceland.

Under Law No. 93 of 5 June 1947 on assistance to municipal waterworks (Lög um aostoo til vatnsveitna), provision is made for the Minister to grant financial assistance from the State Budget to local authorities to cover up to half of the cost of boring for water, providing water-towers (tanks, reservoirs), pumps and water mains. This assistance can be given only if a reasonable water tax will not cover investment and running costs. Under this Law the State can also assist local authorities in obtaining loans and buying waterworks from the free associations referred to.

The Law on energy (No. 58 of 29 April 1967), as revised by Law No. 82 of 1972 (Orkulög), defines among the roles of the National Energy Authority the carrying out of geophysical surveys, with the aim to search for water.

The requirements for wholesome water are laid down in Health Regulations No. 45 of 1972 (Heilbrigoisreglugero), chapter III relating to waterworks, reservoirs and wells.

Law No. 50 of 29 May 1981 on sanitary measures and control, which became effective on 1 August 1982, covers *inter alia* water supplies, reservoirs and discharges.

Role of the health department with regard to water quality

Local boards of health (heilbrigoisnefnd) are responsible for public health inspection. The National Centre for Hygiene, Food Control and Environmental Protection, under the Ministry of Health and Social Security, supervises all measures taken to maintain drinking-water quality. For this purpose the laboratory division tests all water samples sent by the public health inspectors at no cost to the local health boards.

Water research

The National Energy Authority is responsible for the surveying of all energy resources in the country including cold groundwater and thermal water. The role of the local health boards and the National Centre has been mentioned above. To this is to be added the work of the Icelandic Agricultural Society, which has been instrumental in providing better water quality in agriculture.

The Nature Conservation Council and the National Centre for Hygiene, Food Control and Environmental Protection have collaborated in surveying the water quality on the Central Highlands.

Finance

Revenue income

The local authorities derive their finance from charges to households and to businesses and industries.

Water charges

Potable water supply

Water charges are decided by each local authority and ratified by the Minister of Social Affairs. These are based on metered volumes and on rateable values of properties, the latter being the general rule for households.

Sewage

Sewage charges are based on rateable property values.

Industrial effluent

Charges are calculated in the same way as for sewage.

Responsible agencies

Operation	Carried out by
Water resources survey	National Energy Institute (Orkustofnun)
Water management policy	Ministry of Social Affairs and Ministry of Industry
Drinking-water production	Local authorities in each community
Drinking-water distribution	Local authorities in each community
Drinking-water quality surveillance	National Centre for Hygiene, Food Control and Environmental Protection
Agricultural irrigation	Agricultural Society of Iceland
Industrial water supply	National Energy Authority
Underground water protection	Local Board of Health and their Public Health Inspectorates National Centre for Hygiene, Food Control and Environmental Protection Nature Conservation Council
Surface water protection monitoring	Local boards of health and their public health inspectorates National Centre for Hygiene, Food Control and Environmental Protection
Water pollution control	Local boards of health and their public health inspectorates National Centre for Hygiene, Food Control and Environmental Protection Nature Conservation Council
Water resources storage and allocation	Local boards of health

Water resource availability and management

Reference is made to:

Hjartarson A., Andersen L.J., Kelstrup N., Rasmussen J., Struckmeyer: Explanatory notes for the international hydrogeological map of Europe Scale 1:1 500 000, Sheet B 2, Island. Hanover, Bundesanstalt für Geowissenschaften und Rohstoffe, and Paris, UNESCO, 1980.

Rainfall

Iceland lies in the path of maritime depressions coming in from the south. The most common wind direction is south-easterly and southerly, these also being the directions of most precipitation. In the south-east and the east there is high precipitation (above 1400 mm/year nearly everywhere on the lowland) with two distinct areas of observed maximum precipitation, one south of the glacier Vatnajökull and south of the glacier Myrdalsjökull with annual measured precipitation 2000-3000 mm/year. In the north and north-east the precipitation is much lower, between 400-600 mm/year. The highlands drain much of the precipitation from the southern winds, and the northerly winds which predominate here carry much less precipitation due to the lower temperature of the air. The highland north of Vatnajökull is the driest part of the country with precipitation below 400 mm/year. This is the effect of the glacier which causes a precipitation shadow. Usually the precipitation is highest in October and lowest in May. In South Iceland one can expect 200 days of precipitation annually, compared to 140 in the North.

Average runoff per km^2 in Iceland is among the highest in Europe, because of high precipitation and low evapotranspiration. The highest average runoff per km^2 is in the southern flanks of the glaciers Vatnajökull and Myrdalsjökull (about 140 l/s per km^2) but it is much lower in the north (about 25-30 l/s per km^2). Mean average runoff for the whole country is about 55 l/s per km^2.

The proportion of precipitation falling as snow varies considerably over the island. From November to April snow often covers the whole country. On the south coast snow seldom lies for long periods because of frequent thaws. In winter when the ground is frozen and most precipitation falls as snow, very little water is added to the groundwater storage. Rain and melting snow during winter thaws runs off on the surface for the most part. In spring most of the melt water runs off on the surface too. In the highly permeable areas of the volcanic zones, however, some water drains to the groundwater storage.

Topography

As a result of volcanism and the erosion of wind, water and ice, Iceland is a predominantly mountainous island. Two-thirds of its surface are over 200 m in height, its highest points being the peaks of Vatnajökull (approximately 2000 m high). The most extensive lowlands are in the south. Iceland is a young volcanic island. Its bedrock is made up predominantly of effusive igneous rocks. The volcanos are mostly composed of basic rocks, basaltic lavas or palagonite. Acid and intermediate rocks are of much more limited occurrence. Sedimentary strata between the lava layers are generally very thin. Intrusions are numerous and most often in the forms of dykes. Their hydrological importance is unquestionable.

Population/water resources

Drinking-water management does not pose very great problems in Iceland. In most places enough groundwater is available, although surface water is still used. As a rule it is easiest to harness groundwater inside the volcanic zones, where all the precipitation percolates into the ground and the groundwater flow can be quantified.

The longest pipeline for water supply in Iceland is that of the Vestmannaeyjar. Laid in 1960, it is 32 km in length, of which 12 km are in the sea. Water is supplied from one of the great springs of Eyjafjallajökull, emerging from pillow breccia at the base of the stratovolcano Eyjafjallajökull.

In the older parts of the country the bedrock is much denser than in the volcanic zones and, therefore, water extraction is more problematical. Here the best aquifers are in the unconsolidated rocks, especially in river deposits and rockclides.

The total annual water consumption from public water works and geothermal heating services in Iceland is estimated at 95 million m^3. Approximately, 47 million m^3 of this total is distributed as "cold water" (49.5%). The remaining 48 million m^3 (50.5%) is represented by geothermal waters. About 87.2% of the 47 Mm^3 of the water supplied as "cold water" is extracted from groundwater sources (87.2%), while the remaining 6 Mm^3 (12.8%) is taken from surface water sources.

A large proportion (75%) of the geothermal water consumption is approximately 48 million m^3 (50.5%). About 75% of the geothermal water is used for space heating, the rest for domestic and commercial use. The total consumption of cold and thermal water per person per day is just above 1000 litres, and the average domestic use excluding heating is estimated to be about 300 litres per day per person.

General statistics

General statistics

Population

Population in urban areas	89.6%
Population in rural areas	10.4%

Drinking-water supply

Total piped supply for drinking purposes	1.25 Ml/d[a]
Total population served by a piped public water supply	100.0%
Urban population served by a house connection	100.0%
Urban population without house connections but with reasonable access to public standposts	0.0%
Rural population served by house connections (public or private)	100.0%[b]
Rural population without house connections but with reasonable access to public standposts	0.0%

Drinking water supply uses

Water supplied for domestic and commercial use	50.0%
Water supplied for industrial use	50.0%
Other uses	0.0%

Industrial water supply: direct abstractions

Total supplied from inland waters for industrial use	0.65 Ml/d
Used for industrial cooling water	NA[c]
Used as industrial process water	NA
Total coastal water used	Not permitted

Agricultural use: direct abstractions

Total amount abstracted for irrigation	0.003 Ml/d[d]
Other agricultural uses including fish ponds	NA Ml/d

[a] Ml/d = 1 million litres/day

[b] Although only 10% of the rural population is served by public water supply, 100% of rural households have piped water supply, either private or shared with neighbouring farms.

[c] NA = Not available

[d] Mostly for use in greenhouses

Wastewater disposal services

(a)	% of urban population served by a sewerage network	100.0%
(b)	% of urban population served by other adequate means	0.0%
(c)	% of urban population lacking adequate disposal means	0.0%
(d)	% of rural population served by a sewerage network	100.0%
(e)	% of rural population served by other adequate means	0.0%
(f)	% of rural population lacking adequate disposal means	0.0%

Sewage treatment

(g)	% of sewerage systems receiving primary treatment only	10.0%
(h)	% of sewerage systems receiving secondary treatment	%
(i)	% of sewerage systems receiving tertiary treatment	%
(j)	% of sewerage systems receiving no treatment (raw discharge)	90.0%

Discharge of treated sewage

(k)	% discharged into the sea	%
(l)	% discharged into surface water bodies	%
(m)	% discharged onto farmland	%

Discharge of untreated sewage

(n)	% discharged into the sea	96.0%
(o)	% discharged into surface water bodies	4.0%
(p)	% discharged onto farmland	

Sludge disposal

(q)	% of sludge disposed into the sea	90.0%
(r)	% of sludge disposed into surface water bodies	0.0%
(s)	% of sludge disposed onto farmland	10.0%
(t)	% of sludge disposed as landfill	0.0%
(u)	% of sludge incinerated	0.0%

Useful contact points

Governmental

Ministry of Health and Social Security
Laugavegir 116
105 Reykjavik

Tel. (91) 28455
Telex 2225 EXTERN Is
2220 EXTERN Is

Water industry

National Energy Institute
Grensasvegi 9
108 Reykjavik

Tel. (91) 83600

Water research

National Centre for Hygiene, Food Control and Environmental Protection
Skipholti 15
105 Reykjavik

Tel. (91) 29633
Telex 2225 EXTERN Is
2220 EXTERN Is

Others

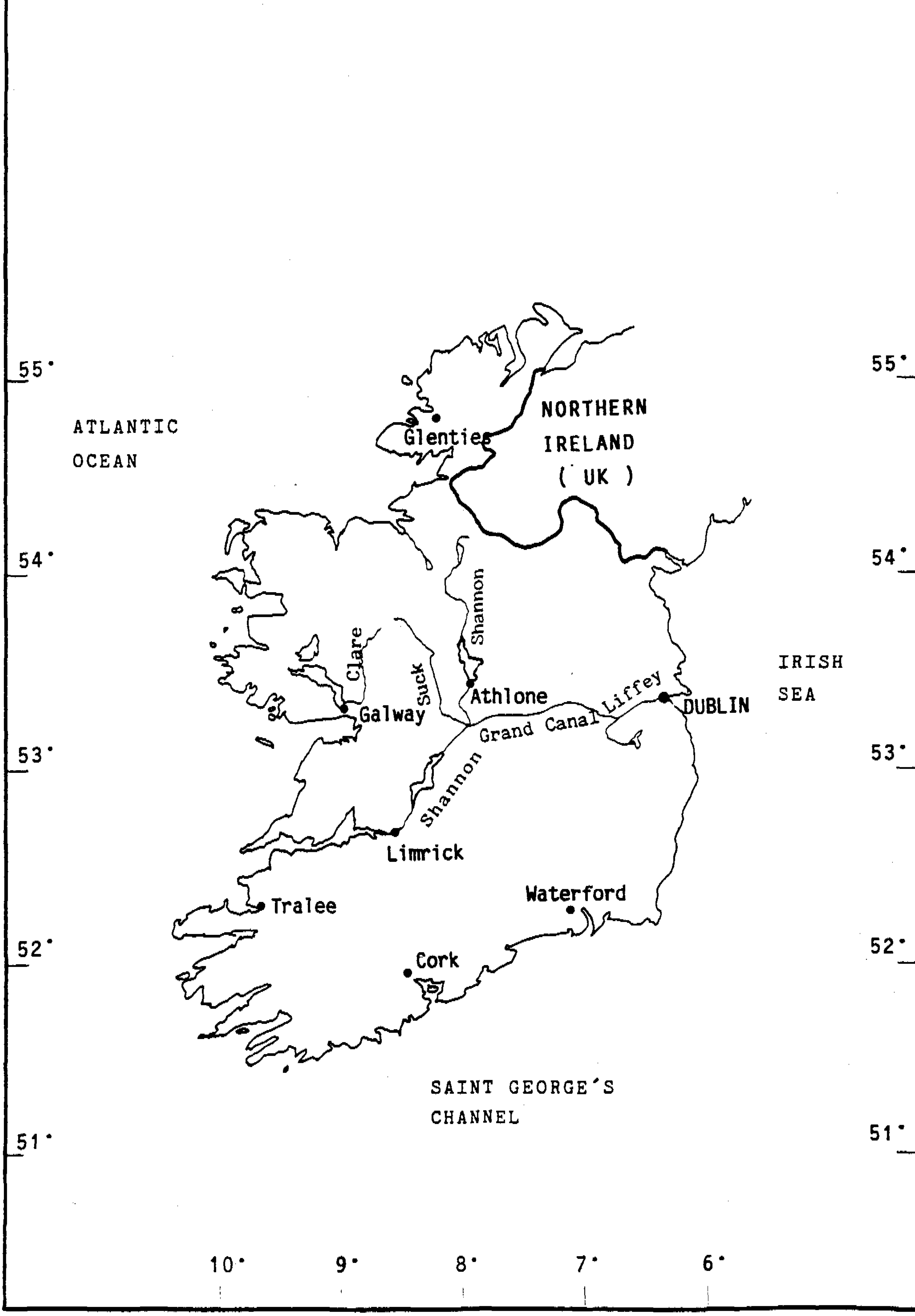
Ministry of Social Affairs and Ministry of Industry Arnarhvoli
101 Reykjavik

Tel. (91) 25000

Agricultural Society of Iceland
Baedahöllinni,
P.P.B 7080
127 Reykjavik

Nature Conservation Council
Hverfisgötu 26
101 Reykjavik

IRELAND


55°
54°
53°
52°
51°
ATLANTIC
OCEAN
NORTHERN
IRELAND
(UK)
Glenties
Shannon
Clare
Suck
Athlone
Galway
Grand Canal
Liffey
DUBLIN
IRISH
SEA
Shannon
Limrick
Tralee
Waterford
Cork
SAINT GEORGE´S
CHANNEL
10°
9°
8°
7°
6°

REPUBLIC OF IRELAND

The Republic of Ireland is situated in the Atlantic Ocean west of Great Britain, from which it is separated by the Irish Sea. It has an area of 70 283 km^2.

In 1982, the population of the Republic of Ireland was estimated to be 3.48 million (50 persons per km^2). About 56% of the population live in urban areas with populations in excess of 1500. The remaining 44% live in villages having populations less than 1500 and in rural areas. The distribution of the population shows that the bulk of the urban population lives in towns and cities on the coast with just about 440 000 persons living in inland towns. The largest urban areas in the country are Dublin (population 915 000), Cork (population 150 000), Limerick (population 76 000), Galway (population 42 000) and Waterford (population 40 000).

Form of government

The basic law of the State is the Constitution of Ireland adopted by referendum in 1937. The Constitution sets out the form of government and defines the powers of the President, the Parliament (Oireachtas) and the Government. It also defines the structure and powers of the courts, sets out the fundamental rights of citizens and contains a number of directive principles of social policy for the general guidance of Parliament.

The President of Ireland is elected by direct vote of the people for not more than two terms, each of seven years. He normally acts on the advice and authority of the Government. He signs and promulgates bills passed by Parliament and acts as guardian of the Constitution. The National Parliament consists of the President and two Houses, a House of Representatives (Dáil Eireann) and a Senate (Seanad Eireann). All laws passed by Parliament must conform to the Constitution. The executive power of the people is exercised by the Government or on its authority. The Government is headed by a Prime Minister (Taoiseach). The Prime Minister is appointed by the President on the nomination of Parliament.

Local government in the Republic of Ireland is carried out by 27 county councils, 4 county borough corporations, 7 borough corporations, 49 urban district councils and 28 boards of town commissioners.

Administrative organization of water services

Local authorities, in their capacity as sanitary authorities, of which there are 87, have the responsibility for providing public water supply and sewerage services for the areas under their control. They are also responsible for the adequate maintenance of these services. While there is no statutory obligation on local authorities to supply the water needs of industrial and other domestic consumers, they have, in fact, been meeting these needs to an increasing extent in recent times.

The role of the health department with regard to water quality

Local authorities, in their capacity as sanitary authorities, have a duty to provide adequate supplies of wholesome water to their consumers. They also have a duty to take appropriate steps to ascertain the quality and wholesomeness of all public water supplies within their areas and of notifying consumers of any inadequacy or unwholesomeness in these supplies. In practice, local authorities rely on a health inspectorate under the direction and control of the local medical officer of health to undertake such checks on their behalf. The monitoring of the bacterial quality of water is undertaken on a regular basis under this arrangement with the analysis being carried out in the laboratories of the Public Analysts or, alternatively, in Regional Health Board laboratories. Generally, the WHO European standards for Drinking-Water are applied. However, this will change under the EEC directive relating to quality of water intended for human consumption when it comes into force.

Water and related legislation

The Local Government (Water Pollution) Act of 1977 provides an effective updated legal framework for the control of water pollution. Its object is to ensure that the quality of national water resources is maintained to a standard consistent with their various beneficial uses. The Act applies to inland waters, tidal waters and the sea. Discharges into tidal waters and the sea from vessels or marine structures are governed by the Dumping at Sea Act, 1981, which is administered by the Minister for Transport.

Local authorities receive direction from the Minister for the Environment and over half of their financial support from the National Exchequer.

The local authorities (except for the town commissioners) are planning authorities under the Local Government (Planning and Development) Acts of 1963 and 1976 and their amendments, including Statutory Instrument (SI) No. 65 of 1977. The Minister for the Environment has overall responsibility for physical planning and development. All development, defined in the legislation as "the carrying out of any works on, in or under land, or the making of any material change in the use of any structure or other land", requires planning permission. Exceptions to this requirement are the use of land for agriculture and forestry, development by state departments, development by planning authorities in their functional area, and certain minor works set out in SI 65 of 1977.

Any person aggrieved at the decision of a planning authority on an application for planning permission may appeal to An Bord Pleanála, an independent tribunal responsible for the determination of appeals, references and certain other matters under the provisions of the Planning Acts. The Board also deals with appeals under the Local Government (Water Pollution) Act of 1977.

Each planning authority is required to make a development plan for its area and to review and update it at least once in every five-year period. This development plan sets out the policy and objectives of the planning authority for the development of its area. The Minister for the Environment has the responsibility and the appropriate powers to ensure that plans are coordinated effectively and may direct a planning authority to amend its plan.

The primary powers of control under the Water Pollution Act of 1977 are vested in local authorities, and chief among these powers is the licensing of discharges into water and sewers. There is a right of appeal to An Bord Pleanála against the decision of the local authority on a licence application. Licences are subject to review at three-yearly intervals but may be reviewed by the local authority within this period if it has reason to believe that the discharge is a significant threat to public health or if an unforeseen material change has taken place in the receiving water.

The Act includes a general prohibition on the polluting of water, but this does not apply to trade or sewage effluents that are subject to the licensing system. Another important provision of the Act enables local authorities to make water quality management plans, setting out objectives for the prevention and abatement of pollution, and providing the informational framework for decisions on water quality issues.

The role of the Minister for the Environment is essentially a supervisory one, the implementation of national policy on water pollution control being ensured mainly through the issue of guidelines to the local authorities. He has, however, a specific statutory power to prescribe quality standards for discharges and for water, and local authorities must observe such standards in the setting of licence conditions. While discharges from public sewers are not subject to licensing, any legal standards prescribed by the Minister place a statutory duty on the local authority to ensure that the sewage effluent does not contravene those standards.

Water pollution comes under specific statutory controls as well as certain non-statutory controls, for example the attachment of pollution control conditions to state aid such as that granted by the Industrial Development Authority or the Department of Agriculture for development projects.

The main statutory controls are contained in the physical planning system operated by local authorities under the Local Government (Planning and Development) Acts, 1963 and 1976, and by the provisions of the Local Government (Water Pollution) Act, 1977. The physical planning system provides a statutory pollution control system of a general nature. Conditions for the control of water pollution may be attached to planning permission for a project. For example, it may be prescribed that an effluent be treated to a certain standard or that waste be disposed of in a certain manner. The Local Government (Water Pollution) Act of 1977 is the principal statutory control on water pollution. This Act, which came into effect on 15 March 1977, includes provision for control, by means of a flexible licensing system to be operated by local authorities, of the discharge of trade effluents and certain sewage effluents from land or premises into water (including inland waters, tidal waters and the sea). Appeals against conditions attached to licences may be made to An Bord Pleanála. Domestic sewage discharges are excluded from the licensing procedure. The main feature of the Water Pollution Act is that it facilitates an integrated approach to the overall management of water resources and provides strong powers for the local authorities under the general guidance and the policy and regulatory control of the Minister for the Environment. The Act also facilitates compliance with international obligations concerning the control of water pollution from land-based sources, including obligations arising under the European Communities Environment Programme. While the polluting waste arising from farm enterprises and from operations such as silage-making cannot be licensed under the Water Pollution Act, the Act contains a general prohibition on causing or permitting an unauthorized entry of polluting matter into water. An offence against this provision carries the risk of a heavy fine and/or imprisonment. In addition, local authorities are enabled to require people who have control of poisonous, noxious or polluting matter to prevent such matter from entering water.

Water research

The National Institute for Physical Planning and Construction Research (An Foras Forbartha) was established in 1963 to meet the central research needs of the local authorities and the Department of the Environment. The research areas covered deal with physical planning, road construction, transportation and road safety, water resources/water supplies and the construction industry. In addition to An Foras Forbartha, many other bodies are engaged in research into water or related matters, and these include the Department of the Environment, the Department of Fisheries, the Office of Public Works, the universities and regional technical colleges.

Finance

Revenue income

Up to 1978, local authorities derived their finance for both water supply and sewerage services from rates on domestic houses, business premises, agricultural land and from charges to business and industrial consumers. Since 1978, rates have been abolished on domestic housing, and financial support to make up the shortfall in income from this source has been provided by the Government to local authorities. In 1983, charges were introduced for water services to domestic consumers. While such charges varied from one local authority to another, the average bill per household was about IR£45 per annum. They were abolished in 1985.

With regard to investments made for water and sanitation services, Table 1 provides the data available up to 1988. Between 1980 and 1988, the European Regional Development Fund committed US$202 million in grant aid in respect of sanitary services schemes, providing 50% grants towards schemes costing US$15.45 million or less and 30-50% grants where schemes exceeded this cost. In the same period, approximately US$268 million has been advanced by the European Investment Bank in respect of sanitary services schemes.

EC assistance has also been made available from the European Agricultural Guidance and Guarantee Fund (FEOGA) to meet part of the cost of water supply schemes in disadvantaged rural areas. This assistance has been directed towards both public and group water schemes supplying farms and villages whose inhabitants are dependant principally on agriculture. From the inception of the package in 1981 up to December 1987, US$25.10 million was made available from FEOGA in respect of water supply schemes.

Water charges

Potable water supply

Water charges are generally based on metered volumes for industrial and certain commercial users and fixed charges (per household) for domestic consumers.

Table 1. Investment in Sanitary Services (US$ million)
21/4/89 IR£1 = US$ 1.4442

Year	Water	Sewerage	Total
1980	40.50	27.00	67.51
1981	58.60	38.12	96.73
1982	78.60	47.60	126.20
1983	81.91	51.89	133.80
1984	83.18	52.55	135.74
1985	83.38	53.50	136.89
1986	78.50	51.97	130.48
1987	53.39	47.61	101.00
1988	38.41	48.81	87.22
Totals	596.47	419.05	1 015.57

Sewerage charges

Up to 1978, sewerage charges were based primarily on rateable values. When domestic rates were abolished, as with the lost water services revenue, the Government made up the shortfall to local authorities. Recently, legislation has been introduced to enable local authorities to charge for such services. Expenditures on the provision of sanitary services have grown from £16 million in 1975 to £89 million in 1983. For sewage services in inland towns and for pollution abatement on priority river stretches, the amount of £31 million was spent in 1982. During the same year, the cost of public sewage schemes, then at construction, planning or proposal stage, was estimated at £392 million.

Industrial effluent

In certain cases, charges for trade effluents discharged into sewers are imposed on the discharger. In some instances, this takes into account the strength, nature and volume of the discharge.

Environmental services

There are no direct charges. Finances are derived from rates on commercial and industrial properties and government support grants.

Land drainage and flood protection

The Office of Public Works is responsible for the design, construction and subsequent maintenance of arterial drainage schemes on a river catchment basis. Finance for maintenance is mainly derived from charges imposed on local authorities.

Responsible agencies

Operation	Carried out by
Water resources survey	Department of the Environment National Institute for Physical Planning and Construction Research Local authorities
Water management policy	Department of the Environment Local authorities National Institute for Physical Planning and Construction Research
Drinking-water production	Local authorities
Drinking-water distribution	Local authorities
Drinking-water quality surveillance	Local authorities
Agricultural irrigation	None designated
Industrial water supply	Local authorities (no statutory responsibility)
Underground water protection	Local authorities
Surface water protection monitoring	Local authorities
Water pollution control	Local authorities
Water resources storage and allocation	Department of the Environment Local authorities

Water resource availability and management

Rainfall

Ireland lies in an area of mild south-westerly winds and comes under the influence of the warm drifting waters from the Gulf Stream. This has assured it an equable climate and, as the island is comparatively small with no part more than 110 km from the sea, the temperature is almost uniform over the country. Average air temperatures in January and February, the coldest months, are mainly between 4°C and 7°C. July and August, the two warmest months, have average temperatures between 14°C and 16°C, but reaching 21°C-24°C at times. Ireland's renewable water resources are derived from a mean annual rainfall (1941-1970) estimated at 1150 mm. About 39% (450 mm) of this rainfall is consumed through evaporation and transpiration. The remaining 61% of the rainfall constitutes the country's average annual run-off of about 700 mm. The rainfall is much higher in the western half of the country than in the eastern half. The lowest mean annual rainfall in the country, less than 625 mm, is experienced along the east coast, in north-east County Dublin. Considerable areas, mostly in the south-western, western and north-western parts of the country, have a mean annual rainfall varying from 1500 mm to 2000 mm. In a few mountainous areas, rainfall between 2000 mm and 3000 mm is experienced. Rainfall for the period (1951-1970) shows that the wettest month of the year is December and the driest month is April. The average rainfall for the driest month approximates to about 50% of the rainfall for the wettest month.

Topography

The Republic of Ireland, having a total area of 70 300 km^2, is characterized by a large limestone plain covering the centre of the country. This plain is ringed almost completely by coastal highlands, which vary greatly in geological structure. Granite predominates in the mountains of the west and north-west and in the east. In the south, the mountains are of old red sandstone separated by limestone river valleys. The central plain, which is broken in places by low hills, is extensively covered with glacial deposits of boulder clay and peat, and it has numerous lakes.

Population/water resources

Ireland has, on the whole, abundant water resources. This results from a comparatively high rainfall and a low density population. Rivers and lakes are well distributed throughout the country and are relatively free from pollution. The average annual run-off approximates to 12 000 m^3 per capita, and therefore the problems of water availability are much less than in most European countries. For the country as a whole, fresh water availability per capita amounts to about 32 600 litres per day. For the purposes of compiling data on water resources, the country is divided into seven water resource regions. There are wide variations both within and between regions in water availability due largely to the almost converse geographical distribution patterns of population density and water resources. The eastern region, with the highest population (1.37 million), has the lowest water availability per capita (7200 litres per day). Conversely, the western (0.2 million) and north-western (0.25 million) regions, which have the lowest populations, have the highest water availability on a per capita basis, sometimes 11 times that of the eastern region. In the other four regions, with populations of more than a quarter of a million (Shannon and mid-western) and less than half a million (southern and south-eastern), the water availability ranges from 35 000 to 55 000 litres per capita per day.

Future trends of water resources

To meet the long-term water demands for various purposes up to the year 2000 and beyond will necessitate the implementation of new strategies in addition to the existing ones. The combined strategies for meeting these future demands are summarized below:

- direct abstractions from existing and new artificial impoundments (direct supply reservoirs);
- increased abstractions from existing impoundments constructed for multipurpose use (this strategy will involve a change of use);
- increased abstractions from existing impoundments originally constructed for hydro-electric purposes (this strategy will involve a change of use);
- increased abstractions from some free-flowing rivers and natural lakes;
- the construction of additional artificial impoundments, mainly operating as regulating reservoirs for the purpose of augmenting low river flows in order to facilitate increased abstractions for public supplies and increased "on stream" use by industry;
- the regulation of the outflow from existing natural lakes for the purpose of augmenting low river flows to facilitate increased abstractions and increased "on stream" use;
- the further development of groundwater resources;
- to a limited extent, the construction of pumped storage reservoirs in certain areas to meet the future demands of public supplies and industry.

Two of the main implications in relation to the successful implementation of some of these strategies in the most equitable (in relation to all beneficial uses) and economic manner relate to the adoption of a multipurpose approach. In some instances, rivers will have to be optimally developed to meet equitably the combined needs of public water supply, industry and agriculture, fisheries, waste disposal, drainage and possibly small-scale hydro-power. This can be done only by adopting a multipurpose approach. Because of the increasing "on-stream" use of river water by industry and others, another vital prerequisite for the successful implementation of the above strategies, and also to meet general public health and environmental requirements, will be to ensure that present river and lake water quality is maintained and where necessary improved. The protection of groundwater against the risk of pollution will also assume increasing importance.

General statistics

Population

Population in urban[a] areas	56.0%
Population in rural[a] areas	44.0%

Drinking-water supply (1980 data)

Total piped supply for drinking purposes	1130 Ml/d[b]
Total population served by a piped public water supply	90.6%
Urban population served by a house connection	98.7%
Urban population without house connections but with reasonable access to public standposts	1.3%
Rural population served by piped public water supply at home	80.5%
Rural population served by private systems at home or having reasonable access to public standposts	19.5%

Drinking water supply uses

Water supplied for domestic and commercial use	NA%[c]
Water supplied for industrial use	NA%
Other uses	NA%

Industrial water supply: direct abstractions

Total supplied from inland waters for industrial use (freshwater: surface and groundwater)	1440 Ml/d
Used for industrial cooling water	65.0%
Usage as industrial process water	35.0%
Total coastal water used	5985 Ml/d

Agricultural use: direct abstractions

Total amount abstracted for irrigation	No significant use
Other agricultural uses including fish ponds	355 Ml/d

Wastewater disposal services (1980 data)

(a)	% of urban population served by a sewerage network	99.4%
(b)	% of urban population served by other adequate means	0.6%
(c)	% of urban population lacking adequate disposal means	0.0%
(d)	% of rural population served by a sewerage network	23.2%
(e)	% of rural population served by other adequate means	76.8%
(f)	% of rural population lacking adequate disposal means	0.0%

[a] Urban areas having a population in excess of 1500 (1981 data) and rural areas having a population less than 1500.
[b] 1 Ml/d = 1 million litres/day.
[c] NA = Not available

Sewage treatment

(g)	% of sewerage systems by number receiving primary treatment only	15.0%
(h)	% of sewerage systems receiving secondary treatment	54.0%
(i)	% of sewerage systems receiving tertiary treatment	1.0%
(j)	% of sewerage systems receiving no treatment (raw discharge)	30.0%

Discharge of treated sewage

(k)	% discharged into the sea	10.0%
(l)	% discharged into surface water bodies	90.0%
(m)	% discharged onto farmland	0.0%

Discharge of untreated sewage

(n)	% discharged into the sea	88.0%
(o)	% discharged into surface water bodies	12.0%
(p)	% discharged onto farmland	0.0%

Sludge disposal

(q)	% of sludge disposed into the sea (Dublin)	49.0%
(r)	% of sludge disposed into surface water bodies	0.0%
(s)	% of sludge disposed onto farmland	23.0%
(t)	% of sludge disposed as landfill	28.0%
(u)	% of sludge incinerated	0.0%

Useful addresses

Governmental

Department of the Environment
Custom House
Dublin 1

Tel: (01) 74 29 61
Telex: 31014

Water industry

County and City Managers' Association
Park House
North Circular Road
Dublin 7

Tel: (01) 30 91 44
Telex: 32981

Water research

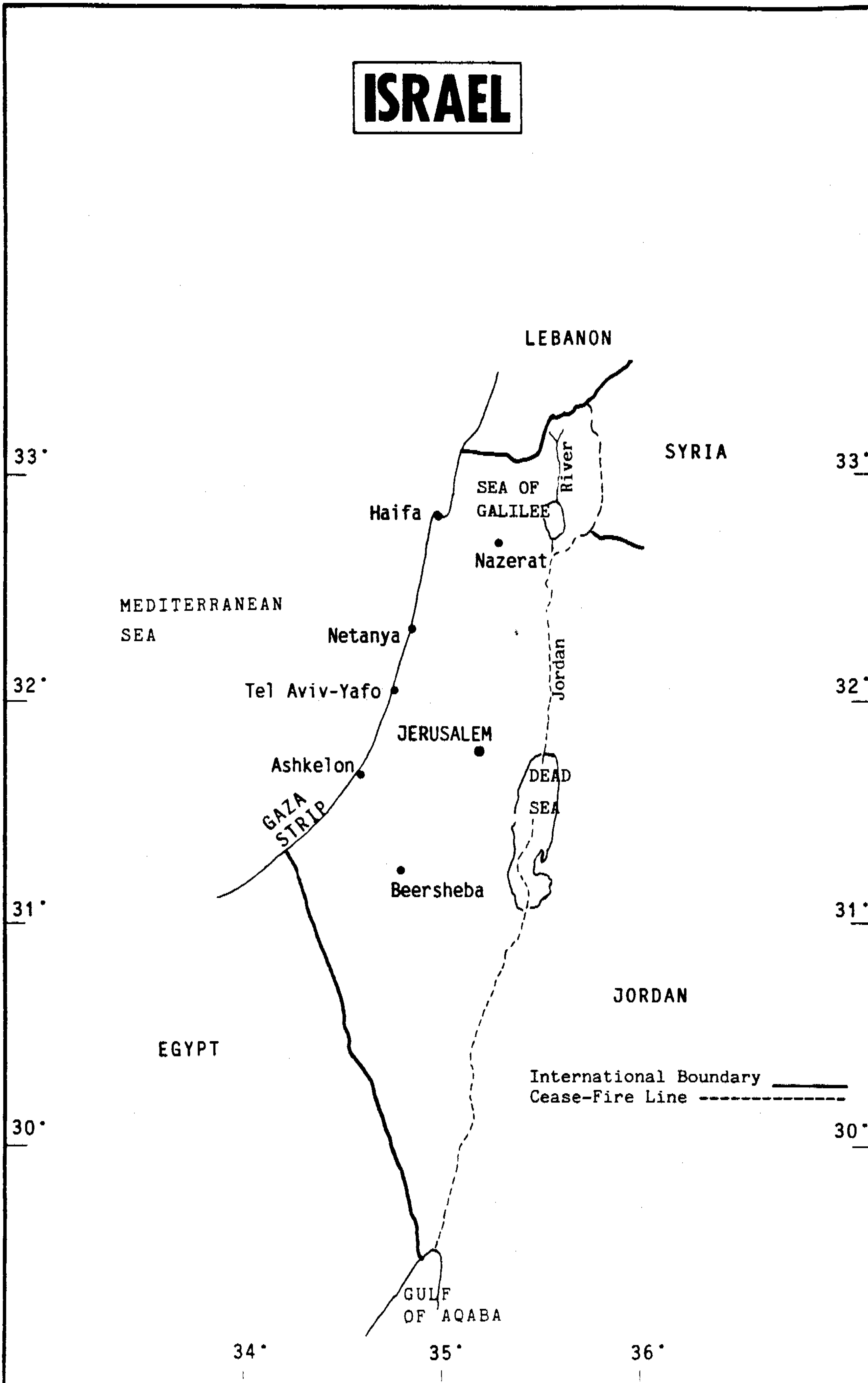
National Institute for Physical Planning and
Construction Research
(An Foras Forbartha (AFF))
St. Martin's House
Waterloo Road
Ballsbridge
Dublin 4

Tel: (01) 76 42 11
Telex: 30846 FORB EI

Annex 1

GENERATED AND DISCHARGED WASTE LOADS IN THE DOMESTIC AND INDUSTRIAL SECTORS (tonnes BOD/annum)

Generated waste loads			Discharged waste loads			Reduction of generated loads on discharge (%)		
Domestic	Industry	Total	Domestic	Industry	Total	Domestic	Industrial	Total
44 298	70 111	114 409	35 792	41 750	77 542	19	40	32


ISRAEL
LEBANON
SYRIA
SEA OF GALILEE
River
Haifa
Nazerat
MEDITERRANEAN SEA
Netanya
Jordan
Tel Aviv-Yafo
JERUSALEM
Ashkelon
DEAD SEA
GAZA STRIP
Beersheba
JORDAN
EGYPT
International Boundary
Cease-Fire Line
GULF OF AQABA
33°
32°
31°
30°
34°
35°
36°

ISRAEL

Israel is located on the eastern shore of the Mediterranean Sea. It extends some 500 km from north to south, and averages 60 km from east to west. On its northern border are Lebanon and Syria, on its eastern border Syria and Jordan, Egypt lies along its south-western border and the Mediterranean Sea is on its west.

Climate

The southern half of the country, from Beer-Sheba to the Gulf of Eilat (Aqaba), is arid and the northern half is semi-arid.

Surface and topography

The country is divided into three north-south topographical strips: the Mediterranean coastal plain, a central ridge and the Syrio-African Rift. Drainage to the west of the ridge finds its way to the Mediterranean, drainage to the east into the Rift. In Israel, the Rift includes the Jordan River, Sea of Galilee, Dead Sea, and the Arava, leading to the Gulf of Eilat.

Population

Israel's population is 4.2 million, of whom 3.8 million live in urban areas and 400 000 in rural areas.

Government

Israel is a democratic republic whose nominal head of State is the President. It has a single-house legislature (the Knesset) which is elected by proportional representation. The Government is headed by a Cabinet and a Prime Minister.

Administrative Division

The country is divided into six administrative districts: the Jerusalem, Tel-Aviv and Haifa districts and the northern, central and southern districts. The districts are divided into 14 subdistricts: four each in the northern and central districts, two each in the Haifa and southern districts, and one each in the Tel-Aviv and Jerusalem districts. Each district houses the district representatives of the major Ministries. The Ministry of Health has a Public Health District (and Subdistrict) Office in each, headed by the District Health Officer (a medical doctor). Each district office has an Environmental Health unit, headed by the District Environmental Engineer.

Legislation and administration of water services

With the establishment of the State of Israel in 1948, it was realized that the challenge posed by the water situation required the promulgation of a system of laws which would serve as a means by which the State would regulate water use.

The first step was to establish state ownership of the water resources, while at the same time starting to plan a suitable legal system.

The drafting of the Water Law of the State lasted more than 7 years. During this period, particularly during 1955-1957, several separate laws were enacted, as it was impossible to wait for the final legislation.

The legislative framework of the Water Laws system today consists of the following laws:

1. The Water Metering Law, 1955.
2. The Water Drilling Control Law, 1955.
3. The Drainage and Flood Control Law, 1957.
4. The Water Law, 1959, which is the basic and most important law in water legislation.

Concomitant with each is an extensive system of regulations and orders, the purpose of which is to implement the provisions of the laws.

The basic idea underlying the Water Law is that water is a commodity which, owing to its shortage, should be used for the benefit of the public and in the best and most efficient way for the development of the country. To ensure this, it was necessary to concentrate all activities relating to these resources in the hands of the State. This concept is expressed in the first clause of the Water Law, which states:

> The water resources of the State are public property, under the control of the State and intended for the needs of its residents and the development of the country.

The control of all the various kinds of water is in the hands of the State, which acts as the trustee of the public as a whole, and whose duty is to ensure the proper distribution of the water for the needs of the inhabitants as well as for the development of the country.

The right to use water is a right extended to every person and to every inhabitant in the State, by law, but is subject to the provisions of the law.

The basic principle of Israel's water policy was that to ensure maximum benefit to the nation, the plan for the development of the country's limited water resources is to be based on maximum water conservation, optimum management of the water resources and carefully considered water allocation. It was necessary to ensure that the authorities would be vested with adequate powers to control the water resources, to prevent their deterioration by contamination and pollution, and to advance their development for the benefit of the country as a whole.

Some of the relevant principal aspects of the law are given below.

<u>The right to the use of water</u>

No abstraction, supply or use of water from any source is permitted except under an annual licence issued by the Water Commissioner. Any person is entitled to receive water, subject to the legal provisions, for purposes legally specified. This right lapses with the cessation of use. The criteria for water allocation and the norms for various uses are stipulated in extensive secondary legislation.

Water metering

Water metering is obligatory without exception, including water metering for every dwelling unit.

Control of water quality

The 1959 Water Law dealt only generally with pollution control, imposing a charge on any person abstracting water from any source to prevent the pollution of that source. The 1971 amendment to the Water Law gave the Water Commissioner very extensive powers for the prevention of pollution. Paragraph 1 of the amendment reads:

> A person shall refrain from any act which, directly or indirectly, immediately or later, causes or may cause water pollution; and it shall be immaterial whether or not the water source was polluted before the act.

However, the effective implementation of this law necessitated the unambiguous definition of its provisions, telling potential polluters exactly what is required of them and what is specifically forbidden. These provisions are comprehensively related to standards for water courses, standards for effluent discharges into the environment and public sewage systems, and to various water uses, especially where those uses are above aquifers of unpolluted groundwater.

Water rates

The 1959 Water Law stipulated the basic rules for central control of water rates and provided for the establishment of a Water Rates Adjustment Fund, "to reduce differences in water charges in various parts of the country".

The administrative system was so designed that the parliamentary responsibility in all matters pertaining to water has been entrusted to the Ministry of Agriculture which, under the provisions of the water laws, is in charge of the enforcement of said laws.

While the ministerial responsibility falls on the Minister of Agriculture, the executor of the provisions of the Water Law is the Water Commissioner, appointed by the Government to manage the water affairs of the State. An extensive network of legal powers has been entrusted to the Water Commissioner, so as to provide him with discretion on all matters concerning the allocation of water, control of water use, planning of water supply schemes and their operation, imposition of sanctions in case of violations of the law, etc.

In order to enable the Water Commissioner to exercise his powers under the provisions of the water laws, an administrative system has been established - the Water Commission.

The Water Commission is comprised of several departments, of which the most relevant to the subject at hand is the Department for Efficient Use of Water (Urban Section).

This department is in charge of enforcing the Metering Law and of setting norms for consumption and planning, and encouraging improvement of the management of the demand, follow-up and compilation of data. Allocations of water and legal and economic affairs are handled by relevant units within the Water Commission. The Commission also operates through the Urban Water Authority and the Israeli Centre of Waterworks Appliances (ICWA).

In addition, public organizations, such as the Water Board, Planning Committee and Water Tribunal, can be found in the legal system. These organizations safeguard the public from any unreasonable, unjustified and uncalculated act of the administration.

The Secretary of Agriculture, through the Water Commissioner, allocates an annual amount of water to each local authority for all the uses within its jurisdiction. The allocation is updated annually, based on norms (by uses) and the changes which have taken place.

The distribution of the water to the different users is the responsibility of the local authority. The local authorities are charged with developing, maintaining and operating the water supply systems within their boundaries. Bound by regulations of the Water Law to remain within the limits of the quantity of water allocated to them, the local authorities express in their by-laws the optimum use target by maintaining apartment and house metering, by establishing various provisions and prohibitions, and by setting progressive water charges. The municipalities also contribute to education, publicity and information concerning the efficient and economic use of water.

The Water Commission acts mainly in a supervisory role regarding the activities of the authorities.

Role of the Ministry of health with regard to water quality

Fixing drinking water quality requirements

The Public Health Ordinance (1940), in Part E-1 (1970), empowers the Minister of Health to enact regulations fixing drinking-water quality standards. The Drinking-Water Regulations (1974, amended 1979) thus issued by the Ministry of Health fix bacterial, chemical, physical and radiological standards. They also fix the frequency of bacterial testing at source and at point of use. A public committee, appointed by the Director-General, recommended revisions and updating of these regulations in 1986, which were published in March 1989.

Fixing testing programmes

Towards the end of each calendar year, Ministry district and subdistrict environmental personnel (engineers and supervisors) sit with waterworks and/or environmental personnel of the local authorities (cities, local councils, regional councils) throughout the country and review the test locations and frequency of bacterial (and in some cases chemical and physical) testing within the purview of each local authority.

Sample delivery service

Those local authorities within short distances from Ministry water testing laboratories (Jerusalem, Tel-Aviv, Haifa and Beer-Sheba) are required to obtain sterile test bottles from these laboratories, to sample at the designated locations and dates, and to return the samples with a prepared form to the laboratories. Those local authorities who are distant from the laboratories pick up the sample bottles from district or subdistrict offices and return them after sampling, early enough in the day so that they may be brought by Ministry personnel to the designated laboratory.

These services, including bacterial testing in the laboratories, are supplied by the Ministry at no cost to the local authority. The Mekorot Water Company, which owns and maintains a network of wells, reservoirs and distribution systems, and supplies water direct to consumers and indirectly through local authorities, maintains its own laboratories for testing the water it abstracts and delivers. The Municipality of Jerusalem, which obtains its water from Mekorot, also maintains its own drinking-water testing laboratory. Test results, if positive (showing coliform) are reported by telephone and if negative (meeting standards) are reported monthly.

Testing and surveillance

Ministry of Health laboratories test the water samples delivered, according to the schedule described above, and notify Ministry district and subdistrict environmental personnel by telephone of any positive (showing coliform) results. These latter telephone to the local authorities requesting retesting. Surveillance is maintained by these personnel to the extent possible to ensure that testing and retesting schedules are adhered to.

Computerized surveillance system

The prepared forms (see point C above) delivered with the samples are completed with regard to test results by the laboratories, and are delivered twice weekly to the central computer of the Ministry of Health. The data are processed and monthly computerized reports are sent out to the subdistrict, district and main environment offices. All this is with respect to bacterial testing. A computerized chemical testing surveillance system is planned but delayed due to lack of funding. A minicomputerized system, with a computer in each district office, laboratory and main office, has begun to be implemented, but desultorily, for similar reasons.

Action orders

District offices, upon receiving positive (contaminated) retest results, may, and almost always do, declare the water unfit for drinking. They then order the water in a certain area (part of a local authority, over several local authorities) to be boiled by consumers before drinking and/or to be disinfected by the local authority in question until the source of contamination is removed. In cases where these actions are not deemed feasible, an immediate order is issued to close the source of supply.

Sanitary investigations

If personnel permits, the subdistrict will send out environmental personnel to investigate the source of contamination and to give orders as to its removal. If not, the district will instruct the local authority to engage suitable environmental engineers to conduct such investigation and submit recommendations for action.

Long-term pollution dangers

Where an immediate order to close a supply is deemed necessary, a copy must be sent to the Water Commissioner. Where a long-term pollution danger exists, the District Environmental Engineer of the Ministry of Health informs the Water Commissioner, who is asked to close the supply as soon as possible and designate another source for the local authority. This may take days or years depending on the local facilities for finding another suitable source.

Annual drinking-water quality report

The Environmental Health Department of the Ministry of Health issues an annual report to the public on the bacterial quality of the country's drinking water, indicating the problems and prospects involved.

Water research

Israel is a rapidly developing country where the demand for water has regularly outstripped the supply, giving rise to a situation in which research and development could no longer precede the commercial exploitation of water resources. Instead, research development activities have had to be fully integrated in water resource management programmes on an on-going basis. As a result, a highly sophisticated national water economy that supplies a relatively large quantity of water (200 million cubic metres per year) effectively functions as a field test for the research and development of water resources.

The integration of research and development activities and water resource management has already reached an advanced level in Israel, focusing on specific areas. The most outstanding are exploitation of the Kinneret, controlled exploitation and development of aquifers, and water reclamation to permit the reuse of effluents.

Problems currently facing the Israeli water economy include:

a. the accelerated development of marginal and nonconventional sources;
b. the competitive demands of the various sectors;
c. flexible distribution systems capable of adapting to changes in consumption patterns;
d. multiple conveyance systems able to distribute water of varying quality;
e. increasingly stringent standards of water quality;
f. production of water at a cost level consistent with the major end-use of water in Israel, which is agricultural production; and
g. the pricing and allocation of water.

The most outstanding problem, however, is the use of marginal water-sewage effluents and brackish water - which is expected to grow to 30% by the year 2000. A national water development programme that emphasizes wastewater recycling will have enormous implications for public health because of the increase in the quantities of treated effluents in the human environment. This approach clearly has to be accompanied by a well-defined research and monitoring programme that can locate problems and come up with solutions. The magnitude of the problems and the urgency of finding a solution will present a rare challenge to the scientific community.

Finance

Revenue income

There are four main sources of revenue income, the importance of which varies with respect to the type of supplier (direct to consumer or via a secondary supplier) and the size of the operation. These are:

1. One-time charge for a consumer connection - usually according to the diameter of the connection.

2. The Water Commissioner's Balancing Fund. In the case of suppliers with especially high costs due to the nature of the system (e.g. high pumping), the supplier is entitled to draw regularly from this fund, to which all the suppliers in the country contribute in proportion to the amount of water sold.

3. The Network Rehabilitation Fund. Suppliers with particularly old and/or debilitated systems are entitled to funding for network rehabilitation. The funding comes from the Ministry of the Interior, the Water Commission and the Council of Local Governments, and the plans for rehabilitation are approved by the Local Supply Systems branch of the Water Commission.

4. Direct subventions from the Ministry of the Interior for special cases.

Water charges

Potable water supply

Domestic use:	US$ 0.35 to 0.85 per cubic metre, depending on usage (higher usage carries higher charges, to discourage waste).
Commercial use:	US$ 0.55 per cubic metre.
Industrial use:	US$ 0.15 to 0.40 depending on usage.
Hotels:	US$ 0.30 to 0.60, depending on usage.
Other public buildings:	US$ 0.40 to 0.85, depending on usage.

Sewage charges

These are added to the water bill by the municipality:

Domestic:	US$ 0.12 cents per cubic meter.

One-time charge for connection to sewer system: US$ 6 per square metre of construction.

Industrial effluent

Discharge of certain organic and inorganic substances into sewer systems are prohibited, except in negligible amounts. These are substances which harm the sewer systems, treatment plants or reuse facilities. The industry must remove these substances before discharging its wastewater into the public system.

Organic wastes which do not harm any of the above, but cause extra loading on the treatment plants which may result in higher running costs or plant enlargement, are subject to surcharges. These are generally not added to the water bill but charged for separately according to special calculations.

Responsible agencies

Operation	Carried out by:
Water Resources Survey	The Water Commission (carrying out the survey)
Water Management Policy	The Water Commission (fixing the policy)
Drinking-Water Production	The Water Commission (promoting water production
Drinking-Water Distribution	The Water Commission (regulating water distribution)
Drinking-Water Quality Surveillance	Ministry of Health (surveillance over self-testing by suppliers)
Agricultural Irrigation	The Water Commission (regulating agricultural irrigation)
Industrial Water Supply	The Water Commission (regulating industrial water supply)
Underground Water Protection	The Water Commission (protecting underground waters)
Surface Water Protection Monitoring	The Water Commission (protecting surface waters)
Water Pollution Control	The Water Commission (control of water pollution)
Water Resources Storage and Allocation	The Water Commission (promoting water storage; fixing water allocation).

Water resource availability and management

Rainfall

The average rainfall over the country is 350 mm per year, ranging from 10 to 1000 mm per year. The northern half of the country has an average of 550-600 mm per year. Rain falling on the outcrops of the aquifer along the coastal plain, and upon the central hill ridge, percolates into the groundwater in the north of the country. Rain falling in the Jordan Valley Basin north of the Sea of Galilee gathers in the lake and provides a source of surface water which is 30% of the country's water resources.

Topography

The Mediterranean coastal plain extends up to 40 km eastwards in the south. Underlying this plain is the Pleistocene sandstone aquifer, which supplies 30% of the country's water and up to half of the groundwater reserves. The central ridge forms a divide up to 1200 m above sea level. Underlying this ridge is the Cenomenian limestone aquifer which also supplies 30% of the country's water and half of its groundwater.

Population/water resources

In 1985, groundwater production was 1000-1200 million m^3 per annum (MCMPA*), and water production from the Sea of Galilee was 600 MCMPA. In addition, surface (flood) waters and reclaimed wastewater, used directly for irrigation, amounted to 100 MCMPA each. The total was 2000 MCMPA. Municipal water use was 430 MCM in 1985. Of the 600 MCMPA produced by the Sea of Galilee in the north of the country, 100 MCMPA was used in the north, 300 MCMPA in the centre of the country and 200 MCMPA was delivered to the south.

Future trends for water resources

Future municipal demand (in the year 2010) will rise from an average of 100 m^3 per capita to 115 m^3 per capita. By this time, reclaimed wastewater use will rise from 100 to 400 MCMPA, and replenishment of overdrawn coastal aquifer water resources will reach an average of 70 MCMPA, with a rainy year maximum of 170 MCMPA.

* (MCMPA) = million m^3 per annum

General statistics

Population

Population in urban areas	90.0%
Population in rural areas	10.0%

Drinking-water supply

Total piped supply for drinking purposes	930 Ml/d[a]
Total population served by a piped public water supply	99.9%
Urban population served by a house connection	100.0%
Urban population without house connections but with reasonable access to public standposts	0.0%
Rural population served by house connections (public and private)	98.0%
Rural population without house connections but with reasonable access to public standposts	2.0%

Drinking-water supply uses

Water supply for domestic and commercial use	19.0%
Water supply for industrial use	7.0%
Other uses	0.0%

Demand:
All efforts are made to meet any and all drinking water demands. These efforts are almost universally successful, with the exception of outlying areas (between the Dead Sea and Eilat) where a sufficient supply is available but is saline - and in a very few areas where increase in demand outstrips supply until a new supply can be brought in.

Municipal water demand is from 80 to 220 Ml/d, depending usually on availability of complete wastewater disposal facilities.

Industrial water supply: direct abstractions

Total supplied from inland waters for industrial use	300 Ml/d
Used for industrial cooling water	35.0%
Used as industrial process water	65.0%
Total coastal water used	5500 Ml/d

Demand:
All efforts are made to meet any industrial demand, which today is considered to be a priority. Thus, as far as the general picture is concerned, supply equals demand.

[a] 1 Ml/d = 1 million litres/day.

Agricultural use

Total amount abstracted for irrigation, including "other" agricultural uses (e.g. livestock)	3500 Ml/d

Demand:
At today's water prices, agricultural demand far exceeds available supply and, therefore, no attempt has been made to estimate demand. This question will become relevant when pricing reduces demand.

Wastewater disposal services

(a)	% of urban population served by a sewerage network	90.0%
(b)	% of urban population served by other adequate means	10.0%
(c)	% of urban population lacking adequate disposal means	0.0%
(d)	% of rural population served by a sewerage network	60.0%
(e)	% of rural population served by other adequate means	40.0%
(f)	% of rural population lacking adequate disposal means	0.0%

Sewage treatment

(g)	% of sewage systems receiving primary treatment only	15.0%
(h)	% of sewage systems receiving secondary treatment	70.0%
(i)	% of sewage systems receiving tertiary treatment	5.0%
(j)	% of sewage systems receiving no treatment (raw discharge)	10.0%

Discharge of treated sewage

(k)	% discharged into the sea	0.0%
(l)	% discharged into dry riverbeds	52.0%
(m)	% discharged through central seepage systems	8.5%
(n)	% discharged for agricultural irrigation	36.0%
(o)	% used for groundwater recharge	3.5%

Discharge of untreated sewage

(p)	% discharged into the sea	10.0%
(q)	% discharged into dry riverbeds	90.0%
(r)	% discharged onto farmland	0.0%

Sludge disposal

(s)	% of sludge disposed into the sea	20.0%
(t)	% of sludge disposed into surface water bodies	0.0%
(u)	% of sludge disposed onto farmland	70.0%
(v)	% of sludge disposed as landfill	10.0%
(x)	% of sludge incinerated	0.0%

Useful addresses

Governmental

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Water industry

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Jerusalem 91181

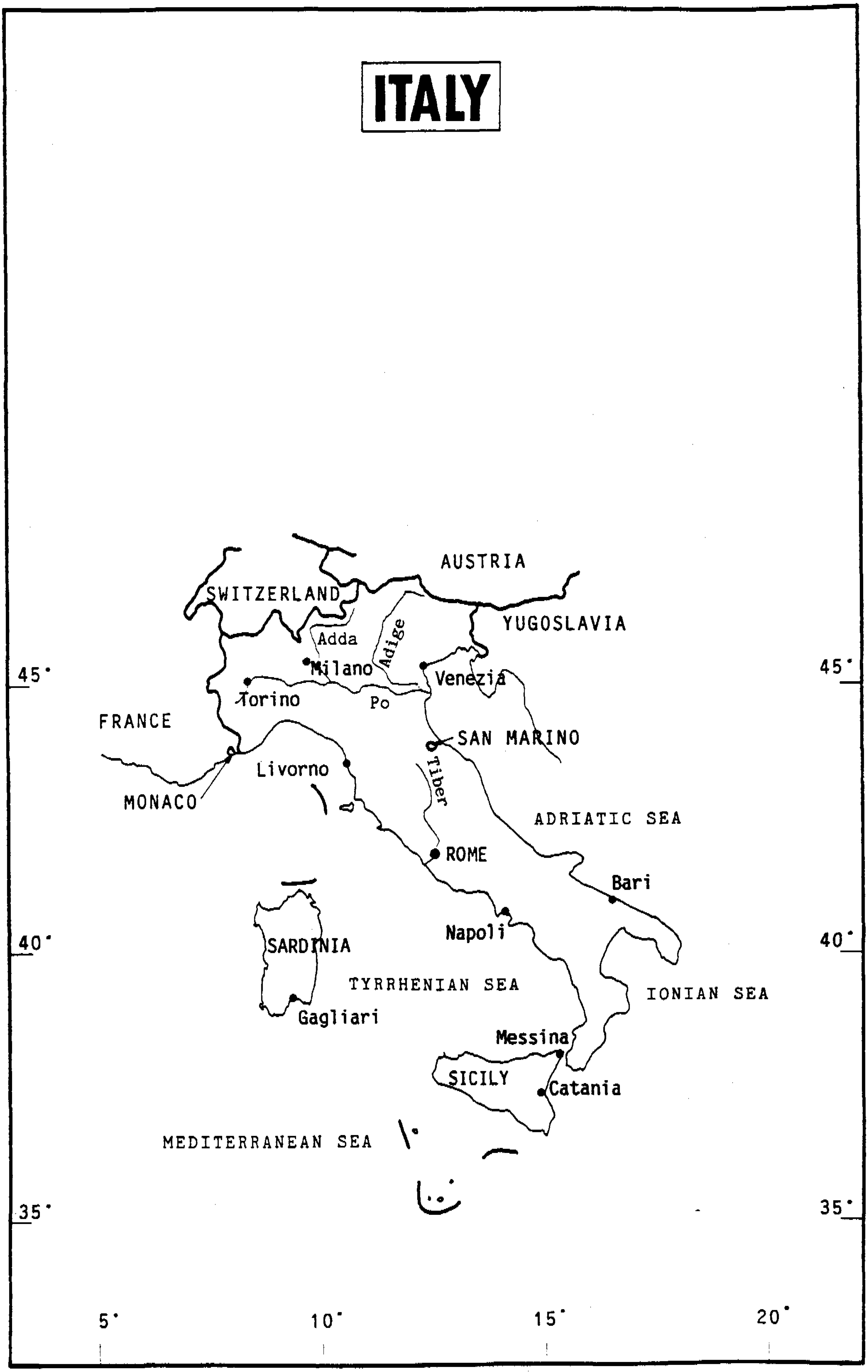
Tel: (02) 81 13 99
Telex: 26188 RECO IL

Annex 1

Percent of water samples found contaminated according to community size (1986)

Range of % of samples found contaminated										Number of samples		
20%		11.1-20.0%		7.1-11,0%		3.1-7.0%		0-3.0%				
In %	No.	In %	No.	In %	No.	In %	No.	In %	No.	Per Group	Per range	Order
0	0	0	0	0	0	0	0	100	14	14	>50	1
0	0	0	0	0	0	23.5	4	76.5	13	17.	26-50	2*
0	0	0	0	15	5	15	5	70	23	33	10.1-25	3
5	2	9	4	15	6	23	10	49	21	43	5.1-10	4
8	72	?	?	?	?	?	?	?	?	>80	<5.0	5
6	1	0	0	0	0	22	4	72	13	18	26-50	2*

*From: "Microbiological Tests Results, Community Drinking Water in Israel, 1986".


ITALY
AUSTRIA
SWITZERLAND
YUGOSLAVIA
Adda
Adige
Milano
Venezia
Torino
Po
FRANCE
SAN MARINO
Tiber
Livorno
MONACO
ADRIATIC SEA
ROME
Bari
SARDINIA
Napoli
TYRRHENIAN SEA
IONIAN SEA
Gagliari
Messina
SICILY
Catania
MEDITERRANEAN SEA
45°
40°
35°
5°
10°
15°
20°

ITALY

The Italian peninsula extends out from southern Europe and is bounded by the Mediterranean sea to the west and south and the Adriatic sea to the east. In the north, Italy has borders with France, Switzerland, Austria and Yugoslavia. Sicily and Sardinia, also in the Mediterranean, are the largest islands.

Italy has an area of 301 225 km^2, and in 1982 had a population of 56 742 000, giving an average density of 188 inhabitants per km^2.

Government

Under the 1948 Constitution, legislative power is held by the two-chamber Parliament consisting of the Senate and the Chamber of Deputies. The President, who is elected in joint sessions of both Houses of Parliament, is the Head of State; he appoints the Prime Minister and, on the latter's recommendation, the other ministers. Executive power is exercised by the Council of Ministers, over which the Prime Minister presides as President of the Council.

The country is divided into 20 regions, which have a large degree of autonomy, 95 provinces and more than 8000 communes. Five of the regions have a special status, but the others operate as decentralized units of central Government. A government commissioner in the regional capital supervises the administrative functions of the State and coordinates them with those of the regions. The special regions have a governmental structure similar to that of the Government, with a directly elected parliament, an executive board and a president. The regional parliament has the authority to promulgate legislation for its area on a range of subjects, including public health.

Each province has two separate administrations: the provincial administration, which is the decentralized unit of the central Government with an elected council and a president, and the communes in the province. The coordinator of the central government's administration of the province is the prefect, who is appointed by and responsible to the Minister of the Interior. His duties include the implementation of national laws and the supervision of certain public health duties. He is assisted by advisory groups and councils. Each commune, like a province, has three organs of government, the council, the board and the mayor. The functions of the council include the provision of health services. As an officer of the central government, the mayor must publish the laws, regulations and announcements of the State and assume certain functions in regard to public works and public health. The communes are subject to strict administrative and financial control by the provincial and central governments. Provincial inspectors examine their organization and administration; when a commune is not performing its duties, the central government or the province can take appropriate action.

Administrative organization of water services

In Italy, water supply, sewage and waste water treatment are run by the local authorities and the State.

Generally speaking, the central organization of the State in relation to water services is made up of the Ministry of Public Works, the Ministry of Agriculture and Forests and the Ministry of Public Health. The Ministry of

Public Works is the most important State authority in the field of water resources development and management. The Ministry is made up of a number of sectors:

The Higher Council of Public Works is called upon to give advice on regulating plans and projects for public works. It is divided into six sections, three of which are particularly involved in water resource development problems. They deal respectively with sanitation works, water conservation, afforestation, drainage and irrigation works, evaluation and control of public water utilization, as well as hydraulic aspects of hydroelectric projects.

The General Directorates are responsible for dealing with the problems of water resources. They implement the decisions of the Higher Council and organize the financing of work carried out by the State.

The Civil Engineering Bureau is responsible for general supervisory services of local works, hydraulic works, land reclamation and diversion of water.

For general, statistical and regulatory studies, the Council is assisted by the Central Technical Department, specifically, the Hydrographic Service. This service, established by the Ministry of Public Works in 1917, provides all data required on meteoric precipitation and water courses. The service is implemented through the twelve hydrographic regions, composed of a network of 7000 stations, 3850 of which carry out precipitation surveys, 1100 measure air temperatures, 633 study the water-bearing strata and 1400 survey watercourses.

The Ministries have decentralized offices in the regions (the Public Works Superintendent Office, the Regional Agricultural Inspectorate) and in the provinces (the Civil Engineering Bureau Office, the Provincial Inspectorates).

As far as other local organizations are concerned, the special status regions carry out their tasks through "Aldermanships", having autonomous regulations, which, however, concur with the general framework of State law. Provinces and communes carry out limited activities under the control of their own authorities.

Another organization of note is the "Cassa per lo Sviluppo Economico del Mezzogiorno" (Southern Italy Economic Development Agency). This agency was created by the Italian Government in 1950 for the execution over a number of years of a development programme in the less socially and economically advanced southern continental and insular areas. Water resources development has been one of the most important sectors of interest to the Cassa.

Role of the health department with regard to water quality

Hygiene and public health came under the Ministry of Health when it was established by Law No. 296 of 13 March 1958 (IDHL, 10: 319). The National Health Council was attached to the Ministry and the Higher Health Institute brought under its authority. The Law also prescribed that the local organs of the Ministry should be the provincial medical officer, as well as the health officers of the communes and groups of communes.

In most communes, there is a local health unit (USL) with a health officer who, in the more important communes in cooperation with the regional health inspectorate, directs the communal health inspectorate. The regional health inspectors are responsible for the smaller communes with no health officer.

The Ministry of Health carries out its quality control and sanitation activities through its provincial organs. In particular in the field of civil provision of sanitary works, no project may be started without the approval of both the Ministries of Public Works and of Health.

Water and related legislation

Italian laws on water rights are based on the principle that surface water, spring water and groundwater are in most cases considered as public property, especially when such water meets or is capable of meeting public requirements either independently or as part of the river basin to which it belongs. Several uses of public waters, such as navigation and animal consumption, when there are no fixed diversion plants, are free to individuals. However, uses involving diversions must be authorized by government bodies. Those wishing to divert and use public water need a special government concession, which implies definite duties and fees on their part. Water sources located on private properties can be used freely by the landowner until it becomes of public interest and may be declared public by being registered in the special "Index of Public Waters" established by the Ministry of Public Works.

The principal water law is the "Unique Text" (Testo Unico), which grouped the previous laws and rules with some amendments and additions. The Unique Text was approved by Law No. 1775 of 11 December 1933, and constitutes the principal code at present in force. It establishes the criteria to be followed for public water concessions as well as sets the rules for electrical installations. The Unique Text was followed by a long series of integrative and modificative dispositions, especially after the Second World War.

The Law No. 319 of 10 May 1976 for the protection of water against pollution repeals earlier laws and includes extensive tables of acceptable concentrations of pollutants in industrial discharges (IDHL, 28: 627). The Law is carried out by a ministerial committee comprising the Minister of Public Works (as Chairman), the Minister of the Merchant Marine and the Minister of Health. The provincial laboratories for hygiene and prophylaxis under the Ministry of Health have inspectors for water pollution who are empowered to take water samples, even inside factory premises. Law No. 319 supplements several laws and decrees, including Law No. 126 of 16 April 1976 on the control of discharges into marine waters. Law No. 650 of 24 December 1979 requires regional governments to regulate the disposal of industrial wastewater using standards more stringent than those in Law No. 319. The regional governments establish their own standards and rules for the disposal of municipal effluents.

Other laws refer directly to public waters, particularly to the activities of development bodies in charge of construction of new aqueducts and other hydraulic works, especially in less developed parts of the country, and to inland navigation.

The use of public water, including groundwater, is regulated by requests for concessions which are submitted to the Office of Civil Engineers in the Ministry of Public Works. Large concessions are approved by decree of the President of the Republic, while smaller requests may be granted by a regional decree based on an opinion from the Adviser for Public Works. Discharges into the Mediterranean are subject to pollution control regulations administered by the Ministry of the Merchant Marine and the local port authorities. The regions have no power in this area.

The regional legislations enacted in the special status regions overlap this complex of State laws in different ways according to the statute of each Region.

Two important modifications in water legislation were made in the 1960s, namely, the establishment of the Electrical Energy National Agency (ENEL) by Law No. 1643 of 6 December 1962 and the preparation of a General Master Plan for aqueducts by Law No. 129 of 4 February 1963. On the basis of the former, concessions for water diversion to be used for power generation can generally be granted only to ENEL; this agency also participates in all associations for the construction and management of multi-purpose projects for what concerns power generation. A special committee was appointed to prepare a draft bill which would do away with discrepancies between the general legislation on public waters and that regarding the ENEL establishment. With the latter reform, a certain proportion of the water resources was reserved to satisfy the civil supply requirements over a fifty-year period.

Italy is a signatory to international conventions on the prevention of marine pollution and the protection of the Mediterranean. Marine discharges must be licensed through the Ministry of the Merchant Marine.

Water research

A number of years ago, the Interministerial Committee for Economic Planning urged the National Research Council (Consiglio Nazionale delle Ricerche) to set up an institution to carry out and promote research in the field of water resources. This institution took the form of the Water Research Institute (Istituto di Ricerca sulle Acque) and operates in cooperation with several governmental and nongovernmental bodies.

The activities of the Institute, spanning conventional and unconventional water resource development, as well as pollution control, are ultimately directed to giving public bodies the necessary information for the promotion and adoption of specific legislative measures; to make available the results of technological studies and product-development research to Italian industry; to carry out studies as specific problems of economic interest on behalf of public bodies as well as working for these bodies on a consultancy basis.

Responsible agencies

Operation	Carried out by:
Water Resources Survey	No information available
Water Management Policy	" " "
Drinking-Water Production	" " "
Drinking-Water Distribution	" " "
Drinking-Water Quality Surveillance	" " "
Agricultural Irrigation	" " "
Industrial Water Supply	" " "
Underground Water Protection	" " "
Surface Water Protection Monitoring	" " "
Water Pollution Control	" " "
Water Resources Storage and Allocation	" " "

Water resource availability and management

Rainfall

The climate is generally Mediterranean but owing to its topography, Italy experiences marked climatic variations in the different regions.

The annual volume of precipitation over the national territory is estimated at about 296 x $10^9 m^3$ corresponding to an average precipitation of slightly less than 1000 mm. Roughly speaking, about 121 x $10^9 m^3$, that is 41% of the total volume, fall on northern Italy, which represents an area of 36% of the entire national territory; about 71 x $10^9 m^3$, that is 24%, fall on southern Italy; about 65 x $10^9 m^3$, that is 22% on central Italy, and about 39 x $10^9 m^3$, that is 13% on the major islands. Winter precipitation increases gradually from north to south; while the contrary is the case for summer precipitation which ranges from the 700 mm on some locations in the Alps down to 50 mm on the south and the islands. The studies carried out by the Hydrographic Service indicate that in the transformation from precipitation to runoff the apparent losses increase gradually from 350 mm in the north to 600 mm in the south. The average annual surface runoff is estimated at about 159 x $109^9 m^3$, of which about 90 x $10^9 m^3$ concern northern Italy, about 32 x $10^9 m^3$ central Italy, 26 x $10^9 m^3$ southern Italy and 11 x $10^9 m^3$ the major islands. Evapotranspiration is very high in the south during the summer months, and irrigation problems are one of the chief concerns of the water management agencies.

Topography

The most important feature of Italian geology is the Apennine chain. On each side, extensive Tertiary deposits are to be found, sometimes as broken hilly country, for example, the Monferrato district in Tuscany, and at others creating broad plains such as the Tavoliere of Apulia. Italy is divided into four basic geographic areas: the north, the peninsula (subdivided into central and southern Italy), the island of Sicily and the island of Sardinia. There are also several distinct volcanic areas, the Euganean hills, the Roman district, the Monte Vulture in Apulia, the Terra di Lavoro in Campania, the Etna in Sicily, where there is still volcanic activity, and the Lipari islands also of volcanic origin.

Population/water resources

Generally speaking, the situation as regards water availability and use is much more favourable in northern Italy than elsewhere. The southern regions of the country and the major islands (Sicily and Sardinia) are conspicuous as being the most deprived of all regions. Even in the north, the hydrogeological and orographic conditions peculiar to some regions or parts of regions keep them short of water and necessitate major diversions from particularly well-endowed neighbouring areas. In other regions, the quantities of water at present withdrawn are near to the technical and economic limit of maximum development of the resources. In this framework, the importance of water economy is evident, the economic development of entire regions being heavily dependent on the availability of fresh water.

Future trends of water resources

The rapid increase in water utilization for all purposes has led the government to take measures to safeguard the water supply to the resident and transient population throughout the country, in both urban and rural areas, on the basis of forecasts up to the year 2015. To that end, the Ministry of Public Works drew up a General Master Plan for Aqueducts which was promulgated by Law No. 129 of 4 February 1963. This plan marks the first attempt at a solution, at the national level, on the basis of uniform criteria, to the problem of water supply to inhabited centres. Through the gradual implementation of the plan, it is thought that the present imbalances will be eliminated, allowing at the same time the achievement of an even standard of living for all parts of the country. It aims at doing away with all one-sided or inadequate arrangements and to arrive at a comprehensive estimate of the needs, on the basis of criteria both technically and economically sound; the principle criterion is a better selection and distribution of water resources.

Finance

Revenue income

Generally speaking, whenever the development of water resources is for the benefit of the community, the State assumes full financial responsibility. For projects that mainly benefit private interests, state participation is restricted to giving grants, which vary according to the type of investment and the economic development of the area concerned.

Water charges

As far as water pricing is concerned, there is no general regulation; any action on the matter is the concern of local bodies which own the aqueducts and sanitary works. The decisions of the bodies concerning prices and tariffs are subject to the evaluation and approval of the tutelary authorizations, including the Interministerial Committee on Prices. The prices in force at the time are applied on a social basis and are not sufficient to ensure the capitalization of the works.

General statistics

Population

Population in urban areas	72.0%
Population in rural areas	28.0%

Drinking-water supply

Total piped supply for drinking purposes	Ml/d[a]
Total population served by a piped public water supply	98.8%
Urban population served by a house connection	100.0%
Urban population without house connections but with reasonable access to public standposts	0.0%
Rural population served by house connections (public and private)	96.0%
Rural population without house connections but with reasonable access to public standposts	4.0%

Drinking water supply uses

Water supplied for domestic and commercial use	NA[b]
Water supplied for industrial use	NA
Other uses	NA

Industrial water supply: direct abstractions

Total supplied from inland waters for industrial use	NA
Used for industrial cooling water	NA
Usage as industrial process water	NA
Total coastal water used	NA

Agricultural use: direct abstractions

Total amount abstracted for irrigation	NA
Other agricultural uses including fish ponds	NA

Wastewater disposal services

(a) % of urban population served by a sewerage network	NA
(b) % of urban population served by other adequate means	NA
(c) % of urban population lacking adequate disposal means	NA
(d) % of rural population served by a sewerage network	NA
(e) % of rural population served by other adequate means	NA
(f) % of rural population lacking adequate disposal means	NA

[a] 1 Ml/d = 1 million litres/day
[b] NA = Information not available

Sewage treatment

(g)	% of sewerage systems receiving primary treatment only	NA
(h)	% of sewerage systems receiving secondary treatment	NA
(i)	% of sewerage systems receiving tertiary treatment	NA
(j)	% of sewerage systems receiving no treatment (raw discharge)	NA

Discharge of treated sewage

(k)	% discharged into the sea	NA
(l)	% discharged into surface water bodies	NA
(m)	% discharged onto farmland	NA

Discharge of untreated sewage

(n)	% discharged into the sea	NA
(o)	% discharged into surface water bodies	NA
(p)	% discharged onto farmland	NA

Sludge disposal

(q)	% of sludge disposed into the sea	NA
(r)	% of sludge disposed into surface water bodies	NA
(s)	% of sludge disposed onto farmland	NA
(t)	% of sludge disposed as landfill	NA
(u)	% of sludge incinerated	NA

Useful addresses

Ministry of Health
Viale dell'Industria 20
00144 Rome
Telephone: (6).59 94

General Directorate of Public Hygiene
Via Listz 34
00144 Rome
Telephone: (6).59 16 941

General Directorate of Veterinary Services
Piazzale Marconi, Pal. Italia
00144 Rome
Telephone: (6) 59 94

General Directorate of Food Hygiene and Nutrition
Piazzale Marconi, Pal. Italia
00144 Rome
Telephone: (6) 59 94

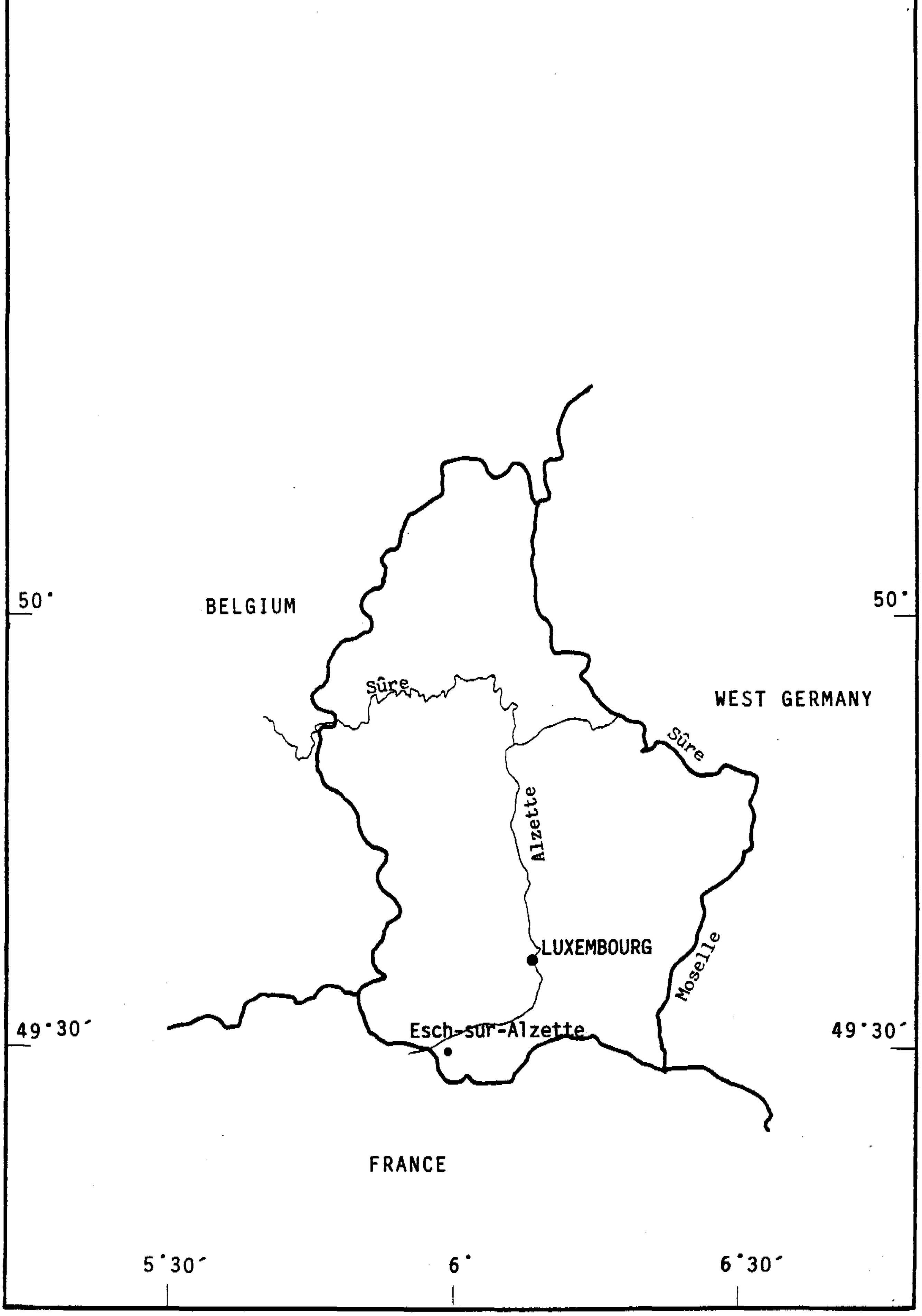
Istituto Superiore di Sanita' (ISS)
Viale Regina Elena 299
00161 Rome
Telephone: (6).49 90

Istituto Superiore Prevenzione e Sicurezza Lavoro (ISPESL)
Via Fontana Candida
00040 Monteporzio Catone (Rome)
Telephone: (6) 94 49 081

Research

Water Research Institute
(Istituto di Ricerca sulle Acque)
Via Reno 1
00198 Rome
Telephone: (8).44 87 41

LUXEMBOURG



50°
BELGIUM
50°
Sûre
WEST GERMANY
Sûre
Alzette
LUXEMBOURG
Moselle
49°30′
Esch-sur-Alzette
49°30′
FRANCE
5°30′
6°
6°30′

LUXEMBOURG

Luxembourg is situated to the south-east of Belgium, between France and the Federal Republic of Germany. It has an area of 2586 km^2, and in 1981 the population stood at 366 000, giving a density of 142 per km^2. The climate is temperate.

Government

The Grand Duchy of Luxembourg is a hereditary and constitutional monarchy. Legislative power is held by the Chamber of Deputies, but some legislative functions are exercised by the advisory Council of State appointed by the Grand Duke. Executive power is vested in the Grand Duke but is normally exercised by the Council of Ministers headed by the President of the Government. The Grand Duke appoints the ministers, but they are not responsible to the Chamber of Deputies.

For administrative purposes, the country is divided into districts and municipalities. The districts serve only as administrative units and are headed by appointed commissioners, who provide liaison between the central and local authorities.

The organization and powers of the municipalities are laid down in the Constitution and in a number of civil laws. The main organs of municipal government are the communal council, the college of mayors and aldermen, and the mayor. The execution of council decisions is the responsibility of the college, which, however, has a dual role as it is an agent of both the State and the municipality. In its capacity as agent of the State, the college supervises the execution of decisions of the central government and the Grand Duke.

Administrative organization of water services

Under the Law of 27 June 1906 relating to the protection of public health, the communes, of which there are 118 in the country, are solely responsible for supplying centres of population with drinking-water and for the disposal of wastewater. Many of these communes have formed associations in order to increase the water resources at their disposal and/or in order to ensure an acceptable standard of water quality. As a rule, communes do not take decisions without first seeking the opinion of the State bodies concerned with matters relating to the management of water (the Department of the Environment, the Department of Bridges and Roadways, the Health Directorate) and which provide considerable assistance with the implementation of projects.

All water abstraction is subject to the authorization of:

- the Minister of the Interior (groundwater);
- the Minister of Agriculture (unnavigable surface waters);
- the Minister of Public Works (navigable surface waters).

The discharge of wastewater into surface waters is also subject to the authorization of the Minister of Agriculture (unnavigable watercourses) or the Minister for Public Works (navigable watercourses), who in turn seek the opinion of the Minister of the Environment as to the conditions of discharge to be set.

The Ministry of the Environment is the main authority in water matters but relies on other departments for technical assistance. The Ministry of Health nevertheless retains full responsibility for the sanitary protection of the Esch-sur-Sûre reservoir, which currently supplies water for 60% of the population.

Role of the health department with regard to water quality

As described in the section dealing with administration, the communes are responsible for the supply of potable water, and it is understood that this responsibility extends to the quality of the water which must conform to the hygiene standards set out by the Grand-Ducal ruling of 13 November 1970. In practice, observance of these standards is checked by the Department of the Environment, which informs the communes of the results and of any improvements necessary. All of this is done in close collaboration with the Health Directorate and the National Health Laboratory.

The Department of the Environment also sets the standards and supervises compliance with the various objectives for the quality of surface waters, as defined in several legislative measures such as those for untreated water from which potable water is to be produced and bathing waters. As soon as it becomes a matter of public health, as, for example, in the Esch-sur-Sûre reservoir scheme, which constitutes a water resource of national importance, the Health Directorate participates in all the decisions affecting water quality.

Regarding the supervision of wastewater quality, e.g. effluents from urban and industrial treatment plants, it is again the Department of the Environment which carries out the necessary checks and passes on the results to the authorities responsible for authorizing discharges (communes, the Ministry of Agriculture, the Ministry of Public Works).

Water and related legislation

Over the last few years, EEC directives have largely determined the regulations relating to water quality. These include:

- the Grand-Ducal Regulations of 17 May 1979 on the quality of bathing water (IDHL, 31: 82);
- the Grand-Ducal Regulations of 20 December 1980 on the quality of waters that need to be protected or improved in order to support fish life (IDHL, 32: 561);
- the Grand-Ducal Regulations of 12 June 1981 on the quality of surface waters used for the production of potable water;
- the Grand-Ducal Regulations of 16 August 1982 on the protection of groundwater against pollution by certain dangerous substances (IDHL, 34: 351).
- the Grand-Ducal Regulations of 17 April 1986 on the limit values and quality objectives concerning discharges of cadmium, mercury and hexachlorocyclohexane.

- the Grand-Ducal Regulation of 7 September 1987 on the limit values concerning discharges of carbontetrachloride, DDT and pentachlorophenol.

In addition to these measures, which are based on the principle of laying down water quality standards, Luxembourg has an extensive portfolio of legislation relating to the protection of water that is now regarded as somewhat outdated (the oldest measure still in force dates from 1669). It is considered to be a rather heterogeneous collection making it difficult to achieve integrated management of water resources in accordance with modern criteria. However, in the Law of 16 May 1929 on the cleaning, maintenance and improvement of watercourses, Article 13 is particularly important since it forbids the polluting of water.

Concerning the protection of groundwater, the Law of 9 January 1961 provides that any new abstraction from groundwater is subject to authorization from the Minister of the Interior. In general terms, it forbids land-owners to place in the ground any substance liable to pollute groundwater. These measures are aimed basically at protecting groundwater as a source of potable water, the quality standards for which are laid down by the Grand-Ducal Regulations of 11 April 1985 relating to the quantity of waters destined directly or indirectly for human consumption, derived from EEC directive No. 80/778/EEC of 15 July 1980.

In order to correct the inconsistencies that exist in present legislation relating to water, it is intended to introduce a new all-inclusive law to deal with the control, distribution and protection of water resources. This law, which is in the planning stage, should make for better quantitative management of water.

Luxembourg is signatory to a number of international agreements, including a treaty with the _Land_ of Rhineland-Palatinate in the Federal Republic of Germany on the Sûre, which deals with both water supply and the elimination of transboundary pollution, and a convention with Belgium concerning the construction of an international sewage treatment plant on the upper Sûre River near Martelange. A broader tripartite protocol concerning pollution of the Mosel was concluded in Paris on 20 December 1961 between France, the Federal Republic of Germany and Luxembourg. Luxembourg is also a member of the International Commission for the Protection of the Rhine against Pollution.

Water research

The Grand Duchy of Luxembourg, being a very small country, has no universities or research institutes. Research relating to water is therefore practically nonexistent, apart from a few instances of applied research relating to analytical methods, undertaken in the laboratories of the Department of the Environment.

Finance

Revenue income

Water charges for:

Potable water supply

All the communes in the country require that all customers using the public supply do so through a water meter.

Sewage

There is a drainage charge based as a rule on the cost of the water consumed, but the amounts levied vary from one commune to another.

One commune only, the Town of Luxembourg, has fixed the drainage charge in relation to the ground area of the buildings concerned.

Industrial effluents

Commercial undertakings connected to the water distribution network pay only the above-mentioned drainage charge. There is as yet no specific charge levied in relation to the degree of pollution of the wastewater to be removed. However, a scheme of charges proportional to the pollution load is currently considered within the context of the proposed new law relating to the control, distribution and protection of waters.

Responsible agencies

Operation	Carried out by
Water resources survey	Department of the Environment (Ministry of the Environment) Geological Service, Department of Roads and Bridges (Department of Public Works)
Water management policy	Department of the Environment (Ministry of the Environment) Geological Service, Department of Roads and Bridges (Department of Public Works) Water Directorate, Department of Roads and Bridges (Department of Public Works) Department of Agricultural Technical Services (Ministry of Agriculture)
Drinking-water production	Department of the Environment (Ministry of the Environment) Water Directorate, Department of Roads and Bridges (Department of Public Works) Ministry of Interior Water Syndicates, South (SES), Ardennes (DEA) East, and Luxembourg Town
Drinking-water distribution	Department of the Environment (Ministry of the Environment) Water Directorate, Department of Roads and Bridges (Department of Public Works) Ministry of Interior Water Syndicates
Drinking-water quality surveillance	Department of the Environment (Ministry of the Environment) Health Service (Ministry of Health) Geological Service, Department of Roads and Bridges (Department of Public Works)
Agricultural irrigation	Department of Agricultural Technical Services (Ministry of Agriculture)
Underground water protection	Department of the Environment (Ministry of the Environment) Health Service (Ministry of Health) Geological Service, Department of Roads and Bridges (Department of Public Works) Ministry of Interior
Surface water protection monitoring	Department of the Environment (Ministry of the Environment)
Water pollution control	Department of the Environment (Ministry of the Environment)

Water resource availability and management

Rainfall

The average figure (over 30 years) for precipitation in Luxembourg is 816 mm per year. The country enjoys a moderate maritime climate with the prevailing wind being from the south-west.

Topography

The Ardennes region in the north constitutes nearly one third of Luxembourg and has an altitude of 430 to 610 m. The southern half of the country has an average elevation of 300 m. The whole Grand Duchy is dissected by deep valleys. The northern part is composed of impermeable Paleozoic (Devonian) schists, which all but preclude the formation of aquifers; in that area, most of the rainwater becomes surface drainage. In the centre and southern areas, on the other hand, there are sedimentary rocks of the Mesozoic (Triassic and Jurassic) period within which substantial aquifers are formed. The "Luxembourg Sandstone" (lower Jurassic) is worthy of special mention since it alone supplies 90% of the groundwater resources.

Population/water resources

Three quarters of the population is concentrated in the centre and in the south of the country, and it is in these regions that adequate reserves of groundwater are available, only half of which have been developed. In order to avoid overexploitation and to ensure a diversification of resources, it was considered desirable that surface water should also be used. A reservoir and treatment plant has been constructed in the north, from which water is transferred to the central and southern areas. The public water network supplies 125 000 m^3 per day, of which 2/3 are extracted from groundwater sources and the remaining 1/3 from the reservoir Esch-sur-Sûre.

Future trends of water resources

A study covering the period from 1960 to 1975 has shown a growth rate in water consumption of 4%. Following the economic recession, and also the better management of water, this growth rate has decreased considerably. It can even be said to have ceased altogether, and demand is unlikely to increase in the medium term.

As indicated above, there remain potential reserves of groundwater that will not be subject to continuous development but which can be used as back-up reserves for emergency needs.

General statistics

Population

Population in urban areas[a]	57%
Population in rural areas	43%

Drinking-water supply

Total piped supply for drinking purposes	125.000 m^3/d[b]
Total population served by a piped public water supply	99.0%
Urban population served by a house connection	100.0%
Urban population without house connections but with reasonable access to public standposts	0.0%
Rural population served by a piped public water supply, at home	97.6%
Rural population served by private systems at home or having reasonable access to public standposts	2.4%

Drinking-water supply uses

Water supplied for domestic use	49.0%
Water supplied for industrial use	51.0%
Other uses	-

Industrial water supply: direct abstractions

Total supplied from inland waters for industrial use (freshwater: surface and groundwater)	Ml/d[c]
Used for industrial cooling water	%
Usage as industrial process water	%
Total coastal water used	Ml/d

Agricultural use: direct abstractions

Total amount abstracted for irrigation	Ml/d
Other agricultural uses including fish ponds	Ml/d

[a] Urban area is defined as a commune with 5000 inhabitants or more. When the limit is set at 10 000 inhabitants, the corresponding percentage is 46.

[b] m^3/d = cubic metres per day.

[c] Ml/d = one million litres per day.

Wastewater disposal services

(a)	% of urban population served by a sewerage network	100.0%
(b)	% of urban population served by other adequate means	0.0%
(c)	% of urban population lacking adequate disposal means	0.0%
(d)	% of rural population served by a sewerage network	93.0%
(e)	% of rural population served by other adequate means	7.0%
(f)	% of rural population lacking adequate disposal means	0.0%

Sewage treatment

(g)	% of sewerage systems receiving primary treatment only	8%
(h)	% of sewerage systems receiving secondary treatment	84.0%
(i)	% of sewerage systems receiving tertiary treatment	0.0%
(j)	% of sewerage systems receiving no treatment (raw discharge)	8.0%

Discharge of treated sewage

(k)	% discharged into the sea	0.0%
(l)	% discharged into surface water bodies	100.0%
(m)	% discharged onto farmland	0.0%

Discharge of untreated sewage

(n)	% discharged into the sea	0.0%
(o)	% discharged into surface water bodies	100.0%
(p)	% discharged onto farmland	0.0%

Sludge disposal

(q)	% of sludge disposed into the sea	nil
(r)	% of sludge disposed into surface water bodies	nil
(s)	% of sludge disposed onto farmland	50.0%
(t)	% of sludge disposed as landfill	50.0%
(u)	% of sludge incinerated	nil

Useful addresses

Governmental

Administration de l'Environnement
1A rue Auguste Lumière
L-1950 Luxembourg

Tel. 49 61 05
Telex 60742 ADENV Lu
Telefax 49 62 56

Water industry

Association Luxembourgeoise des Services d'Eau (ALUSEAU)
c/o Syndicat des Eaux du Sud (SES)
Koerich

Tel. 39 91 96

Annex 1

1. Comments on the map of the level of pollution in 1980-1981

a. The Alzette. Approximately 63% of all the wastewater of the Grand Duchy of Luxembourg, i.e. nearly 380 000 population equivalent, are discharged into this river. At present, 80% of this wastewater is treated; this has improved the quality of the river substantially. The last heavily polluted stretches will be done away with by setting up two large treatment plants (near Esch and Bettembourg).

b. The Sûre. Although the Sûre is polluted by the wastewaters discharged in the Martelange region, the river is in general of fairly good quality as far as the area where it joins the Alzette. At that point, its quality deteriorates, although it can still be used for fish-breeding purposes.

c. At its entry into Luxembourg, the Eisch is greatly polluted, but the situation improves as it receives clean effluents. Treatment arrangements on both sides of the border will help to improve the water quality.

d. Not much wastewater is discharged into the Attert, which is therefore virtually "clean". This situation will have to be maintained by preventive measures.

e. Although at its entry into Luxembourg the Wiltz is of good quality from the physical and chemical points of view, its biological quality leaves much to be desired, probably owing to discharges at Bastogne. Upstream the quality of the water decreases slightly owing to the discharges from the commune of Wiltz, which are partly treated.

f. The Clerve is of excellent quality except near Clervaux where the treatment plant is inadequate during the tourist season. Modernization work is now in progress.

g. The quality of the Our is also good, with the exception of a few urban and tourist centres, where eutrophication interferes with the oxygenation of the waters.

h. The Syre remains polluted on a short stretch, but the situation will improve shortly when a new treatment plant gets under way.

i. The dissolved oxygen balance of the Moselle is reasonable.

j. When it crosses the border, the Chiers is heavily polluted. The construction of treatment plants with a total capacity of 65 000 population equivalent will solve this problem.

2. Assessment of the quality of the rivers

The 20 main rivers of the country, with a total length of 600 km, approximately account for 50% of all the surface waters of the watershed. A biochemical and chemical assessment shows that:

- 2.7% of the rivers are not polluted at all; this represents mainly upper courses near the springs, and the quality of the waters is nearly that of a drinking-water; they are obviously excellent for fish-breeding purposes.

- the level of pollution of 60% of the rivers is insignificant or small; they are good fish-breeding waters that may support a balanced population of Salmonidae (e.g. trout); with a few exceptions, they conform to the health standards of bathing waters;

- the level of the pollution of 30.3% of the rivers is average; the oxygen concentration is hardly sufficient to keep a diversified fish population, except small fry such as roach, on a few stretches; However, the water may be used for supplying industries, e.g. for cooling purposes;

- 7% of the rivers are heavily polluted; fish breeding is practically impossible in them and the waters could be used, for instance, for industrial purposes, only after more or less thorough treatment.

<u>Map 1</u> Survey of the levels of pollution of the rivers of the Grand Duchy of Luxembourg

1980-1981

Key

Rank 1 good
3 average
5 bad

Department of the Environment

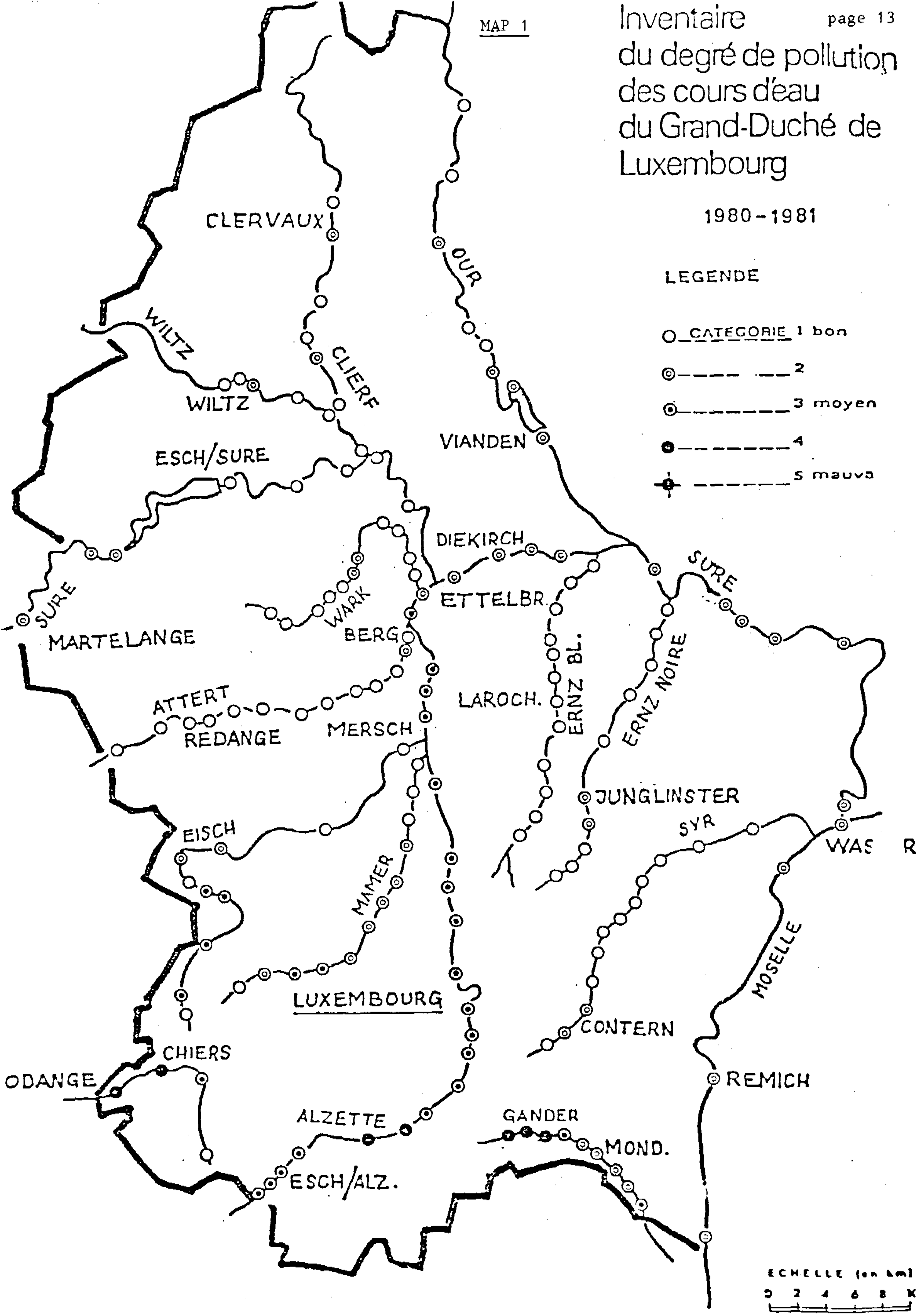
<u>Map 2</u> Drinking-water distribution networks

Distribution network Legend

SEBES (Synd. des Eaux du Barrage d'Esch-s-Sûre)
SES (Syndicat des Eaux du Sud)
DEA (Distribution d'Eau des Ardennes)
Associations of the Mosel Water Distribution Agencies
Autonomous networks
Regional reservoir
Pumping station
Local reservoir/locality

Inventaire du degré de pollution des cours d'eau du Grand-Duché de Luxembourg

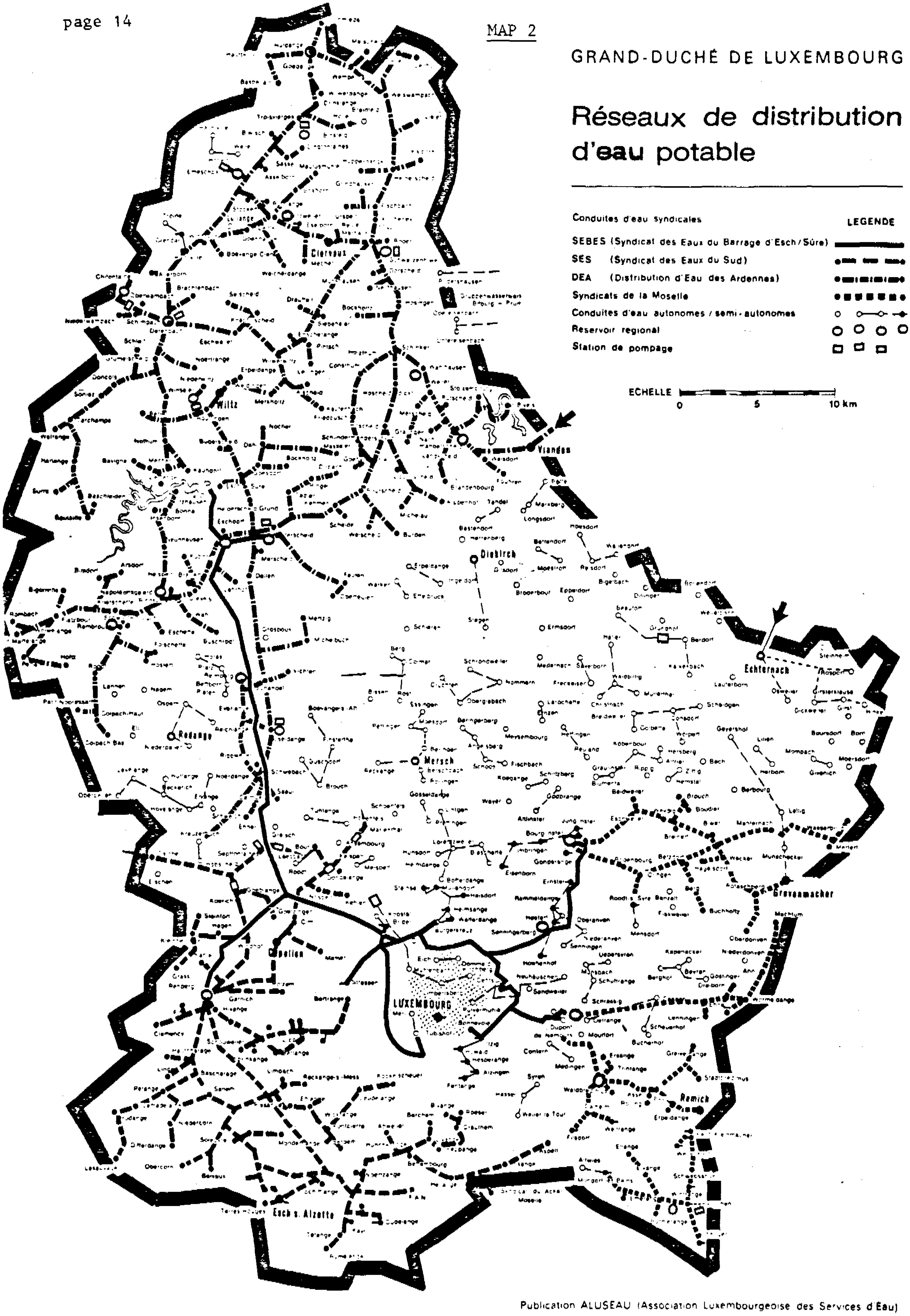
1980 - 1981



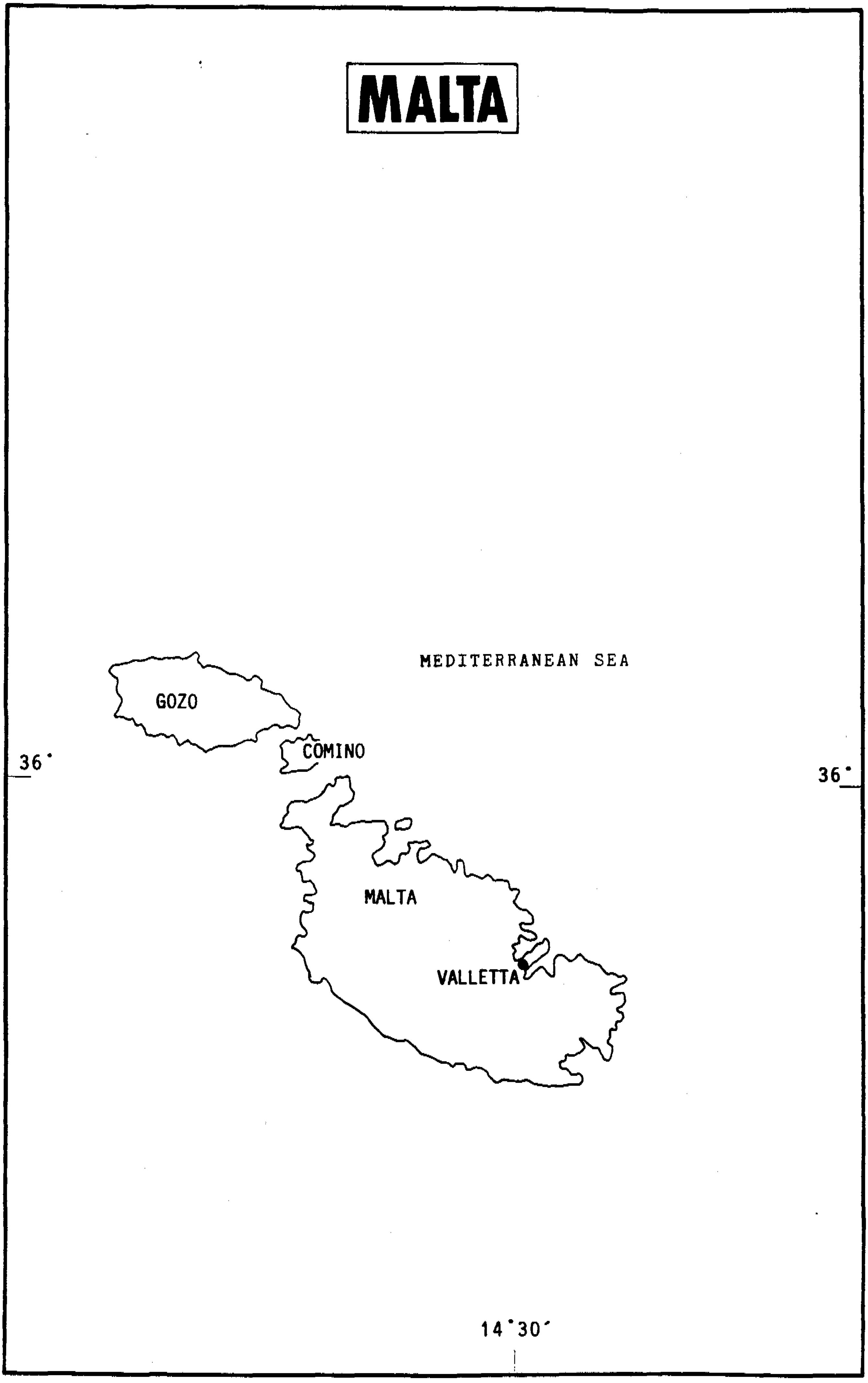
MAP 2

GRAND-DUCHÉ DE LUXEMBOURG

Réseaux de distribution d'eau potable



Publication ALUSEAU (Association Luxembourgeoise des Services d'Eau)
Réalisation PONTS ET CHAUSSÉES · Division des Eaux 1987


MALTA
MEDITERRANEAN SEA
GOZO
COMINO
MALTA
VALLETTA
36°
36°
14°30'

MALTA

The Republic of Malta comprises a group of six islands (the largest being Malta, Gozo and Comino) and several islets in the central Mediterranean, 93 km south of Sicily and 290 km north of the Libyan coast. In December 1984, the population stood at a little above 331 997. 91% of the population live in Malta, the remaining 9% in Gozo. The total land area is 316 km^2 (the island of Malta with 246 km^2), and the average density is approximately 1050 inhabitants per km^2. Population growth is of the order of 1% per year, with variations caused by the migration factor.

Government

Under the 1974 Constitution, legislative power is held by the single-chamber House of Representatives. The Head of State is the President, who appoints the Prime Minister and, on the latter's recommendations, the other ministers. Executive power is exercised by the Government. The island of Malta is governed directly by the central Government and has no system of local government. There are no large municipalities; the largest is the capital, Valletta, with a population of 14 000.

Administrative organization of water service

The administrative organization of water services in Malta falls under the responsibility of the Ministry of Works, from whence all water policy guidelines emanate.

Operational responsibility for public water systems rests with the water works and works departments of the Ministry, which provides water services for all the inhabited islands in the Maltese Archipelago. The administrative aspect side of the water works department is run by the water works manager, who performs the normal function of a head of a government department. He is the de facto water authority and all administrative functions are channelled through him. The technical side of the department is responsible for the production and distribution of water in the islands, and is headed by an assistant director of works. The department carries out planning, all design, most construction work, operation and maintenance functions, water quality surveillance, billing and collecting.

The sewerage system is dealt with by the drainage section, which is a part of the Works Department of the Ministry of Works. The section carries out all planning and design, and most construction work and operation and maintenance of pumping stations, sewage and sewers. 97% of the population of Malta and 75% of Gozo are connected to a common network and a programme of sewer extensions exists to connect further industrial estates and low lying areas, although these are expensive to construct.

Other ministries and agencies involved in water management include the Department of Health under the Ministry of Health and Environment which controls the quality of drinking-water and the sanitary disposal of wastes; the Economic Division in the Office of the Prime Minister, which vets and monitors capital investment in the sector; the Treasury for budgeting allocations; the Ministry of Agriculture and Fisheries; the Malta Development Corporation, the Tourist Board and others for information exchange on requirements for new or improved sector services. There is satisfactory liaison and coordination to harmonize the work of the various agencies.

The role of the Department of Health with regard to water quality

The Ministry of Health and Environment is responsible for water quality under the Food, Drugs and Drinking-Water Act No. XL of 1972 (IDHL, 25: 351)

The Department of Health has supervisory functions but has no executive responsibility insofar as supply, construction and maintenance is concerned in the water supply and sanitation sector. It has authority by legislation on the safety of drinking-water supplies and on house plumbing and sanitation. While drinking-water legislation is recent, legislation relating to environmental and pollution control goes back to the beginning of the century and has been amended through the years. The Department of Health approves building plans and has authority to determine where new cesspits are allowed and to monitor and prevent bathing in polluted waters. It also operates and supervises the emptying of cesspits which is practically free of charge to cesspit owners. It has set the eradication of typhoid fever as an operational goal. In fact, local cases of this disease are now rare.

The Public Health Laboratory, staffed with bacteriologists and analysts, has among its main functions the bacteriological monitoring of water supplies. At least twice weekly, samples are taken from all boreholes, reservoirs and pumping stations and also from all towns and villages. Some samples are taken before chlorination. The bacteriological record is very good. In the extremely rare case of bacteriological contamination, the Laboratory notifies the Water Works Department and uses radio and TV to request the people concerned to boil the water.

As regards water, public health inspectors become involved only where bacteriological contamination is detected. As regards liquid wastes, they supervise the cesspit servicing operations and house connections to public sewers, ensure that where possible such connections are made, and report on any occurrences needing attention.

There is an engineer, based in the sanitary engineering office of the Department of Public Works, who is responsible to the Chief Medical Officer, Department of Health. Buildings and drains are the engineer's main concerns. On satisfactory completion responsibility passes over to the public health inspectors.

Water and related legislation

There are various laws and regulations covering the water supply, the first being Proclamation XI of 30 September 1886. However, the main legislation that is updated when necessary is Chapter 36 of the Laws of Malta, Water Supply, and the Underground Water Ordinance No. XIII of 1943.

Water supply is regulated under Government Notice No. 133 of 16 March 1948, which is regularly amended, and the Food, Drugs, and Drinking-Water Act No. XL of 1972 (IDHL, 25: 351).

The Marine Pollution (Prevention and Control) Act No. XII of 1977 (IDHL, 28: 1026) implements international and regional conventions and protocols relating to the protection of the marine environment.

In the field of the control of oil pollution at sea, the Division of the Environment advises the armed forces of Malta (who are responsible for the actual control operations) on techniques and the most appropriate dispersants.

A regional oil-combating Centre for the Mediterranean Sea was established in Malta in 1976 by a grant from the United Nations Environment Programme (UNEP) in cooperation with the International Maritime Organization (IMO). This implements the Barcelona Convention of February 1976 on oil pollution in the Mediterranean Sea, which was signed by plenipotentiaries from 16 of the 18 states with shores on the Sea. The Centre is sited on premises provided by the Maltese Government, on Manoel Island in the Marsamxett Harbour. Its basic objectives are to facilitate cooperation among the Mediterranean states in the event of a massive oil spillage and to help them to develop their own anti-pollution capabilities. It has been active in collecting and disseminating information on products, equipment and experts available in the Mediterranean states to combat oil pollution of the sea, and its role may be expanded to include other harmful substances besides oil.

Water research

Research is geared to the needs of the Government, for example, new designs for water treatment plants, reservoirs, dams and water distribution networks and the correct running of existing sites.

The Scientific and Technical Pollution Control Subcommittee situated in the University of Malta, advises the Government, through the Central Pollution Control Committee, on pollution control problems, and up-to-date measures, and carries out projects in this field.

The Human Environment Council coordinates the national pollution research and control programmes, and advises the Government through the Ministry of Health and Environment on pollution problems.

The Water Works and Works Departments have chemical and bacteriological laboratories where some research is carried out by the permanent staff. Continuous analyses of water and sewage and their trends are also carried out by the staff of both departments, which employ a number of engineers and technicians as well as two geologists. In addition to carrying out their own research programme, they utilize the knowledge of foreign experts, who from time to time are detailed for duty in Malta.

Finance

About three-fourths of the water production are measured with master meters. All service connections are metered. Meters are read every four months and billing and collecting are carried out by the Department, which also collects bills for electricity on behalf of Enemalta. Water revenues go into the Consolidated Fund from which yearly expenditures are met for water and other services, including sewerage, for which there is no service charge. The tariff structure is progressive, thus penalizing high consumption and stipulates much higher rates for non-essential uses. Rates also vary depending on the category of the user, i.e., whether domestic, touristic, industrial or commercial. Government departments are charged a flat rate, as are sea crafts.

Sewage charges

There are no direct sewage charges. However, a frontage rate is charged to cover initial Government expenditure to extend drainage facilities.

Treated effluent

A new Government scheme to supply treated effluent is being implemented in the Sant'Antnin Area (M'Scala). Charges have been laid down by Law No. 28 of 13 May 1983 at Lm36 per Ha per annum of irrigable land.

Responsible agencies

Operation	Carried out by:
Water resources survey	Ministry of Works, Economic Division, Office of the Prime Minister
Water management policy	Ministry of Works, Economic Division, Office of the Prime Minister
Drinking-water production	Water Works Department
Drinking-water distribution	Water Works Department
Drinking-water quality surveillance	Department of Health Water Works Department
Agricultural irrigation	Department of Agriculture
Industrial water supply	Water Works Department
Underground water protection	Water Works Department
Surface water protection monitoring	Water Works Department
Water pollution control	Department of Health
Water resources storage and allocation	Water Works Department

Water resources availability and management

Rainfall

The climate of the Maltese Islands is of a Mediterranean type, with a mild wet winter and a long dry summer.

Malta is confronted with a relative scarcity of water. Average rainfall is about 508 mm per year and is unevenly distributed, with 86% falling between October and March. Surface runoff is very small, and natural recharging averages 120 mm per year.

Topography

"The Maltese Archipelago is the emerged part of the extensive North African Pelargean Carbonate shelf that stretches from the eastern Tunisian coast to the Ionian sea and from the Libyan coast to Sicily. This shallow shelf is predominantly of fossil origin and extends from the Late Tertiary down to at least the Upper Triassic. The Maltese Islands themselves are built up of a sequence of calcareous rocks of Miocene age with the lower parts of Oligocene age. Some sporadic deposits of thin terrestrial Quarternary deposits are also found directly on the Miocene."[a]

Water resources

"Although the major source of potable water of the Maltese Islands comes from the extraction of groundwater from aquifers, surface water also receives due consideration and accounts for 2% of the total water production."

"There are no provisional surface streams, the only surface water being limited to temporary flows along the beds of major valleys lasting only a few days after heavy downpours. These springs originate mostly from gravity discharges of the Perched Aquifer in the western part of Malta."

"Although the geological formations are almost horizontal, there is a regional dip to the North East, as a result of which the most elevated parts of Malta lie in the West and South West. This topographic configuration controls the major surface drainage which luckily crosses the entire width of the Island from the source close to the elevated West/South West to the North East where it enters the sea. This gives the surface water maximum time to seep into the underground aquifer through the pores and fissures of the permeable formations and accounts for the relatively low run-off figure of about 3% of the total precipitation which is lost directly to the sea."

"Percolation of surface water into the aquifer is also maximized by the presence of a large number of dams constructed across these drainage lines. These dams retard storm water and besides increasing seepage into the ground they also retard soil erosion. Because of this important function, desilting of these dams receives prior consideration and is carried out at frequent intervals."

"The little surface water that escapes permanent seepage into the ground forms springs and is mostly exploited by farmers between intermittent rains and the rest is collected into open reservoirs. Such water is usually of a high nitrate content and is always treated and blended with groundwater before put into the distribution network for consumption. Production from this surface water amounts to about 0.32 million gallons daily."

"Farmers have also, since prehistoric times, excavated underground cisterns in solid rock to store surface water led into them from lanes, gutters and the roofs of farmhouses. More recently, especially in the past decade, there has been a rapid increase in urbanization with numerous housing estates and accompanying roads cropping up all over the Island. Although this

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[a] Extracted from: The development of water resources in Malta, by A. Abela.

has undoubtedly modified to some extent the water balance of the Island, loss of surface water along roads has been minimized by constructing open reservoirs and soak-away pits. Furthermore, every house built in town or village has to provide a leak-proof underground cistern of about 0.7 m^3 capacity for every square meter of roof space of the house."

"Extraction of groundwater from the aquifers is the major source of potable water and accounts for some 12.5 million gallons per day. This water is extracted from 36 km of galleries in the Mean Sea Level Aquifer, 4.2 km of galleries in the Perched Aquifer and from over 150 boreholes scattered all over Malta and Gozo."

"There are twelve operational systems of galleries in Malta, two in Gozo and one in Comino. 150 boreholes have been successfully drilled and the average borehole production amounts to about 45 000 gallons daily (204 525 litres)."[a]

Practically all areas are served with piped drinking-water. 85% is for domestic use including tourism, or commerce, 12% is used by industry and the remaining 3% by agriculture (this figure excludes irrigation, which is not piped). The total piped water supplied in 1984 averaged 80 million litres per day. The deep underground fresh water lens constitutes the main source of water supplies. The perched aquifer furnishes only one tenth of the public water systems but supplies many private wells that draw from it about 6.3 million m^3 per year. To supplement the underground resources the policy in the past was to rely on sea-water desalting. Malta has four distillers with combined rating of 20 000 m^3 per day whose actual maximum output is 16 000 m^3 per day. At present only two distillers operate. Gozo has one distiller rated at 2250 m^3 per day.

Future trends of water resources

The breakdown on public water production for Malta is 57 000 m^3 per day from underground sources, 21 000 m^3 per day from reverse osmosis, and 2000 m^3 per day from distillers, giving a total of 80 000 m^3 per day. Underground water exploitation is confronted with the problem of salt water intrusion. Sea water distillation is a very expensive process that the present Government seeks to limit to the strictly necessary. The Maltese Government has installed two reverse osmosis plants at Ghar Lapsi and Marsa respectively which started production during 1983. They are producing 20 000 m^3 and 4 540 m^3 daily respectively at a much lower cost. It is now possible to do away to a large extent with the distillers.

The sewage treatment plant at Sant'Antnin was commissioned in 1983 and is producing 12 800 m^3 of treated effluent per day. Its effluent is used for agricultural irrigation, thus reducing the draw on groundwater. The purified water is also utilized by several industries.

[a] Extracted from: The development of water resources in Malta, by A. Abela.

The origin of drinking-water supply can be subdivided as follows:

- groundwater
- surface water
- desalinated water.

The present sources of water in Malta are listed below. Their average daily output for 1986 shows the relative importance of each source in the water supply structure.

SOURCE	PRODUCTION MILLION GALLONS PER DAY	PERCENTAGE OF TOTAL
Galleries - pumping station	6.90	34.79
Boreholes	4.86	24.51
Springs	0.30	1.51
Treatment plants	0.02	0.10
Brackish Water R.O.	0.59	3.15
Sea Water R.O. Lapsi/Tigne	6.00	26.16
Sea Water Distillation	0.83	4.43
Transfer of excess water from Gozo	0.33	1.76
TOTAL PRODUCTION	19.83	100%

General statistics

Population (December 1984)	331 997
Population in urban areas	75.0%
Population in rural areas	25.0%
Drinking-water supply	
Total piped supply for drinking purposes	80 Ml/d[a]
Total population served by a piped public water supply	98.0%
Urban population served by a house connection	100.0%
Urban population without house connections but with reasonable access to public standposts	0.0%
Rural population served by a piped public water supply, at home	96.0%
Rural population served by private systems at home or having reasonable access to public standposts	4.0%
Drinking-water supply uses	
Water supplied for domestic and commercial use	85.0%
Water supplied for industrial use	12.0%
Other uses	3.0%
Industrial water supply: direct abstractions	
Total supplied from inland waters for industrial use	12 Ml/d
Used for industrial cooling water	10.0%
Used as industrial process water	90.0%
Total coastal water used	20 Ml/d
Agricultural use: direct abstractions	
Total amount exstracted for irrigation	3 Ml/d
Other agricultural uses including fish ponds	Ml/d
Wastewater disposal services	
(a) % of urban population served by a sewerage network	95.0%
(b) % of urban population served by other adequate means	5.0%
(c) % of urban population lacking adequate disposal means	0.0%
(d) % of rural population served by a sewerage network	84.0%
(e) % of rural population served by other adequate means	16.0%
(f) % of rural population lacking adequate disposal means	0.0%

[a] Ml/d = million litres per day.

Sewage treatment

(g)	% of sewerage systems receiving primary treatment only	%
(h)	% of sewerage systems receiving secondary treatment	%
(i)	% of sewerage systems receiving tertiary treatment (315 000 persons)	95.0%
(j)	% of sewerage systems receiving no treatment (raw discharge)	5.0%

Discharge of treated sewage

(k)	% discharged into the sea	%
(l)	% discharged into surface water bodies	%
(m)	% discharged onto farmland	100.0%

Discharge of untreated sewage

(n)	% discharged into the sea	100.0%
(o)	% discharged into surface water bodies	%
(p)	% discharged onto farmland	%

Sludge disposal

(q)	% of sludge disposed into the sea	100.0%
(r)	% of sludge disposed into surface water bodies	%
(s)	% of sludge disposed onto farmland	%
(t)	% of sludge disposed as landfill	%
(u)	% of sludge incinerated	%

Useful addresses

Governmental

Ministry of Works
Water Works Department
Valletta

Tel. 22010 - 29918
Tel. 1100 MODMLT MT

Water Industry

As above

Water research

As above

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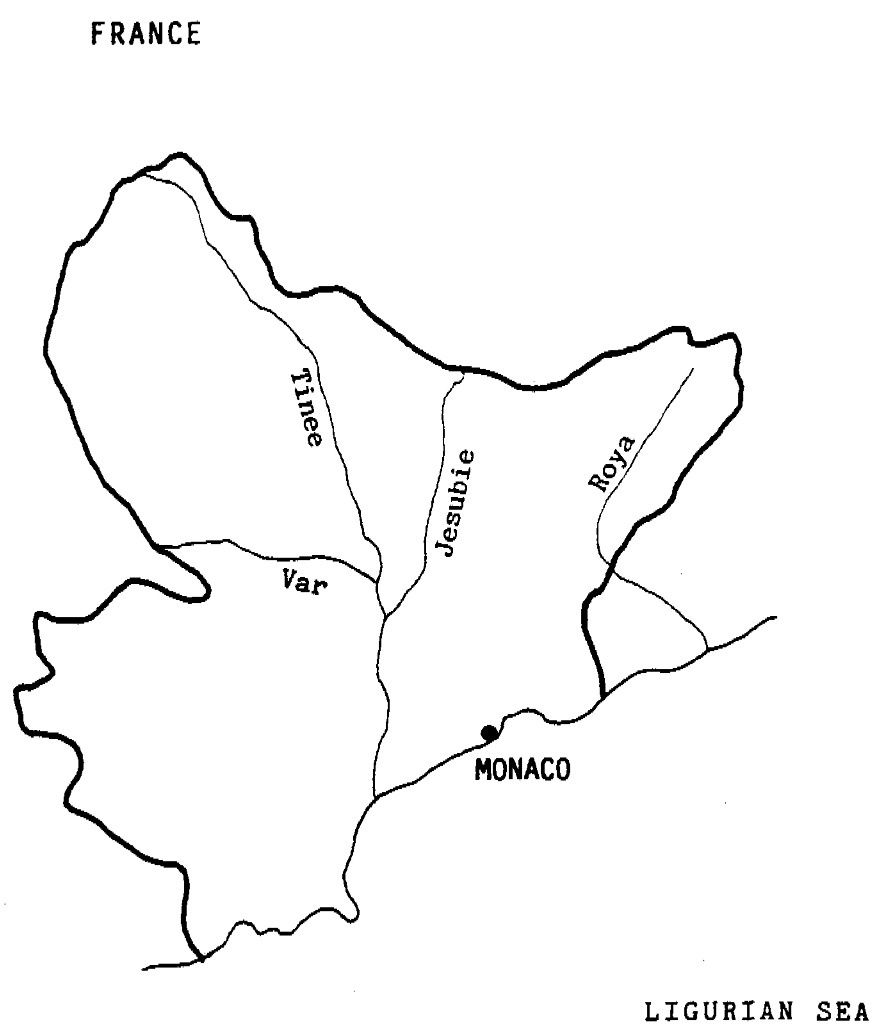
Assistant Director of Public Works
Head of Water Works Department
Beltissebh

Tel. 225583 or 227534
Tlx. 1100 MODMLT MT

MONACO



MONACO

Monaco is a small Principality lying on the south-eastern Mediterranean coast of France and it is surrounded by the French Department of "Alpes Maritimes". The total area of Monaco is 195 hectares (1.95 Km^2) which is entirely urban in character. About 20 hectares have been recovered from coastal areas, permitting the accommodation of the surplus of population.

The total population of the Principality is 27 063 (1982). However, this is considerably augmented throughout the year by the arrival of large numbers of tourists attracted by the sea, the climate and other attractions offered by the State.

Government

Monaco is governed by a heriditary monarchy represented by a reigning Prince who is assisted by a National Council (18 members elected every 5 years), a Communal Council (16 members elected every 4 years) and several Government Councillors taking care of the implementation of internal and external policies. The country is divided into four districts: Monaco-Ville, la Condamine, Monte Carlo and Fontvieille.

Administrative organization of water services

The water resources of Monaco are insufficient to cater to the needs of the resident population and visitors (approximately 242 000 tourists were recorded in 1983). Water is therefore supplied from the neighbouring French and Italian Riviera Regions.

The Société Monégasque des Eaux (S.M. EAUX) is responsible for distributing the water supplied and for monitoring its quality. The S.M. EAUX is controlled by an institution of the Administrative Services of the Government of Monaco: The Services for Technical Controls (C.T.).

Role of the health department with regard to water quality

Public health affairs are the responsibility of the Councellor for the Interior. The Sanitation and Social Work Department administers and evaluates specialized services, with the assistance of a consultative committee on public health. The mayor of the town is responsible for sanitation and public hygiene, under the authority of the Minister of State. With regard to water quality, however, the contract established with the Société Monegasque des Eaux gives them the responsibility for chemical and biological analyses of water, with official health laboratories exercising daily analytical control from the point of view of public health only.

Water and related legislation

A large proportion of the water supplied to the country (between 10% and 20% of the total) arrives from France, for which reason all legislative matters concerning the quality of water from France has to adhere to French legislation.

With regard to water produced locally, it is being controlled and protected in accordance with special local decrees: "Ordonnance Souveraine et Arrêtés Ministériels".

Water research

Research activities are mainly related to the studies on the pollution of coastal waters caused by waste processing and discharges. Research activities are carried out by the "Centre scientifique de Monaco". Monaco is the headquarters of the International Commission for the Scientific Exploration of the Mediterranean Sea (ICSEAM).

Finance

Public funds are allocated, when required, to the construction of water and sanitation systems. In general, financial means for waterworks, wastewater and sewage treatment plants are derived from charges to households, industrial and commercial undertakings, and farmers. The price per cubic metre of water is the same as the one of the neighbouring French community of Beausoleil

Water charges

At present, the S.M. Eaux pays about 8 million francs per year to the French firms providing water to the country. The cost of production and management is estimated at FF 2 350 000 annually. This amount does not include the depreciation of the capital investment made for the water supply system of "La Roya" which is estimated at FF 6 500 000 per year.

Sewage Charges

The maintenance of the sewage system costs about FF 650 000 per year. The rehabilitation of old sewage pipes also represents an additional expenditure which varies from year to year.

Responsible agencies

Operation	Carried out by
Water resources survey	Monaco Government authorities
Water management polity	Monaco Government authorities
Drinking-water production	French water supply firms and Société Monégasque des Eaux
Drinking-water distribution	Société Monégasque des Eaux
Drinking-water quality surveillance	Société Monégasque des Eaux Health Authorities and Service Nationaux de Contrôle Technique
Industrial water supply	French water supply firms and Société Monégasque des Eaux (domestic and industrial water distributed together)
Marine pollution control	Centre Scientifique de Monaco
Underground water protection	Monaco Government authorities
Wastewater collection and treatment	Public Works Department

Water resource availability and management

Rainfall

An analysis of the data collected during the last 20 years at Nue and Monaco has made it possible to identify the relation between rainfall intensity ("i", in mm/minute) and the duration ("t") of the rain in minutes:

$$i = 6,\ 6 \times t^{-0.56}$$

This correlation is being applied to estimate critical storm rainfall rates when designing rainwater network systems.

Topography

The landscape is very irregular, composed of deep slopes descending from the hills to the coastal areas. Flat land can only be found in a few places, mainly near the sea.

Population/water resources

The Principality is deficient in water resources and much of the local water supply comes from France and Italy. In 1983, a total of 5 511 391 m^3 was consumed, out of which 1 096 755 m^3 had been produced locally (approximately 20%). Water consumption per capita per year is estimated at 200 m^3.

Wastewater management

The national master plan of sanitation has three main objectives:

1. treatment of the present and future quantities of wastewater produced during the dry season (rainwater and sewage);

2. partial treatment of the first storm water wave carrying the maximum pollution charge;

3. to reduce to a minimum the discharge of untreated wastewater in the marine environment.

The wastewater system has been subdivided into two main components, the first one being the pretreatment installations located underground, inside the Saint-Martin Gallery. It consists of mechanical devices for the removal of suspended solids, sand and oils, transported by a network that carries rainwater and wastewater. The second one is the treatment station which is capable of receiving about 500 litres/second of pretreated effluents. This amount corresponds to the maximum dry season flow foreseen for the years 2015-2025. Treatment is carried out by decantation through numerous thin plates ("décantation lamellaire" or laminated decantation). In order to improve the performance of the laminated decantation process, the influent is previously forced to pass through special mixing and floculation tanks. Then, the fluid undergoes biological filtration (biocarbone filters or membranes) according to a method designed by the French firm of "Omnium de Traitements et de Valorisation" (O.T.V.).

The sludge produced follows a special centrifugal-drying process until total stabilization is obtained and the sludge is reduced to a granular form which can be incinerated at the solid waste treatment plant of the town, or it can be placed into bags for subsequent use as fertilizing material.

General statistics

Population

Population in urban areas (1982)	27 063
Population in rural areas	0

Drinking-water supply

Drinking-water supply

Total piped supply for drinking purposes (1983)	5.5 m^3/y[a]
Total population served by a piped public water supply	100.0%
Urban population served by a house connection	100.0%
Urban population without house connections but with reasonable access to public standposts	0.0%
Rural population served by house connections (public or private)	-
Rural population without house connections but with reasonable access to public standposts	-

Drinking-water supply uses *

Water supplied for domestic and commercial use
Water supplied for industrial use
Other uses

Industrial water supply: direct abstractions *

Total supplied from inland waters for industrial use
Used for industrial cooling water
Usage as industrial process water
Total coastal water used

Agricultural use: direct abstractions

Total amount abstracted for irrigation	None
Other agricultural uses including fish ponds	None

[a] Mm^3/y = million cubic metres per year

* Domestic and industrial water are supplied by the same system. There are no heavy water consuming industries in Monaco.

Wastewater disposal services

(a)	% of urban population served by a sewerage network	100.0%
(b)	% of urban population served by other adequate means	-
(c)	% of urban population lacking adequate disposal means	-
(d)	% of rural population served by a sewerage network	-
(e)	% of rural population served by other adequate means	-
(f)	% of rural population lacking adequate disposal means	-

Sewage treatment

(g)	% of sewerage systems receiving primary treatment only	-
(h)	% of sewerage systems receiving secondary treatment	100.0%
(i)	% of sewerage systems receiving tertiary treatment	-
(j)	% of sewerage systems receiving no treatment (raw discharge)	-

Discharge of treated sewage

(k)	% discharged into the sea	100.0%
(l)	% discharged into surface water bodies	-
(m)	% discharged onto farmland	-

Discharge of untreated sewage

(n)	% discharged into the sea	-
(o)	% discharged into surface water bodies	-
(p)	% discharged onto farmland	-

Sludge disposal

(q)	% of sludge disposed into the sea	-
(r)	% of sludge disposed into surface water bodies	-
(s)	% of sludge disposed onto farmland	50.0%
(t)	% of sludge disposed as landfill	-
(u)	% of sludge incinerated	50.0%

Useful addresses

Governmental

Mr A Vatrican
Secrétaire Général
Centre Scientifique du Monaco
16, boulevard de Suisse
MC-Monaco

Monsieur le Conseiller de Gouvernement pour les Travaux Public
et les Affaires Sociales
Ministère d'Etat
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Monaco-Ville

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Telex 46 99 42 gouvermo-carlo

Water industry

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Centre Administratif
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Société Monégasque des Eaux
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Water research

Contrôle Technique
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Others

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MC-Monaco

Dr E. Boéri
Conseiller technique
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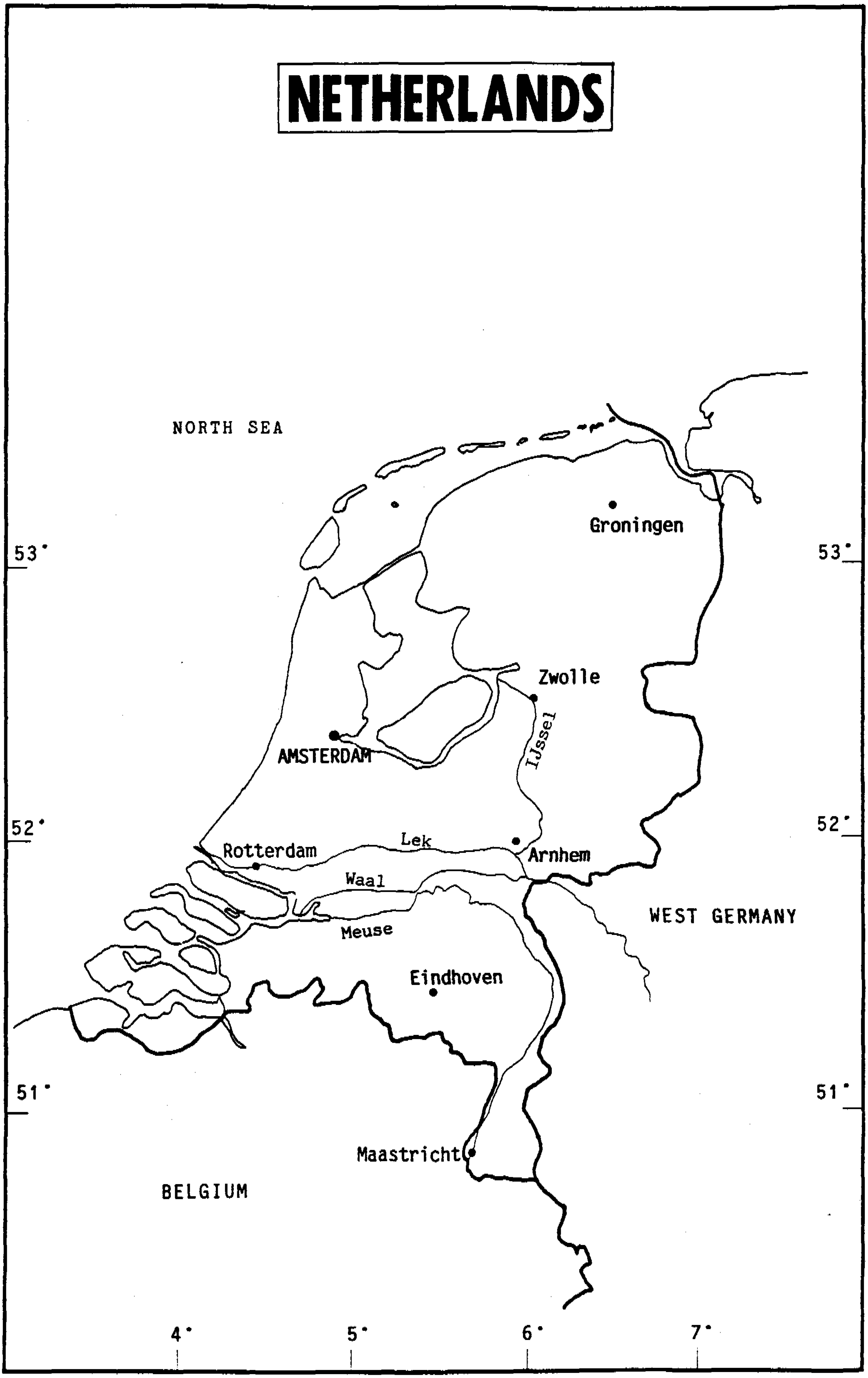
MC-Monte-Carlo


NETHERLANDS
NORTH SEA
Groningen
53°
53°
Zwolle
IJssel
AMSTERDAM
52°
52°
Lek
Rotterdam
Arnhem
Waal
WEST GERMANY
Meuse
Eindhoven
51°
51°
Maastricht
BELGIUM
4°
5°
6°
7°

THE NETHERLANDS

The Netherlands is situated in northwest Europe at latitude 52°N and longitude 5°E; the country is bounded on the east by the Federal Republic of Germany, on the south by Belgium and the west and north by the North Sea. It has a total area, including inland lakes, estuaries, etc., of 41 548 km^2; the land area is equal to 33 930 km^2. In 1985, its population was 14 453 833 (348 inhabitants per km^2). The capital, Amsterdam, has a population of 998 130 but the agglomeration of Rotterdam has 1 021 141 inhabitants. The seat of government is in The Hague ('s-Gravenhage).

Government

The Netherlands is a constitutional and hereditary monarchy with legislative power vested in the Crown and a two-chamber Parliament or States-General (Staten Generaal). Parliament consists of a lower house (tweede kamer) of 150 members elected for four years by direct universal suffrage; and an upper house (eerste kamer) of 75 members elected by the provinces, equally for four years. Legislation must be approved by both chambers. Executive power is exercised by the monarch and by a council of ministers (ministerraad) who are referred to jointly as "the Crown". However, the assent of parliament (statengeneraal) is necessary for making war or peace, for the ratification of treaties, the appointment or dismissal of ministers and the right to dissolve either of the chambers of parliament. The Crown is advised on legislative matters by a council of state (raad van state) of 29 members. The Sovereign appoints and presides over the Council of State and, with the Cabinet, consults it on legislation and administrative policy and on the issuing of decrees. The Council is the highest Court of Appeal in administrative disputes.

For local government, the Netherlands is divided into 12 provinces, each of which has its own directly-elected representative body, the Provincial Assembly. Each Provincial Assembly elects from its members a college of "Provincial Councils" ("Provinciale Staten") to act as the executive committee of the province. A Royal Commissioner is appointed and may be discharged by the Crown, and is the representative of the Crown in the province. He acts as chairman of both the Provincial Assembly and the Deputy States. The Provincial Assembly has a constitutional right to make its own decisions on measures of interest to the province.

At local level, the administrative units are the municipal councils. There are about 720 municipalities, each governed by a Burgomaster appointed by the Crown and assisted by municipal councils elected by direct popular vote. Municipalities may make local regulations.

Administrative organization of water services

The 86 public water supply undertakings are divided as follows:

- 52 municipal institutions
- 17 publicly owned limited liability companies
- 3 foundations
- 6 joint organizations
- 1 provincial body
- 1 state-owned body
- 3 privately owned limited liability companies

Income amounts to about 1 500 X 10^6 guilders.

Role of the health department with regard to drinking-water quality

The Ministry of Housing, Physical Planning and Environmental Management is responsible for drinking-water quality standards and their supervision. In order to undertake this responsibility the Ministry needed a legal framework. This need became more urgent as water abstraction and production became consolidated in some 90 water companies that supply all the large population centres and almost 100% of houses, even in rural parts of the country.

The Law No. 150 of 6 April 1957 on drinking-water supplies and the Decree No. 345 of 7 June 1960 (IDHL, 10: 110 and 13: 129), which became effective on 1 March 1961, allowed inspection of the water companies, not only with respect to aspects of water resources and distribution, but also regarding hygienic production methods and health of the staff.

This government inspection is being coordinated by the Ministry's Directorate for Drinking Water Supply, Water and Soil Quality. In cooperation with the water supply companies themselves and other ministries, and after consultation of provincial governments, this Directorate is also responsible for planning and protecting water resources to cover water demands.

The supervision is carried out by regional inspectors of public health, who also supervise the protection of groundwater and surface water catchment areas. The purpose of the supervision is to ensure compliance with a fundamental requirement of the Law No. 150 (Section 4, 1st para.): "It shall be the duty of the owner of a water company to ensure that the provision of wholesome drinking-water to consumers in his distribution area is guaranteed in such quantity and at such pressure as the interest of public health requires".

Hydrogeological and biochemical assistance to the Directorate and the inspectors is given by the National Institute for Public Health and Environmental Hygiene (RIVM). All circumstances that could be hazardous to the distribution of drinking-water, have to be reported to the Inspector. Almost from the time the Law of 6 April 1957 came into effect, an informal consultation body has been established with representatives of the Inspectorate of Public Health and the Netherlands Waterworks Association (VEWIN). The main task of this body is to stimulate uniformity in the application of the regulations. Matters dealt with include technical and hygiene aspects of water undertakings' policies; the risks from cross-connections; the installation of water treatment apparatus; drinking-water installations in large buildings; the problems of lead pipes and the periodical revision of the "General Regulations on Drinking-Water Installations" and the consequences of these regulations.

In the future, the attention paid to water works by the Inspectorate of Public Health is likely to increase rather than decrease; it will be more broadly aimed and include also aspects outside the legal framework.

Water and related legislation

The control of water in the Netherlands goes back to the earliest systems of dikes and pumps to drain and reclaim land from the North Sea and the Rhine Delta. Most of the water corporations are still concerned with water removal, but several now work on the augmentation of water supply and the control of pollution. The Surface and Water Pollution Act was promulgated in December 1970 and provided the legal basis for controlling water pollution. National policies for sanitation and water quality were formulated as an integral part of "Water Action Programmes" which have come into operation every five years since 1975. One of the main features of the Act was the promotion of an administrative decentralization that subdivided the responsibility for water quality management into three hierarchical levels:

- State level: for main rivers (Rhine, Meuse and Scheldt), lakes, coastal waters, etc.

- Provincial level (all other waters)

- Water Boards for supply systems and for water quality control.

The majority of the above-mentioned Boards are separately responsible for either water supply or water quality control. However, there are a few Water Boards holding both responsibilities.

The Surface and Water Pollution Act established the conditions for the quality and quantity of residual waters to be discharged into surface water bodies. It also set up the basis for the adoption of the "polluter-pays" principle which has been adopted by the country.

The enforcement of this Act is directed by the Ministry of Transport and Public Works and is carried out by the provincial executives and their deputies with the advice of the National Institute for Effluent Treatment (RIZA). Among the decrees enacted under WVO, that of 28 November 1974, Stb 709 (IDHL, 27: 176) contains a list of substances whose discharge into surface waters is prohibited or subject to licence. The Council Directive on biodegradability of surfactants in washing products is implemented by the Decree of 16 June 1977, Stb 474 (IDHL, 30: 95). The WVO is currently being revised to bring it into line with Council directives.

EEC Directive No. 80/778/EEC on the quality of water intended for human consumption was incorporated in the above-mentioned decree No. 345 of 7 June 1960. In June 1981, the Law on the pollution of surface waters (WVO) was adapted to the EEC Directive No. 75/440/EEC on the quality of water intended for human consumption.

In 1980, another law concerning the environment was edicted, the "Environmental Protection (General Provisions) Act". This Act regulated the procedures for authorizing wastewater discharges into the environment (discharge licences), and laid down the principles which make it possible to appeal decisions made on the basis of misinterpretation of various environmental acts.

Provisions for groundwater quality control can be found mostly in Provincial Protection Ordinances, Municipal Planning Regulations and other legislation (e.g. Nuisances Act; Chemical Waste Law; Mining Law and Nuclear Energy Law). A Law on Groundwater Abstraction (Groundwater Act) came into force on 1 March 1984.

Recently, a "Soil Protection Act" (covering also several aspects of groundwater protection) has come into force (1 January 1987), delegating responsibilities to provinces, but allowing for a broad supervision at national level. In addition, Parliament is studying a new "Water Management Bill" which defines the responsibilities between the different administrative levels and simplifies the water planning systems.

The Netherlands is signatory to the Convention for the Protection of the Rhine against Pollution.

Marine pollution is covered by the WVO and by the laws of 16 September 1966 (No. 400) and of 5 June 1975, Stb 352 (IDHL, 18: 778 and 28: 317) which implement the London and Oslo Conventions. The Bonn Convention of 1969, which was ratified in 1972, Stb 472, provides for cooperation among the North Sea states to control oil pollution. Drilling and mining in the territorial waters of the North Sea comes under the Mines Council, while drilling in the Netherlands zone of the North Sea continental shelf is under the authority of the Ministry of Economic Affairs, with advice from the Mines Council.

Water research

Since the public water supply in the Netherlands already covers the needs of 99.2% of the population and a great deal of the industrial water demand (excluding cooling purposes), the focus points for research are mainly in the impact of environmental pollution on the water resources, the quantitative restrictions to the availability of resources for water supply and the steadily increasing demand for water.

Many organizations are involved in this research. At the national level research is carried out by:

- The National Institute of Public Health and Environmental Hygiene (RIVM) (Bilthoven), including the former National Institute for Water Supply (RID);

- Institute for Inland Water Management and Wastewater Treatment;

- The Central Research Institute (KIWA) of VEWIN;

- The National Institute for Effluent Treatment (RIZA) including water quality management;

- The National Waterways Authority (RWS);

- The Delft Hydraulic Laboratory (WL);

- The Research Institute for Environmental Hygiene, Delft;

- The Institute for Land and Water Management Research (Wageningen);

- The Agricultural University, Department of Land and Water Use, Department of Water Pollution Control.

- The Ministry of Housing, Physical Planning and Environmental Management (VROM).

At the provincial level, research is carried out by the Provincial Water Management Authority (PW) and the Institute for Groundwater Exploration (DGV-TNO).

Besides, local studies are carried out by water supply companies (Regional Water Boards), the Advisory Committee for Licensing of Groundwater Withdrawal (COGROWA) and several public institutes and consultant organizations dealing with water management, agriculture and nature management.

The annual research budget of KIWA is approximately US $3.5 million. The annual budget for the relevant research of RIVM and VROM is approximately US $2 million.

The main objects of research are:

<u>Quality</u>

- monitoring the quality of drinking-water by the water companies' own laboratories and by RIVM;

- monitoring the quality of surface water in a joint monitoring network of RIVM, RIZA, KIWA and some major water companies. There are now about 2500 sampling stations, 250 of which are located along water bodies under the control of the Central Government. Sampling is carried out fortnightly and an average of 20 parameters are controlled. This means that about 120 000 water quality data are processed and stored in a data bank just for surface waters controlled by the state. In order to cope with the volume of water quality data, automatization of services is being progressively introduced;

- monitoring the quality of groundwater in a monitoring network of RIVM;

- periodical surveys of the quality of surface water and groundwater, focused on specific groups of chemicals by RIVM and KIWA;

- preservation of water recharge areas from pollution by RIVM, KIWA, and PW;

- the occurrence and behaviour of chemicals in water resources and drinking-water, especially pesticides and other hazardous organic chemicals by RIVM and KIWA;

- improvement of methods for water treatment by KIWA and major water companies;

- permission for application of materials and chemical in the water supply by KIWA and manufacturers.

Quantity

- availability of surface water by RWS, WL, RIVM;
- groundwater resources by RIVM, DGV-TNO, PW, water companies;
- groundwater recharge capacity at district locations and restrictions by related interests, for example agriculture and nature management, by COGROWA, RIVM, other institutes and consultants.

Planning and development

- water demand by the Ministry of Housing, Physical Planning and Environmental Management, VEWIN and water companies,
- components for the long-term planning or the national policy by the Ministry of Housing, Physical Planning and Environmental Management and RIVM,
- components for the medium-term planning by VEWIN.

Finance

Water undertakings get their revenue from householders, farmers, industrial and commercial enterprises, but in some instances, as in Amsterdam for example, revenue is not received from the householders but from the houseowners.

Water Charges for

Potable Water Supply

Public water supply companies are all self-supporting on their income from water delivery. However, their rating systems as well as their prices per m^3 differ widely. All industrial consumption and about 70% of domestic consumption is being rated by metering; for about 30% of domestic consumption there exist still other rating systems (dwelling surface, number of taps, etc.). As metering small amounts of water is still costly, in relation to water prices, growth of metering percentage is very low. In the old unmetered cities (Amsterdam, Rotterdam), piping systems in the houses would also have to be changed before introducing water meters.

Sewage Charges

Sewage charges are currently based on rateable values for domestic properties and for the smaller industries. Larger industries are charged according to the metered amount of water supplied by the waterworks.

Responsible agencies

Operation	Carried out by
Long-term planning of water resources management	a. Ministry of Housing, Physical Planning and Environmental Management b. Ministry of Agriculture and Fisheries c. Ministry of Transport and Public Works d. Provincial Authorities
Water resources survey	a. Ministry of Housing, Physical Planning and Environmental Management b. Provincial Authorities
Water management policies	a. Ministry of Housing, Physical Planning and Environmental Management b. Ministry of Agriculture and Fisheries c. Ministry of Transport and Public Works d. Provincial Authorities
Drinking-water production	Water supply companies
Drinking-water distribution	Water supply companies
Drinking-water quality surveillance	a. Ministry of Housing, Physical Planning and Environmental Management b. Water Quality Boards c. Ministry of Health and Environmental Protection
Agricultural irrigation	a. Ministry of Agriculture b. Provincial Authorities
Industrial water supply	a. Water supply companies b. Local and Provincial Authorities
Underground water protection	Provincial Authorities
Surface water protection monitoring	a. Ministry of Public Works b. Provincial Authorities
Water pollution control	a. Ministry of Housing, Physical Planning and Environmental Management b. Ministry of Health and Environmental Protection c. Provincial Authorities

Water resources availability and management

Rainfall

The climate of the Netherlands varies according to maritime influences, but it is fairly uniform throughout the country. The mean winter temperature is around 0°C and the mean summer temperature about 16°C. Precipitation varies between 650 and 900 mm, the average annual rainfall being considered to be 700 mm. The areas with the heaviest precipitation are the regions behind the dunes, the sandy areas in the middle of the country and southern Limburg. The mean annual evapotranspiration reaches 500 mm. The combined cycle of precipitation and evapotranspiration provides for a water surplus in the winter and a deficit in the summer.

Topography

The total area of the country has varied widely. It has been decreased by coastal erosion and sea flooding, but these losses have been more than compensated by extensive silting and by land reclamation. Approximately two-fifths of the country lies below sea-level and has to be protected from flooding by dunes and dikes. A large part of the remainder of the country is composed of sandy regions that rarely rise above 100 m except in south Limburg. Three large rivers, the Rhine, Meuse and Scheldt, flow through the centre of the country. Their courses are roughly parallel and have formed a wide alluvial plain.

There are four main geological areas.

1. The southern Limburg plateau rises to more than 100 m generally and in some places to more than 300 m. It is dissected by deep valleys with swift streams. The soil is fine loess and is used for growing wheat and sugar beet and for meadowland in the valleys. The underlying carboniferous deposits, a continuation of those in Belgium, have been used for coal mining.

2. The sandy areas of the south east consist largely of alluvial deposits and reclaimed peat bogs with some glacial ridges rising to 100 m. They are largely agricultural with some wooded and heathland areas.

3. The alluvial plain of the Rhine and the Meuse. The rivers are slow moving and meandering and deposit large quantities of silt. The plain stretches across the central Netherlands and largely consists of the Rhine delta with its divergent tributaries. The rivers are diked along a large proportion of their lengths, mainly at some distance from their summer beds. Villages and their arable lands are mostly situated on sandy levees along the rivers.

4. The coastal belt is divided by the wide estuaries of the Scheldt and Rhine-Meuse and includes several large islands. Most of the area, including the islands, is protected from flooding by dikes and dunes. Land reclamation has been in progress for many centuries and the peat and clay soils have been made suitable for various types of agriculture.

Population/water resources

The highest concentrations of population are in the provinces of South- and North-Holland and Utrecht, an area which is less than one-fifth of the country, but which contains nearly half the total population. Most of the towns with over 100 000 inhabitants are in this area. The port areas of Amsterdam and Rotterdam are heavily industrialized and there are large concentrations of industry around the towns of The Hague, Utrecht, Haarlem, Leiden, Hilversum, Delft, Dordrecht and Amersfoort.

The Water supply companies supplied in 1984 a total of 1102 million m^3. The major part of this water (739 million m^3) is derived from groundwater. Most of the surface water is abstracted from the Rhine and the Meuse. These international rivers, especially the Rhine (which supplies 70% of the total amount of fresh water in the country), are heavily polluted when they enter the Netherlands. Interstate agreements have recently been reached in the European Community to abate surface water pollution but, although some improvements are noticeable, the overall situation is far from satisfactory. From the total surface water abstraction of 382 million m^3, 165 million m^3 is abstracted after bankside infiltration and the remainder is abstracted directly or via storage basins. Additional groundwater is abstracted directly by industry (235 million m^3 in 1984) and for agricultural use (312 million m^3 in 1981).

Future trends of water resources

The greater awareness of the effects of pollution on drinking-water quality will in the near future lead to changes in the drinking-water legislation that will also affect the legislation on water resources. In general, about 70% of the drinking-water is obtained from groundwater sources and the balance from surface waters. However, this proportion is expected to be almost inverted by the turn of the century.

The water policy, at present being implemented, is based upon seven basic principles, which are:

a. To bring about a harmonized policy by means of a water system approach (conciliating the interests of the different water users: drinking water, industries, agriculture, shipping, recreation, nature, environment and economy).

b. More effective use or innovation of the infrastructure (optimalization of water uses).

c. Ecological assimilation of human action.

d. Further development and differentiation of policy on discharges (regulation of emissions to protect the ecological functioning of water systems).

e. Review of groundwater policies (extraction control, pollution control).

f. Review of the administrative and legal instruments (to adjust them to an integrated water management system).

g. Review of the present financing system (optimalization of the allocation of financial resources according to responsibilities).

General statistics

Population (1980)

Population in urban areas	88.0%
Population in rural areas	12.0%

Drinking-water supply

Total piped supply for drinking purposes (1984)	624 (10^6) m^3/y*
Total population served by a piped public water supply	99.2%
Urban population served by a house connection	99.8%
Urban population making use of an entirely private system	0.2%
Rural population served by house connections	95.0%
Rural population served by private systems (wells, etc.)	5.0%
Rural population without house connections but with reasonable access to public standposts	0.0%

Drinking water supply uses

Water supplied for domestic and commercial use	73.0%
Water supplied for industrial use	20.0%
Other uses	7.0%

Industrial water supply: direct abstractions, groundwater 1984

Total supplied from inland waters for industrial use	235 (10^6) m^3/y
Used for industrial cooling water	122 (10^6) m^3/y
Other purposes	49 (10^6) m^3/y

Agricultural use: direct abstractions

Total amount abstracted for irrigation (1976)	775 (10^6) m^3/y
Other agricultural uses including fish ponds	m^3/y

Wastewater disposal services (1985)

(a) % of urban population served by a sewerage network	99.8%
(b) % of urban population served by other adequate means	0.0%
(c) % of urban population lacking adequate disposal means	0.0%
(d) % of rural population served by a sewerage network	18.0%
(e) % of rural population served by private adequate means	82.0%
(f) % of rural population lacking adequate disposal means	0.0%

* m^3/y = cubic metres per year

Sewage treatment (1985)

(g)	% of sewerage systems receiving primary treatment only	7.0%
(h)	% of sewerage systems receiving secondary treatment	75.0%
(i)	% of sewerage systems receiving tertiary treatment	3.0%
(j)	% of sewerage systems receiving no treatment (raw discharge)	15.0%

Discharge of treated sewage (1985)

(k)	% discharged into the sea	5.0%
(l)	% discharged into surface water bodies	95.0%
(m)	% discharged onto farmland	-

Discharge of untreated sewage (1985)

(n)	% discharged into the sea	-
(o)	% discharged into surface water bodies	100.0%
(p)	% discharged onto farmland	-

Sludge disposal (1982)

(q)	% of sludge disposed into the sea	7.8%
(r)	% of sludge disposed into surface water bodies	0.7%
(s)	% of sludge disposed onto farmland	53.2%
(t)	% of sludge disposed as landfill	28.7%
(u)	% of sludge incinerated	9.6%

NOTE: the estimated production of sewage sludge for 1985 is 300 000 tons of dry-sludge.

Useful addresses

Governmental

Ministry of Housing, Physical Planning and Environmental Management
Directorate of Drinking and Industrial Water Supply
P.O. Box 450
2260 MB Leidschendam
Tel.: (70) 209367

National Institute of Public Health and Environmental Hygiene (RIVM)
Postbus 1
3720 BA Bilthoven
Tel.: 030-749111

Water Industry

The Netherlands Waterworks Association (VEWIN)
KIWA Building
Sir Winston Churchill laan 273
Postbus 70
2280 AB Rijswijk
Tel.: (70) 953535
Telex: 32480

Dutch Association for Water Treatment and Water Quality Control
P.O. Box 70
2280 AB Rijswijk
Tel.: (70) 902720
Telex: 32480

Water Research

Central Research Institute
(Keuringsinstituut voor waterleidingartikelen (KIWA N))
Sir Winston Churchill laan 273
Postbus 70
2280 AB Rijswijk
Tel.: (70) 902720
Telex: 32480

Research Department:

Groningenhaven 7
Postbus 1072
3430 BB Nieuwegein
Tel.: (3402) 60860

Water Management

Union of Water Boards
P.O. Box 29740
2502 LS The Hague
Tel.: (70) 469797

Agriculture/Landscape Management

Institute for Land and Water Management Research
P.O. Box 35
6700 AA Wageningen
Tel.: (70) 19100

Universities

Agricultural University
Department of Land and Water Use
Nieuwe Kanaal 11
6709 PA Wageningen
Tel.: (70) 82875

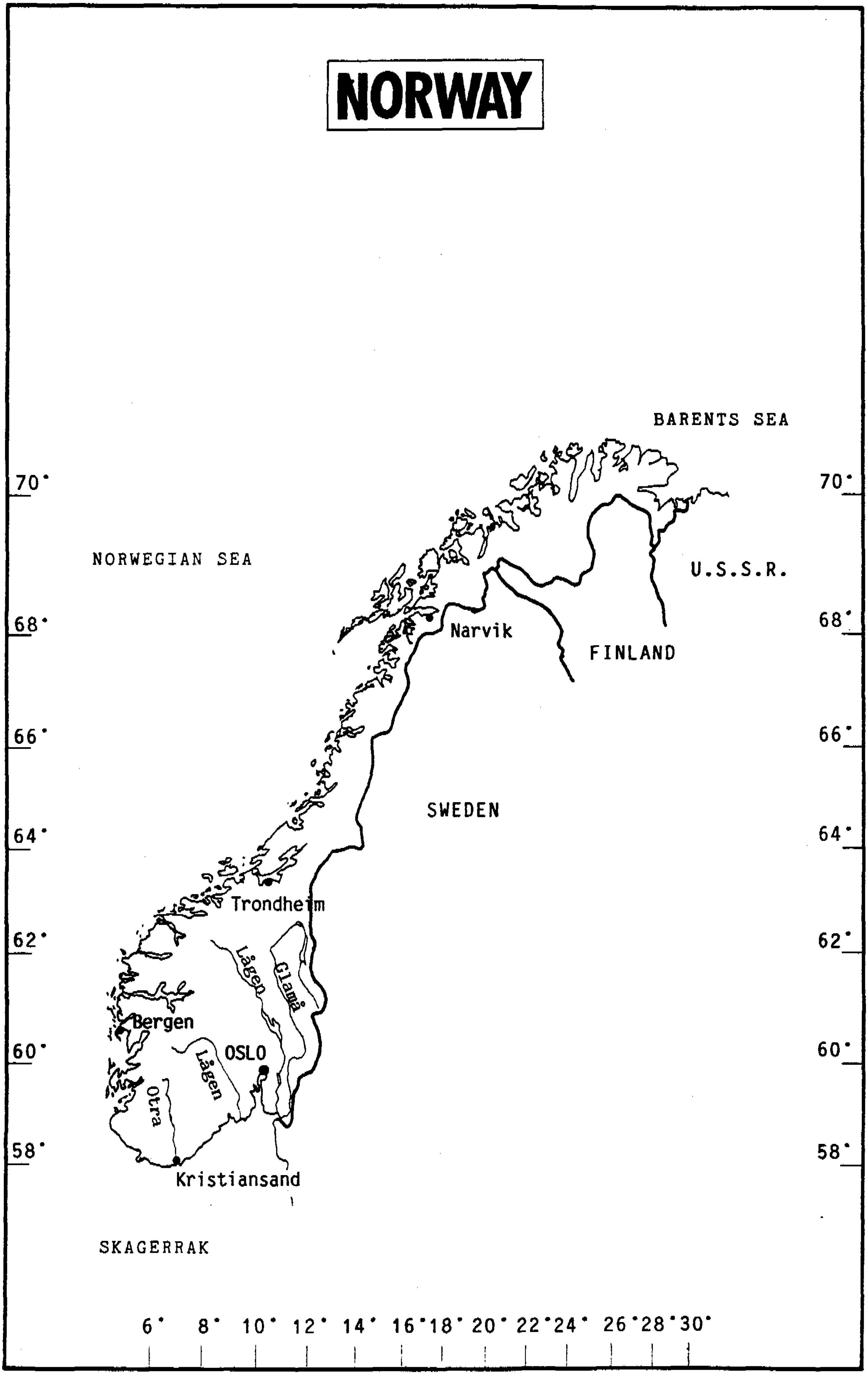
Agricultural University
Department of Water Pollution Control
De Dreijen 12
6703 BC Wageningen
Tel.: (70) 84039

Delft University of Technology
Discipline Group of Sanitary Engineering and
Water Management
P.O. Box 5048
2600 GA Delft
Tel.: (15) 781377

Other Institutes

Delft Hydraulics Laboratory
P.O. Box 177
2600 MH Delft
Tel.: (15) 569353

International Institute for Hydraulic and
Environmental Engineering
P.O. Box 3015
2601 DA Delft
Tel.: (15) 783401


NORWAY
BARENTS SEA
NORWEGIAN SEA
U.S.S.R.
Narvik
FINLAND
SWEDEN
Trondheim
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Bergen
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NORWAY

The Kingdom of Norway forms the western part of Scandinavia in Northern Europe, bordered to the east by Sweden and, within the Arctic Circle, by Finland and the USSR. A long, indented coast faces the Atlantic. Norway exercises sovereignty over the Svalbard archipelago, halfway between North Cape and the Pole.

Norway has an area of 324 219 km^2, one-third of which lies within the Arctic Circle. The total length of the coastline, deeply indented with numerous fjords, is approximately 16 000 km and is fringed with an estimated 150 000 islands.

In 1986 the population was 4 159 335; with an average population density of 12.7 persons per km^2, it is the most thinly populated country in Europe. The population of the capital, Oslo, was 449 337.

Government

Norway is a constitutional and hereditary monarchy, legislative power being held by Parliament (Storting). Executive power is nominally held by the King but is exercised by the Cabinet (Council of State) led by the Prime Minister. The Cabinet is appointed by the King in accordance with the will of the Storting. The 155 members of the Parliament are elected by universal suffrage from 19 electoral districts.

The country is divided into 19 counties (fylker), including the city of Oslo. The counties are divided into 454 urban and rural municipalities (kommuner). These municipalities are administered by locally elected councils through an executive committee (formannskap) and have considerable autonomy in environmental matters. The scope of municipal affairs in Norway is very wide and the municipalities derive their income from local income tax, municipal trading profits and state grants. Smaller municipalities cooperate on a district basis, establishing common laboratory services and appointing inspectors.

Administrative organization of water services

The administrative structure of the management of inland water resources in Norway is rather complex. There are the following two "systems" for the management of water resources: (1) the "permit system" consists of numerous administrative bodies who have the authority to grant permits for abstractions, flow regulations, discharges, etc., according to law or decree; (2) the planning system consists of various overall and sectoral plans that provide a framework for the permit system.

The "permit system" is divided according to user interests. The system has a strong historical basis, and each user interest has its vertical structures at national, regional and local level.

The development of water management institutions reflects among other things the history of conflicting interests in water. An abundant resource, with few conflicts between user interests, can safely be managed so that each user interest is accommodated. Consequently, as the importance of each water use grows, organizations are built up with the aim of promoting a special interest. Examples are the Norwegian Water and Electricity Board with responsibility for energy supply (including power), flood prevention and navigation, the National Institute of Public Health, the Ministry of the Environment and local health councils with responsibility for water supply and the Directorate for Wildlife and Freshwater Fish with responsibility for inland fish management.

The conflicts between environmental protection, pollution and the community's increasing recognition of the amenity value led to the establishment of the Ministry of the Environment in 1972 and the State Pollution Control Authority (SFT) in 1974.

From September 1982 each county commissioner (fylkesmann) has an environmental department with responsibility for many practical water management tasks. In the "permit system" there is a trend towards decentralization.

A National Committee for Water Resources Management was formed in 1978 to coordinate the water activities of the central government. The committee worked at a high administrative level with the overall aim to promote a more coordinated and integrated water management policy in Norway, and was terminated in 1987 after having fulfilled this aim.

The structure of the "planning system" (in contrast to the vertical structures of the "permit system") is horizontal and coordinating. At the national level, sector plans are predominant (water power development, pollution control, water supply). At regional (county) level, county planning is supposed to be coordinated with governmental sector plans. Water resources planning based on river basins is under development as an important tool in water resources management.

The organizational structures for the management of public water supplies in Norway are under intense discussion. The questions being discussed are the distribution of responsibilities among the ministries and the extent to which decentralization in decision-making can be carried out. Decentralization of waterwork approval to municipalities (intermunicipal waterworks to counties) will be practised from 1989.

According to ownership, waterworks can be classified into three categories: intermunicipal, municipal and private (see Table 1).

Table 1: Waterworks in Norway for more than 100 persons supplied
(Extracted from Aqua No. 1, IWSA)

Ownership	Waterworks Number	Waterworks %	Persons supplied in millions
Inter-municipality	19*	-	0.6
Municipality (estimated)	950	53	2.1
Private (estimated)	850	47	0.6

* Delivering water to 58 other waterworks

The total distribution of waterworks by magnitude is as follows:

Table 2: Waterworks in Norway by magnitude

Size of waterwork (persons supplied)	Number of waterworks	Population supplied	
		Millions of people	% of population
less than 100	› 150 000	0.8	20
100 to 1000	1 400	0.3	7
more than 1000	400	3.0	73
TOTAL	151 800	4.1	100

Role of the Health Department with regard to water quality

The responsibility for the management of potable water is divided among various ministries and departments.

These institutions are essentially the Ministry of Social Affairs with the Directorate of Health, the National Institute of Public Health (SIFF) and the local health authorities, the Ministry of the Environment, the county and municipality commissioners, and the Norwegian Water and Electricity Board.

The Ministry of Social Affairs has the overall responsibility for drinking-water quality, the technical functioning of waterworks and for the effects of other activities within catchment areas.

SIFF is the central drinking-water authority for the approval of waterworks serving more than 1,000 people (decentralized from 1989, see page 4). SIFF also has an advisory function and serves as an expert body for the Directorate of Health and the local health authorities.

The local health authorities have several important tasks relating to drinking-water; for instance, waterworks serving between 100 and 1000 people have to be locally approved (from 1989 this applies to all waterworks). The local health authorities are also responsible for approving private drinking-water supplies to food-catering establishments; they also have fundamental responsibility for the general control of drinking-water quality. Waterworks supplying less than 100 persons are not submitted for approval to any authority and its supervision is not carried out on regular basis.

Local health authorities collect and analyse between 120 000 and 150 000 water samples annually. In addition to laboratory analyses, the national health institutions are also in charge of the inspection of water sources, water treatment plants and water supply networks.

Water and related legislation

The following legislation is of particular importance for water supply:

- The Municipal Health Services Act of 19 November 1982 (Lov om kommunehelsetjenesten)
- The Health Law of 16 May 1860 (Sundhetsloven)
- The Food Law of 19 May 1933 (Naeringsmiddelloven)
- The Law on Water Courses of 15 March 1940 (Vassdragsloven), in particular sections 17 and 18
- The Health Protection Law of 2 December 1955 (Lov om helsemessig beredskap)
- The Law on Planning and Construction of 29 March 1985 (Plan- og bygningsloven)
- The Crown Resolution of 10 September 1970 on hygiene conditions in cottage areas (Forskrifter om hygieniske forhold - hytteomrader)
- The Law of 31 May 1974 on communal waters and sewage changes (Lov om kommunale vann- og kloakkavgifter).
- The Directive of 22 February, 1980 (Wastewater discharges)
- The Act of 13 March 1981 (Pollution act)

The quality of drinking-water is the responsibility of the health authorities according to Royal Resolution of 28 September 1951 (IDHL, 4: 103). Recent amendments to this Resolution, dated 10 August 1979 (IDHL, 31: 124), prohibit bathing that would pollute drinking-water and water used for food preparation.

A basic principle of the Pollution Act is that all activities that may pollute the waters of the Kingdom must be licensed by the Ministry. The Regulation of 1 May 1980 on wastewater discharges deals with sewage from small settlements and groups of summer cabins following ministerial guidelines.

The Regulations of 21 January 1972 (IDHL, 26: 568) apply to the control of trade in drinking-water. Monitoring at every stage of the operation must be carried out in accordance with the guidance given by the National Institute of Public Health.

Water research

The National Institute of Public Health has increased its activity in drinking-water research in recent years, with plans of strengthening its engagement even more. Apart from Toxicological and epidemiological projects, relevant problems are taste-and-odour, microbiological and trace agents.

The Norwegian Institute for Water Research (NIVA) was created in 1958 to meet important research needs on water supply and water pollution. NIVA has been the main institution in this field and at present has about 170 employees. The 1986 budget was NKr 61 million of which about one fifth is direct Government support.

NIVA carries out research in the fields of hydrochemistry, hydrobiology and hydrotechnology and it deals with both freshwater and marine problems.

During the last few years there has been an increasing involvement of other organizations in research. These include the Foundation of Scientific and Industrial Research and the Norwegian Institute of Technology at the University of Trondheim, the University of Oslo, the Central Institute of Industrial Research. Financial assistance for research activities is being provided by several Ministries, (Environment, Industries, Agriculture, etc) and by the Royal Norwegian Council of Scientific and Industrial Research.

The estimated level of research activity in Norway on problems related to public water supply is 35 man-years of research effort. The largest emphasis is put on raw water quality and pollution, but one is also engaged in water treatment, transport and drinking-water quality and health.

Finance

Revenue Income

In highly populated areas the owners (mostly municipalities, some inter-municipalities and private companies) derive mostly their finance from annual charges to householders, businesses and farmers for both water supply and other services such as sewage and sewage treatment. In sparsely populated areas many farmers use their own supplies for water. In addition to annual charges, municipalities demand fixed charges for new houses and other premises when connected to water supply and sewage systems.

Water charges for

Potable Water Supply

Water taxes cover approximately 50% of the expenses in the water supply sector (1987). The yearly water taxes can vary from NKr 100 to NKr 1700 per household. The average is NKr 500 per household, established as a fixed tax rate, independent of the amount of water used. Water meters are installed in only two out of 400 municipalities. Prices of water vary from NKr 0.30 to NKr 8.80 per cubic meter (average NKr 2.90 per cubic meter). Industries normally are charged for the total amount of water used as measured by appropriate water meters.

Sewage

Sewage charges are at present primarily based on rateable values of housing and properties but for some commercial premises the charges are based on the metered amount of water supplied and this could become common in the future.

Industrial effluents

Charges for trade effluents discharged into sewers are based on volume of the discharge and the possibilities to take into consideration the strength, and the nature of the discharge.

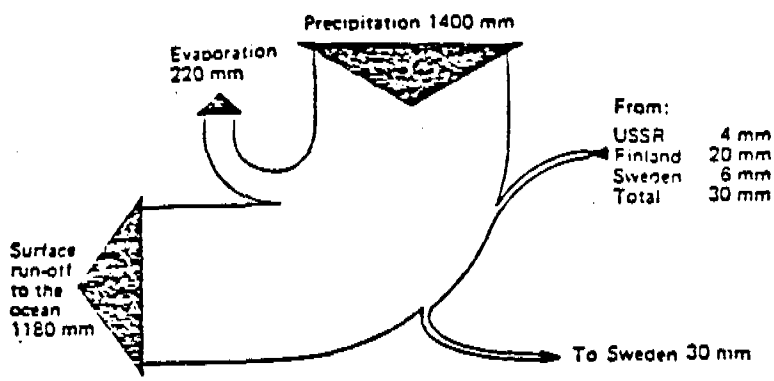
Responsible agencies

Operation	Carried out by
Water resources survey	The Ministry of the Environment (MD) The State Pollution Control Authority (SFT) Norwegian Water and Energy Board County commissioner
Water management policy	The Ministry of the Environment (MD) The Ministry of Petroleum and Energy (OED) The State Pollution Control Authority (SFT) The Water and Energy Board The National Institute of Public Health (SIFF)
Drinking water production	The National Institute of Public Health (SIFF) The local health authority
Drinking water distribution	The National Institute of Public Health (SIFF) The local health authority
Drinking water quality surveillance	The National Institute of Public Health (SIFF) Local Health Authorities Local Food Control Authority
Agricultural irrigation	The Ministry of Agriculture
Industrial water supply	Inter-Municipalities or Municipal Water Authorities
Underground water protection	The State Pollution Control Authority (SFT)
Surface water protection monitoring	The State Pollution Control Authority (SFT)
Water pollution control	The State Pollution Control Authority (SFT)
Water resources storage and allocation	The State Pollution Control Authority (SFT)
Protection of drinking-water sources	The National Institute of Public Health Local Health Authorities The County Governor

Water resource availability and management

Rainfall

Norway is a water-rich country with a good supply of clean water. The average water balance in Norway (1931-1960) is shown in Fig. 1.



Region	Area sq. km· 1000	Precipitation mm	Evaporation mm	Run-off mm	Run-off l/sec· sq. km
East Norway	90.6	865	255	610	19.3
South and West Norway	63.4	2 170	285	1 885	59.8
More — Trondelag region	57.9	1 590	270	1 320	41.9
Nordland	40.6	2 010	175	1 835	58.2
Troms — Finnmark	71.5	900	100	800	25.3
The country	324	1 400	220	1 180	37.5

Figure 1 Average water balance in Norway 1931-60.

Specific runoff varies considerably from region to region. The lowest specific runoff is 10 - 12 l/s km^2 (315-380 mm), and the highest is 150 l/s km^2 (4700 mm). The average is 38 l/s km^2 (1180 mm). There are also large season and year-to-year variations in specific runoff, e.g. spring flooding due to snow melting. In many areas, in particular at Sorlandet, Vestlandet and Trondelag, autumn floods with even higher flows occurring regularly.

Topography

Norway is part of the Scandinavian peninsula, a much eroded plateau, composed mainly of Palaeozoic and Archaean rocks, with gneiss and other crystalline rocks appearing intermittently. The landscape is generally mountainous, and Norway has an average height above sea level of 534 metres. South eastern Norway is the lowest part and even this is of a hilly nature. The other predominant features are the fjords, which were formed out of an ancient folded mountain chain of Palaeozoic and Archaean rock, which has been worn down and faulted up.

Population/Water Resources

The total freshwater area is estimated at 15.600 km^2, spread over more than 200 000 lakes joined by several water courses. About 85% of the population consume water from surface water systems, the remaining part being served by groundwater supply systems.

The fact that population, industry, agriculture and other activities are relatively concentrated and confined to certain areas has led to quality, and sometimes quantity, problems of a more continental scope. Most water resources are clean and very nearly in "natural condition". However, all types and degrees of water pollution occur. Regionally, eutrophication and the effects of acid precipitation are most prevalent. Most surface waters, both in lakes and rivers, are slightly acidic, soft, and contain a certain amount of coloured organic substances, the so-called humic materials or peat. The groundwater is not so rich in minerals as in many other countries where it is located in porous rocks.

Future trends of water resources

The increasing pollution of water resources and the increasing concern for environmental protection in general has led to a great number of conflicts between various water users.

All types and degrees of water conflicts are represented in Norway today. However, perhaps the most typical are the conflicts in connection with the control of rivers for hydroelectric power production. Water resources will be developed further for the generation of hydropower. Oil, coal or nuclear energy-based plants are not likely to be constructed for at least two decades, but a gas power plant is likely to be built within the near future.

A greater awareness of environmental effects, stricter quality requirements for raw water used for public supply, more extensive recreational use, the considerable increase in irrigation and, not least, the contribution of water courses to future energy production are all important factors that illustrate clearly that Norway's water resources are, in fact, limited. The need to balance these various user interests and build them into overall evaluations, i.e. to introduce more integrated water management, is becoming more and more necessary.

General statistics

Population

Population in urban[a] areas (1986)	79.4%
Population in rural[a] areas (1986)	20.6%

Drinking-water supply[b]

Total water delivered for drinking purposes, household and small businesses	700 Ml/d[c]
Total population served by a piped public water supply (3.6 million people)	87.0%
Urban population served by a house connection (3 302 512 people)	100.0%
Urban population without house connections but with reasonable access to public standposts	0.0%
Rural population served by piped public water supply systems at home (297 488 people)	34.7%
Rural population served by private systems at home or having reasonable access to public standposts (559 335 people)	65.3%

Drinking water supply uses (all delivery)

Water supplied for domestic and commercial use	47.0%
Water supplied for industrial use	27.0%
Other uses	26.0%

Industrial water supply: direct abstractions[d]

Total supplied from inland waters for industrial use	3930 Ml/d
Used for industrial cooling water	30.0%
Usage as industrial process water	70.0%
Total coastal water used	810 Ml/d

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[a] Urban areas: A contiguous group of buildings housing more than 200 persons

[b] Data collected in recent years indicate that future demand is likely to decline rather than increase.

[c] 1 Ml/d = 1 million litres/day.

[d] The industrial water use increased by about 1% per annum from 1970 to 1978, mainly owing to increased usage of seawater and water from private sources. Due to the decline in industrial activity within water consuming organizations, total water demand increase has probably stabilized. Water consumption in industry supplied by public water works indicates a decline in demand due to increased water and wastewater tariffs.

Agricultural use: direct abstractions[a]

Total amount abstracted for irrigation (over 3 months)	45×10^6 m^3/y
Other agricultural uses	data not available

Wastewater disposal services

(a)	% of urban population served by a sewerage network (3.1 million)	94.0%
(b)	% of urban population served by other adequate means	6.0%
(c)	% of urban population lacking adequate disposal means	0.0%
(d)	% of rural population served by a sewerage network	0.0%
(e)	% of rural population served by other adequate means	100.0%
(f)	% of rural population lacking adequate disposal means	0.0%

Sewage treatment
(618 municipal sewage treatment plants in about 800 sewage networks)

(g)	% of sewerage systems receiving primary treatment only	8.75%
(h)	% of sewerage systems receiving secondary treatment	34.38%
(i)	% of sewerage systems receiving tertiary treatment	33.75%
(j)	% of sewerage systems receiving no treatment (raw discharge)	23.12%

Discharge of treated sewage (by volume)*

(k)	% discharged into the sea	70.0%
(l)	% discharged into surface water bodies	29.0%
(m)	% discharged onto farmland	1.0%

Discharge of untreated sewage (by volume)

(n)	% discharged into the sea	96.0%
(o)	% discharged into surface water bodies	4.0%
(p)	% discharged onto farmland	0.0%

Sludge disposal (by volume)

(q)	% of sludge disposed into the sea	0.0%
(r)	% of sludge disposed into surface water bodies	0.0%
(s)	% of sludge disposed onto farmland	60.0%
(t)	% of sludge disposed as landfill	39.0%
(u)	% of sludge incinerated	0.0%
(v)	% of other disposal	1.0%

[a] Expected increase in irrigated area: 1981 8×10^9 m^2
1990 12×10^9 m^2
Average 60 mm irrigation per year (season)

* Approximately 75% of the population (3.1 million people) are connected to a sewage network of which 1 million people (25%) do not have their sewage treated in a plant. The rest of the population (= rural) is not connected to a piped network.

Useful addresses

Governmental

Ministry of the Environment
Postboks 8013 Dep.
N-0030 Oslo 1
Tel.: (02) 41 90 10
Telex: 18 990

Ministry of Social Affairs
P.O. Box 8011
N-0030 Oslo 1

Water Industry

National Institute of Public Health
Geitemyrsveien 75
N-0462 Oslo 4
Tel.: (02) 35 60 20

Water Research

Norwegian Institute for Water Research
Postboks 333
Blindern
N-0313 Oslo 3
Tel.: (02) 23 52 80

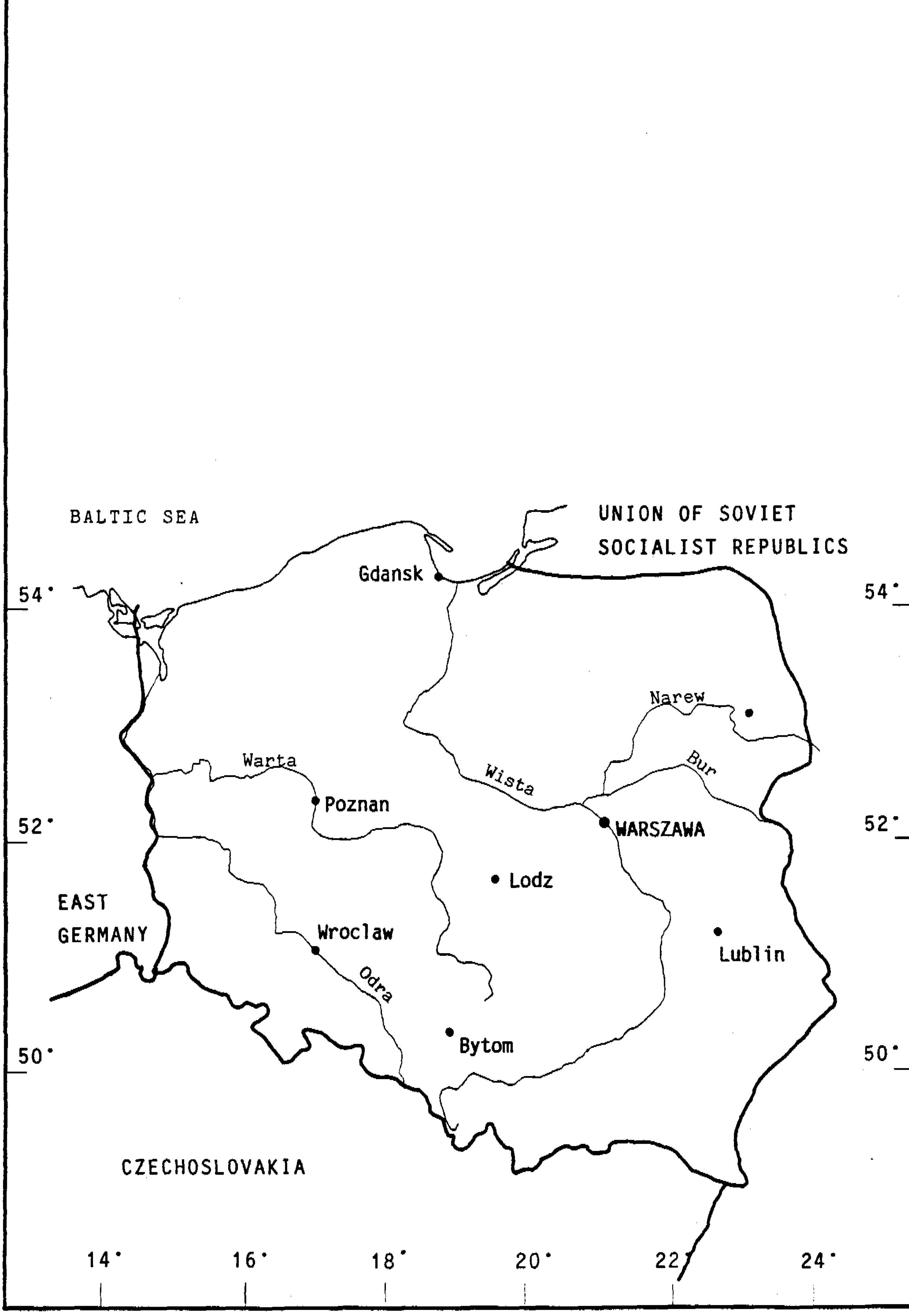
Directorate of Health

Directorate of Health
P.B. 8128 DEP,
N-0032 Oslo 1
Tel.: (02) 34 90 90

- Directorate of Environmental Pollution

Statens Forurensningstilsyn
Postboks 8100 DEP
N-0032 Oslo 1
Tel.: (02) 65 98 10
Telex: 76 684 SFT N
Telefax: (02) 65 87 93/65 98 10

POLAND



BALTIC SEA
UNION OF SOVIET
SOCIALIST REPUBLICS
Gdansk
Narew
Warta
Bur
Wista
Poznan
WARSZAWA
Lodz
EAST
GERMANY
Wroclaw
Lublin
Odra
Bytom
CZECHOSLOVAKIA
54°
52°
50°
14°
16°
18°
20°
22
24°

POLAND

The Polish People's Republic lies in Central Europe, with the USSR in the east, the German Democratic Republic in the west, Czechoslovakia in the south and the Baltic Sea coastline lies in the north. It has an area of 312 683 km^2 and an estimated population in 1985 of 37 114 000, giving an average density of 119 per km^2.

Government

Under the 1952 Constitution the supreme organ of State power is the single chamber Parliament (Seym). The Seym elects from its members the Council of State to be its permanent organ. The Council of State is the supreme executive authority but is responsible to the Seym. The Supreme Board of Control exercises surveillance of national and local administration. It is responsible to the Seym and to the Council of State but is independent of the Government, whose activities it supervises.

Since 1975 there has been a two-tier system of local government, with the country divided for administrative purposes into 49 provinces (voivodships), including 3 large cities treated as separate units. Each province is divided into towns and communes; there is a total of 808 towns and 2138 communes. At both tiers each administrative unit has its own elected People's Council. This system of local administration ensures that the general policy of the State is applied at the appropriate level.

Administrative organization of water services

Since 1983 the responsibility for overall water management in Poland has fallen within the jurisdiction of the Ministry of Environment Protection and Natural Resources. The Minister of Environment Protection and Natural Resources and the Chairman of the People's Councils of the 49 provinces (voivodships) are responsible for carrying out the provisions of the Law on Water.

Also since 1983 the Ministry of Environment Protection and Natural Resources has coordinated all environmental protection activities, including water pollution control. The Ministry of Building, Physical Planning and Municipal Economy is responsible at municipal level for public water supply, wastes treatment and sewerage systems. The Ministry of Agriculture and Food Economy is responsible for similar activities in rural areas.

The Ministry of Transport is responsible for navigation matters and the Central Board of Geology for recording underground water resources.

The day-to-day coordination and supervision of water management and environmental protection matters, including water quality control, is in the hands of the 49 Provincial People's Council Chairmen (Voivods) and the regional authorities for each separate administrative area.

Investment and development matters concerning construction projects related to water are managed by 7 Regional Water Management Offices reporting to the Minister of Environment Protection and Natural Resources. They were established according to the hydrographical features of existing river basins in the country.

Role of the health department with regard to water quality

The Ministry of Health and Social Welfare is concerned with problems related to hygienic control and sanitary and epidemiological aspects of water surveillance systems. It has both legislative and control functions. The Sanitary and Epidemiology Department of the Ministry coordinates all activities related to water quality. These are carried out by a network of sanitary and epidemiological stations (sanepids) that function at the provincial and the district level. Sanepids exercise control over the quality of water supply sources and they are concerned with overall hygiene problems, including the quality of recreational waters. Each of them has chemical and microbiological laboratories, where samples of water are analysed.

The main tasks of the sanepids can be summarized as follows:

- to make decisions on issues pertaining to drinking-water quality;

- to give consent to utilization of water equipment and implementation of new technologies for water treatment (to this end, sanepids examine water samples taken from water intakes and pipe networks);

- in case of water contamination in intakes or pipe networks, to take part in localizing and eliminating the source of contamination;

- to supervise the work of laboratories;

- to coordinate and give advice on the design and installation of water pipe constructions and extensions;

- to present to the territorial government administrations comprehensive evaluations of water supply systems, including proposals concerning improvement in this field;

- to initiate activities aiming at the improvement of water supply in towns and rural areas;

- to control the quality of surface waters used for water pipe purposes and as watering places.

In small water pumping stations only the quality of the disinfection is controlled, but at the same laboratories checks are made on the efficiency of water treatment plants. The chemical and microbiological laboratories of the sanepids are also responsible for checking the efficiency of the wastewater purification processes. All operations concerning public health aspects of water resources, abstraction protection zones and equipment for public water supplies are managed by a physician, the chief of the department of communal hygiene and the sanepid. When necessary he informs one of the vicepresidents of the district People's Councils, responsible for the local water supply. The latter organizes the coordination between the different services responsible for water supply and gives the orders necessary to solve any problems concerning public water supply or purification of wastewater, in accordance with the existing laws.

Water and related legislation

The basic principles of water utilization and pollution control are subject to legislation. The first Water Act was passed by Parliament in 1922 and its provisions remained in force for 40 years until they were strengthened by the Water Act of 1962, which was replaced by the Water Law of 24 October 1974, to cover changes that had taken place in the administrative structure of the country.

In 1980, the Parliament (Seym) passed the Environment Protection and Development Law, which covers the general aspects of drinking-water quality. By decision of the Parliament (Seym) undertaken in 1983, the Environment Protection and Water Management Office was established.

According to the provisions of the Water Law, the inland waters, both surface and underground, serve the purposes of the national economy, the country's population and other purposes determined by particular regulations. The Law specifies the basic tasks of water management as the maintenance and development of water resources and protection of those resources against pollution.

Among other requirements, there are detailed regulations defining:

- water quality standards and conditions for effluent discharges into inland and coastal waters, the ground and sewerage systems;
- the financial penalties for causing excessive water pollution;
- the principles of establishing protection zones for water intakes and effluent treatment plants;
- the documents required to obtain consent to consume water and to discharge sewage or wastes;
- the charges for water consumption and effluent discharges as an economic instrument of rational water management.

The detailed regulations divide water quality into three categories according to their intended use:

Category I — waters fit for potable and municipal use, food processing industries, other industries requiring high quality water and pisciculture of Salmonidae.

Category II — waters fit to be used for recreation and sports, animal farming and pisciculture of fish other than Salmonidae.

Category III — waters used in other industries, agriculture and horticulture etc.

Water quality standards in each category were determined, taking into account physical, chemical and biological indices.

Separate regulations enacted by the Minister of Health and Social Welfare define drinking-water quality standards.

Poland has signed bilateral agreements concerned with water management and pollution control matters on bordering waters with all the neighbouring countries.

Water research

Many institutions and offices are engaged in research into water related activities. These include:

- research institutes of the Polish Academy of Science;
- research institutes of the technical universities;
- research institutes, central laboratories, industrial laboratories, research and development centres, reporting to various Ministries, e.g. the Research Institute on Environmental Development, the National Institute of Hygiene, the Centre of Municipal Technology and other bodies where there are branches or divisions carrying out research into special water problems.

The leading research bodies in water problems are the Institute of Meteorology and Water Management (IMWM), the Bureau of Studies and Designs for Hydraulic Engineering (Hydroprojekt), the Water and Effluent Treatment Studies and Projects Offices (Prosan and Hydrosan). All of these bodies are subordinated to the Ministry of Environment Protection and Natural Resources.

The Institute of Meteorology and Water Management (IMWM) was founded on 1 January 1973 by amalgamation of the State Hydrometeorological Institute created in 1918 and the Water Economics Research Institute created in 1960. The IMWM has a staff of more than 2600 including about 800 people at the research branch to fulfil the responsibilities placed upon it. These include theoretical, applied and development studies in hydrology, meteorology, oceanography, water management and water engineering and water quality control.

The area of operations covers all of Poland together with its offshore waters. The IMWM elaborates and disseminates short and long term meteorological and hydrological forecasts and warnings for the national economy and population. Water pollution control matters occupy a research staff of about 200.

The Bureau of Studies and Designs for Hydraulic Engineering (Hydroprojekt) was established in 1951. Hydroprojekt is in charge of design and studies related to comprehensive water resources development projects, water storage reservoirs, flow control structures, irrigations and drainage schemes, inland waterways and river and mountain stream training. Hydroprojekt is staffed with 720 people, among which there are 320 graduates highly skilled experts in hydraulic, civil, structural, electrical and mechanical engineering.

The main research work on the problems of water management and pollution control is carried out under a government research programme entitled "Development and Utilization of Water Resources", established by a recommendation of the Second Congress of Polish Science and approved by the Government in 1977.

The objectives of the programme are scheduled to be completed by 1985 and include research and practical economic tasks. The basic research objectives may be defined as follows:

- to identify underground and surface water resources more completely and to develop mathematical models of the hydrological processes that affect water resources and their quality;

- to examine the physical, chemical and biological influences on surface and underground waters mathematically and to record these influences as a means of achieving accurate forecasting capability;

- to develop information monitoring systems for water quality and quantity;

- to develop and implement technological advances in water purification and effluent treatment, including water reuse and mine-water desalination techniques;

- to develop technology for the more economic use of water as a raw material in industry and agriculture;

- to improve planning methods in the development of water management systems in terms of the legal, administrative and economic factors involved;

- to optimize the water management control function.

The economic objectives of the programme include implementation of two experimental pilot water management systems in the industrial Silesian conurbation (Katowice and Bielsko provinces) and in an agricultural region in the Upper Notec basin.

The programme is being carried out by about 200 organizations including research institutes, universities, design offices and others involved in all aspects of water management, water engineering and pollution control, and the IMWM has been appointed by the Government to coordinate the project. Results todate show that the concentration of effort in complex research schemes helps to integrate representatives from the scientific and technical practices connected with water resources management. Moreover, the programme links qualitative and quantitative elements and identify and utilize their interrelationships.

Responsible agencies

Operation	Carried out by:
Water resources survey	Ministry of Environment Protection and Natural Resources
Water management policy	Ministry of Environment Protection and Natural Resources
Drinking-water production	Ministry of Construction, Physical Planning and Municipal Economy
municipalities -	Ministry of Environment Protection and Natural Resources
rural areas -	Ministry of Agriculture and Food Economy
Drinking-water distribution	as above
Drinking-water quality surveillance	Ministry of Health and Social Welfare
Agricultural irrigation	Ministry of Agriculture and Food Economy
Industrial water supply	Various industrial ministries in cooperation with the Ministry of Environment Protection and Natural Resources
Underground water protection	Central Board of Geology in cooperation with the Ministry of Environment Protection and Natural Resources
Surface water protection monitoring	Ministry of Environment Protection and Natural Resources Environmental research and supervision centres Ministry of Construction, Physical Planning and Municipal Economy
Water pollution control	Ministry of Environment Protection and Natural Resources in cooperation with Ministry of Health and Social Welfare
Water resources storage and allocation	Ministry of Environment Protection and Natural Resources

Finance

Revenue Income

Provincial administrative authorities and municipal bodies responsible for water supply, sewage treatment and sewerage systems derive their finance mainly from the central Government budget.

Water charges

Potable water supply

Water charges for domestic consumers are based on metered volume where meters are installed or calculated by a formula that takes into account the standard of water equipment installed and the number of inhabitants. Water charges for domestic users are calculated below production cost and the balance is subsidized from the Government budget.

Industrial users are obliged to pay additional charges for underground or surface water abstraction and effluent discharges. Collected finances are used to create a special water management fund which is utilized for additional subsidizing of water resources development including pollution control and research. Water charges for industrial users are based on the effective water production cost, and they are generally based on metered volume.

Sewage

Sewage charges for industrial, trade and domestic users are calculated as a percentage of the water charges. Special regulations specify quality standards for industrial and trade effluents discharged to the municipal sewerage systems. Exceeding the quality limits is calculated as an additional charge or penalty.

Water resource availability and management

Rainfall

The mean annual long term precipitation in Poland is about 600 mm. The country is subject to a moderate, maritime-continental climate dominated by air masses coming across the Atlantic Ocean (west winds) or winds from the east. The average annual temperature, measured at the surface, is approximately 9°C and the range of temperatures is about 20°C. Precipitation occurs throughout the year and in the mountains it exceeds 1000 mm.

Topography

Poland is a particularly low-lying country: 75.2% of its territory lies below 200 m above sea level and the average altitude is 173 m. The oldest geomorphological features (the uplands and mountains) were formed in the Tertiary period during warm climatic conditions. Old geological structures were levelled several times and reconstituted by uplifting processes. The geomorphology of the low-lying lands was formed in the Pleistocene age under varying climatic conditions, from arctic and subarctic to moderate. The present land forms of the northern part of Poland (the maritime regions) were formed at the time of the last (Baltic) glaciation. The oldest geological structures appear in the southern part of Poland (the Sudety and Carpathians, including the mountain ranges of Tatra, Beskidy and Bieszczady).

Population/water resources

The country, situated between the Tatra mountains and the Baltic Sea, suffers from a shortage of water. The total water resources, having been thoroughly researched and identified, are estimated for an average year to be about 58.6×10^9 m^3. Related to a population of 37.1 million, the per capita water resources are around 1580 m^3, a figure which is some two to five times less than in other European countries. Total water resources are estimated for a dry year to be only about 31×10^9 m^3.

Taking into consideration the stochastic nature of hydrological phenomena and processes, it follows that the usable water resources are significantly lower than the figures quoted above. In addition the resources are not distributed uniformly either geographically or seasonally. If available resources are taken as the volume of water which can be supplied to users for at least 95% of each year - and this is the conventional assumption - it is estimated that they will amount to something in the region of 22×10^9 m^3 per annum. This quantity may then be compared to the actual and future requirements of households, industry, power, agriculture and other water uses.

It should also be noted that recent detailed studies estimate a required minimum flow of about 15×10^9 m^3 of water per annum to ensure that acceptable environmental, biological and public health conditions are maintained within the country. Therefore the difference between the available resources and the minimum acceptable flow is the maximum permissible non-returnable water consumption, which can be easily calculated at only some 7×10^9 m^3. It is planned to increase this figure by construction of water storage reservoirs and rational water usage.

At present there are 131 reservoirs capable of gathering 2.9×10^9 m^3 of water, which is about 5% of the total annual runoff in an average year. This proportion is much lower than in other European countries and it is planned to reach a level of 15%, which is believed to be a realistic maximum considering the geographical, demographical and technical conditions.

The data in Table 1 shows the actual and estimated water consumption in Poland, illustrating the problem to be dealt with:

Table 1

Year	Water consumption ($10^9 m^3$)
1960	5.6
1970	10.4
1980	14.2
1983	16.0
1985	18.1[a]
1990	19.5[a]
2000	25.6[a]

[a] estimated

Table 2 shows an analysis of water consumption in 1978

Table 2	
	($10^9 m^3$)
Municipal supply	18.12
Industrial supply	70.62
Agricultural and forestry	11.26
Total	16.00

Serious water shortages have recently been recorded in Upper and Lower Silesia, the regions of Rybnik, Bielsko-Biala, Czestochowa and the provinces of Cracow, Lodz, Rzeszow and Krosno, most of these areas being highly populated.

Future Trends of Water Resources

Several water management plans have been prepared in Poland since 1945 and they have all played a role in formulating the water management programme. Mathematical modelling and optimization methods have been used since 1970 for establishing water management programmes. In 1978 the Government took a number of decisions regarding the complex and far-reaching programme for the development of the Vistula river and its basin and the overall utilization of water resources. The "Vistula Project" was the starting point for wide application of the above methods. This Project (including 2/3 of the Polish territory) was carried out during the years 1969-1972 by Polish engineers financially supported by the UNDP.

The Implementation Programme has been designed up to the year 1990. The Programme forms part of the "Comprehensive Water Management Plan" elaborated by the Ministry of Environment Protection and Natural Resources and approved by the Polish Government in 1985. The following activities are under development:

- the implementation of water reservoir projects and water transfer projects designed for areas with water shortage;

- the implementation of sewerage treatment plants and other projects concerning water protection (studies on specific problems of saline water extracted from coal mines);

- the implementation of distribution systems for water consumers (particularly for the areas with water shortage);

- activities for the proper utilization of water resources (control of wastages, leaks, etc.), reuse of water, implementation of new technologies, etc.

Similar schemes have been prepared for the development of the Odra river and for the rivers of the coastal region.

General statistics

Population

Population in urban areas	60.17%
Population in rural areas	39.83%

Drinking-water supply

Total piped supply for drinking purposes	8500 Ml/d[a]
Total population served by a piped public water supply	79.9%
Urban population served by a house connection	93.1%
Urban population without house connections but with reasonable access to public standposts	6.9%
Rural population served by piped public and private water supply systems at home	55.8%
Rural population served by other systems or having reasonable access to public standposts	44.2%

Drinking water supply uses

Water supplied for domestic and commercial use	52.0%
Water supplied for industrial use	23.0%
Other uses	25.0%

Industrial water supply: direct abstractions

Total supplied from inland waters for industrial use	30 100 Ml/d
Used for industrial cooling water	77.0%
Usage as industrial process water	23.0%
Total coastal water used	NA[b]

Agricultural use: direct abstractions

Total amount abstracted for irrigation	2000 Ml/d
Other agricultural uses including fish ponds	3200 Ml/d

Wastewater disposal services

(a) % of urban population served by a sewerage network	79.0%
(b) % of urban population served by other adequate means	21.0%
(c) % of urban population lacking adequate disposal means	0.0%
(d) % of rural population served by a sewerage network	6.2%
(e) % of rural population served by other adequate means	93.8%
(f) % of rural population lacking adequate disposal means	0.0%

[a] 1 Ml/d = 1 million litres/day.

[b] NA = Not available

Sewage treatment

(g)	% of sewerage systems receiving primary treatment only	35.0%
(h)	% of sewerage systems receiving secondary treatment	21.0%
(i)	% of sewerage systems receiving tertiary treatment	%
(j)	% of sewerage systems receiving no treatment (raw discharge)	44.0%

Discharge of treated sewage

(k)	% discharged into the sea	NA
(l)	% discharged into surface water bodies	NA
(m)	% discharged onto farmland	NA

Discharge of untreated sewage

(n)	% discharged into the sea	NA
(o)	% discharged into surface water bodies	NA
(p)	% discharged onto farmland	NA

Sludge disposal

(q)	% of sludge disposed into the sea	NA
(r)	% of sludge disposed into surface water bodies	NA
(s)	% of sludge disposed onto farmland	NA
(t)	% of sludge disposed as landfill	NA
(u)	% of sludge incinerated	NA

Useful addresses

Governmental

Ministry of Environment Protection and Natural Resources
Wawelska 52/54
00-922 Warsaw

Tel: 25 00 01
Telex: 81 71 57 pl or 81 28 16 pl

Water research

Institute of Meteorology and Water Management
ul. Podlesna 61
01-673 Warsaw

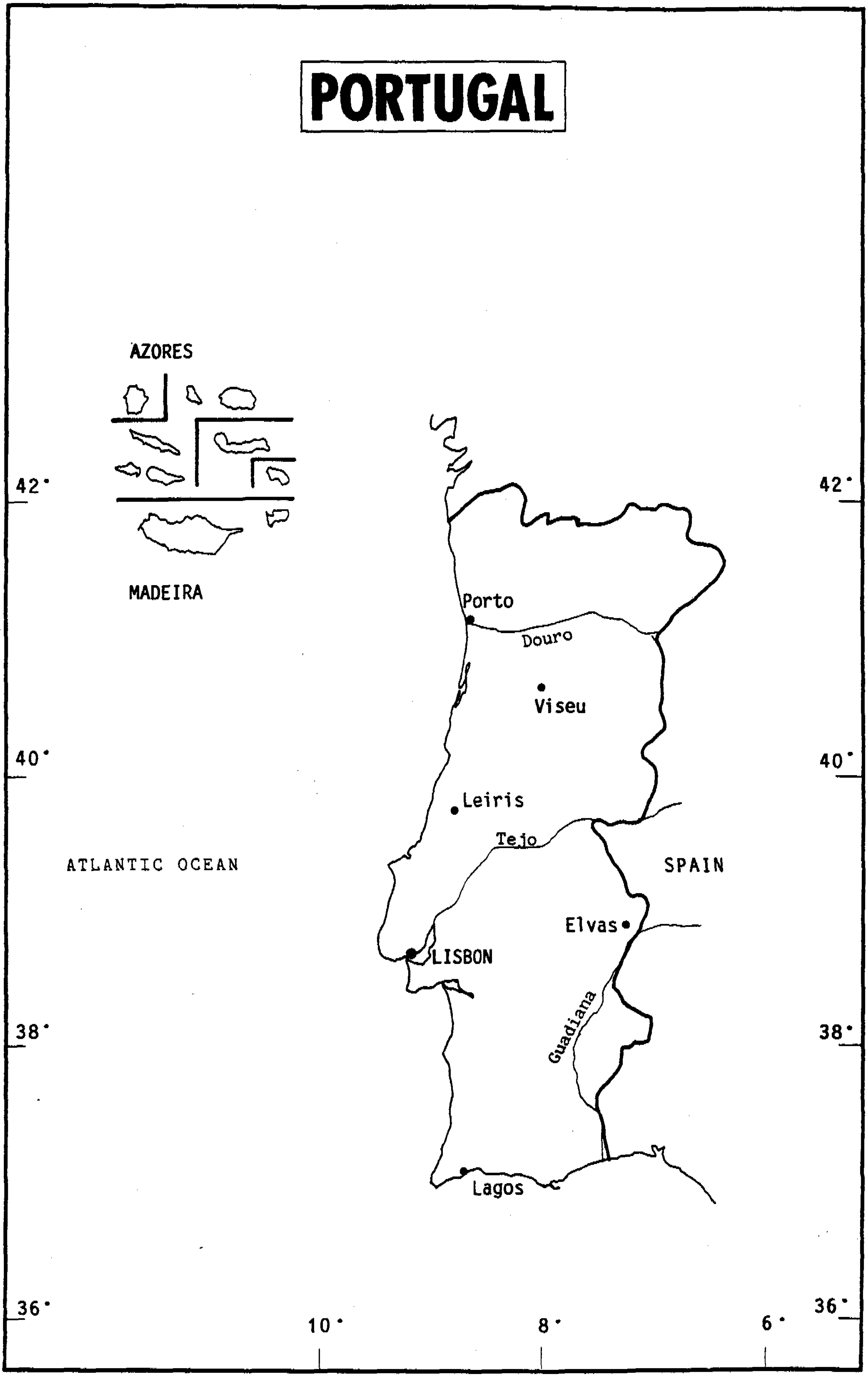
Tel: 34 18 64; 34 16 51
Telex: 81 4331

The Bureau of Studies and Designs for Hydraulic Engineering
HYDROPROJEKT
ul Dubois 9
00-182 Warwaw

Tel: 38 85 38; 38 70 41
Telex: 81 2826

Ministry of Construction, Physical Planning and Municipal Economy
Department of Foreign Affairs
Wspolna 2
00-926 Warsaw

Tel: 28 14 76 or 29 26 47
Telex: 814411 mb pl


PORTUGAL
AZORES
MADEIRA
ATLANTIC OCEAN
Porto
Douro
Viseu
Leiris
Tejo
SPAIN
Elvas
LISBON
Guadiana
Lagos
42°
40°
38°
36°
10°
8°
6°

PORTUGAL

The territory of the Republic of Portugal has a total area of 92 000 km^2, including its continental part and the Atlantic island groups of Azores and Madeira.

The last demographic census was held in 1981 and revealed a total population of 9 833 014[a] which means an average density of 107 inhabitants per square kilometre.

Between 1970 and 1981, the population increased by 13.7% with rural areas showing signs of demographic recovery in relation to the losses occurred during the sixties[b].

Government

The country is ruled by normal European democratic standards, with an elected one-chamber Parliament and a Central Government nominated by the President of the Republic according to election results. The President is also elected in general elections for a five-year term.

A significant administrative feature of Portugal is the division of the country into municipalities, called "concelhos" in Portuguese. These "concelhos" represent the local level of administrative rule and their council members, including the mayor, are elected for a four-year term.

The territory of Portugal is divided into 305 municipalities, distributed as follows:

- 275 in Continental Portugal, grouped in 18 districts (95% of the whole population);

- 11 in the Madeira Islands, which form an autonomous region (2.6% of the whole population);

- 19 in the Azores Islands, which form another autonomous region (2.4% of the whole population).

In Continental Portugal, five coordinating bodies were established at a regional level, grouping the municipalities located in the following population areas:

North; Centre; Lisbon and the Tejo Valley; South; Algarve.

These coordinating entities, called "Comissoes de Coordenaçao regional", have important tasks at the regional and district levels with regard to water and wastewater related projects.

[a] National Institute for Statistics - Census of 81 - official results - Lisbon June 1984.

[b] Please see page 10.

Specifically for the Algarve region, a coordinating body was set up for water, wastewater and solid wastes projects. This body is called "Comissao de Saneamento Basico do Algarve" (CSBA) and is linked direct to the Prime Minister.

Administrative organization of water and wastewater services

In accordance with the general administrative laws, water supply and wastewater systems are administered by the municipalities. This means that all local authorities, with the only exception of the water supply of the City of Lisbon, have complete institutional, technical and financial responsibilities for the water services.

The municipalities exert their administrative powers over the water and wastewater systems either directly, by means of their own services, or through semi-autonomous bodies called "Serviços Municipalizados".

With the exception of some well-equipped urban municipalities, the majority of the municipalities do not have the manpower or the technical, financial and institutional resources to achieve their objectives. Therefore, they are often supported, technically and financially, by the Central Administration.

Within Portugal, it was felt that the existing structure showed a need for creating intermediate management agencies which would be incorporated into the regionalization programme in due course. The practical implementation of such an idea proved to be difficult. Some municipalities are now grouping themselves in order to set up and operate intermunicipal undertakings. In this way, they can obtain financial support from the Central Administration through a specific programme which is currently in operation.

In Lisbon, the wastewater system is administered by the municipality, the water-supply system being operated by a public enterprise, called "Empresa Publica de Aguas Livres" (EPAL).

EPAL is responsible for the abstraction, treatment and distribution of public water supplies to the municipality of Lisbon. EPAL also supplies supplementary water to the municipalities surrounding Lisbon, which then undertake distribution within their own area. The public enterprise "Saneamento Basico da Regiao da Madeira, E.P." (SABAM, E.P.) (Madeira Basic Sanitation) was created recently to undertake potable water supply, water drainage and treatment, clearance and removal of solid waste in the autonomous region of Madeira. In practice, this body has limited its action to giving technical and financial support to the municipalities of the islands of Madeira and Porto Santo.

The autonomous region of the Azores follows the traditional pattern used in Continental Portugal, which is based on either municipal or "municipalized" services. As far as Central Government Bodies are concerned, the two most influential ministries in the field of water supply and wastewater drainage, treatment and disposal are the Ministry of Health and the Ministry of Social Equipment. The work of the former will be discussed in detail later in this document, for which reason only the organisms of the latter are presented below.

The two main General Directorates of the Ministry of Planning and Territorial Administration, mainly concerned with water aspects, are the "Direcçao-Geral dos Recursos Naturais" (DGRN) (General Directorate for Natural Resources), and the "Direcçao-Geral da Qualidade do Ambiente" (DGQA) (General Directorate for the Quality of the Environment).

Apart from being the national reference basis for technical aspects of water and sanitation, the DGRN offers technical and financial support to the design and construction of water-supply and sewerage schemes, at both local and regional levels.

With regard to water, other than that of public supplies and domestic sewerage, the DGQA is responsible for:

- river regulation and navigation;
- hydraulic works (dams, canals, aqueducts, etc.);
- flow measurements and other hydrological work;
- pollution control through the granting of permits for industrial wastewaters discharges and the imposition of water quality parameters;
- supervision of all aspects of surface and groundwater management.

This work is undertaken by five regional water departments which are subdivided into 19 water offices comprising the local management working in coordination with the Central Directorate.

The DGQA also works with the following governmental departments:

- Health;
- Fisheries and Agriculture;
- Environment;
- National Commission on Water Pollution Control.

Of all these institutions, special mention should be made of the General Directorate for the Quality of the Environment (Direcçao-Geral da Qualidade do Ambiente) under the Secretariat of State for Environment. It coordinates all activities related to the proposed inclusion of Portugal into the European Economic Commission (EEC) as far as environmental issues are concerned, water supply and water pollution being two of these issues.

Role of the Ministry of Health in the field of water supply and sanitation

The Ministry of Health has three well-defined institutional levels: national, regional and local. At all these levels, activities concerning water supply and sanitation are carried out.

In general, the health authorities have the task of advising on the prevention of health risks in the utilization of water resources, by means of sanitary surveillance programmes and health education schemes applied all over the country.

At national level, three sectors are worth mentioning: planning, operating and training.

The planning activities are the role of the "Departamento de Estudos e Planeamento da Saude" (DEPS), which assumes the coordination of national, regional and local plans and programmes, and also has the role of liaison with the World Health Organization together with the follow-up of international actions.

The national department in the operating sector is the "Direcçao-Geral dos Cuidados de Saude Primarios" (DGCSP) (General Directorate for Primary Health Care), which was established by a Decree-Law in March 1984 and replaced the old General Directorate for Health (Direcçao-Geral de Saude).

Also within the operating sector, it is important to mention the National Institute for Health (Instituto Nacional de Saude, INSA), the reference centre for all laboratory work and research projects in the field of health. This Institute comprises well-staffed and well-equipped chemical and microbiological laboratories which operate in the field of water and wastewaters.

The DGCSP is divided into Service Directorates, one of which is the Direction of Services for Sanitary Engineering (Direcçao de Serviços de Engenharia Sanitaria). This Direction of Services has overall responsibilities for the control of water quality from the point of view of health, including water for human consumption, for recreation and for the manufacture of foodstuffs.

As head of the health operating administrative structure, the General Directorate for Primary Health Care plays an important role in emergency or accident situations.

Still at national level, the training departments of the Ministry of Health are the National School of Public Health (Escola Nacional de Saude Publica (ENSP), for post-graduate studies, and other medium-level teaching institutions.

At the ENSP, there is a section devoted to environmental health, in which courses for doctors, engineers, municipal high-level technicians, are given on the subjects of water supply and sanitation.

Sanitarians are trained at the INSA during their basic studies and at the ENSP for post-graduate courses.

All operating activities of the Ministry of Health work within a decentralized administrative structure, comprising 18 Regional Health Administrations (Administraçoes Regionais de Saude, ARS), in Continental Portugal, one in each district, and two autonomous health organizations in the island groups.

A network of Health Centres, at least one in each municipality, and Public Health Laboratories, at least one per district, completes the whole structure. Each Health Centre has at least one sanitarian, who is technically dependent on the Sanitary Engineering Department at each ARS. The whole organization comprises approximately 30 sanitary engineers and 400 sanitarians.

The main tasks related to water supply and sanitation performed at the Health Centres, are inter alia:

- Surveillance of drinking water quality;

- Inspection of water-supply and sanitation systems in order to detect health risk factors;

- Laboratory examination of waters from various sources and origins;
- Epidemiological survey devoted to water-borne or water-related diseases;
- Inspection of water-supply and sanitation systems for private and industrial consumption, at both design and construction stages;
- Advising the municipalities on all aspects of water supply and sanitation;
- Activities of health education and health monitoring.

Water-related legislation

Some of the most significant legislative documents concerning water and sanitation are as follows:

- Decree No. 8, December 1, 1892
  Defines the organization of hydraulic services at national level.
- Decree of December 19, 1982
  Approves the "Regulamento dos Serviços Hidraulicos" (Water Management General Regulation).
- Decree No. 5787, May 10, 1919
  Approves the so-called "Law of Water", which sets rules for water control at national level.
- Regulation No. 6065, March 30, 1929
  Defines hazardous, dangerous and toxic establishments, and the rules for their geographical location in urban and touristic zones.
- Regulation No. 10367, April 14, 1943
  Approves the General Regulation for Water-Supply Systems.
- Ministerial Regulation No. 11 338, May 8, 1946
  Approves the General Regulation for Sewerage Systems.
- Decree-Law No. 38382, August 7, 1951
  Approves the General Regulation for Urban Buildings.
- Law No. 2097, June 6, 1959
  Lays down the basis for promotion of fish breeding in inland waters.
- Law No. 2103, March 22, 1960
  Lays down the basis for water supply to rural populations.
- Decree-Law No. 45 551, January 30, 1964
  Approves the regulations for the industry of bottling mineral waters.
- Decree No. 46924, March 28, 1966
  Approves the regulation for the settlement and labouring of industrial establishments.

- Decree-Law No. 47802, July 19, 1967
  Lays down the rules for commercialization of the phytopharmaceutical products appropriate to the defence of the vegetal production, excluding chemical fertilizers and agricultural correctives.

- Decree No. 48517, August 6, 1968
  Lays down the rules for periodical control of the public water-supply systems, amended in "Diario da Republica" No. 234, I^{a} Série, October 6, 1969.

- Decree-Law No. 48483, July 11, 1968
  Lays down the rules for control of public waters as receptors of wastewater.

- Decree-Law No. 166, April 15, 1970
  Amends the licensing of private buildings.

- Ministerial Regulation No. 53, February 3, 1971
  Approves the general rules of hygienics and safety of labour in the industrial establishments.

- Decree-Law No. 502, November 18, 1971
  Lays down the basis for protection of public water reservoirs.

- Decree-Law No. 569, July 19, 1976
  Defines the intervention of sanitary authorities.

- Decree-Law No. 383, September 10, 1977
  Approves the Organic Law of the DGQA.

- Decree No. 1, January 7, 1978
  Approves, for ratification, the Convention for the prevention of sea pollution of telluric origin (the Paris Convention).

- Decree No. 2, January 7, 1978
  Portugal agrees with the Convention on the Prevention of Marine Pollution by Dumping of Wastes and other Matters.

- Decree-Law No. 74-C, March 2, 1984
  Creates the DGCSP and extinguishes the DGS.

- Decree-Law No. 98, March 19, 1984
  (Decree-Law of Local Finances) - Revokes Law No. 1 of 2 January 1979.

- Decree-Law No. 100, March 29, 1984
  Lays down the attributions of local authorities and the competence of their bodies; revokes Nos 1 and 81 and from 97 to 115 of Law No. 79 of 25 October 1977.

Water research

There are many organizations carrying out research in fields related to water. Some of these organizations are:

- Direcçao-Geral da Qualidade do Ambiente - DGQA
- Direcçao-Geral dos Cuidados de Saude Primarios - DGCSP
- Universities
- Laboratorio Nacional de Engenharia Civil - LNEC
- Direcçao-Geral dos Recursos Naturais - DGRN
- Laboratorio Nacional de Engenharia e Technologia Industrial - LNETI
- Instituto Hidrografico (National Defence Ministry)
- Instituto Nacional de Investigaçao das Pescas (Ministry of the Sea -Fisheries State Secretariat).

All these organizations are doing research on one or more aspects of water, mostly on an independent basis, and contributing to the solution of various problems related to water (concerning each specific task). Sometimes, when necessary, they agree to develop conjoint programmes and studies.

Financing

Revenue income

The municipal authorities derive their revenue income from water supply and, generally, also from drainage and treatment of waste materials.

Water charges

Potable water

Water is metered, and the charge levied per meter depends on volume consumed and type of consumer (whether domestic, commercial or industrial). Water charges are higher in Lisbon and surrounding municipalities where a significant section of the population resides.

Sewerage

Generally speaking, these taxes vary between 3% and 10%. The municipalities collect sewerage through taxes. There are three kinds of taxes: connection tax, maintenance tax and operation tax. The first one is collected on connection to the public sewer. The maintenance tax is collected annually. Both taxes are paid by the owners of the connected premises on the basis of a percentage of the total legal property value. Only some municipalities apply the operation tax paid by the users on the basis of the volume of the water supply consumed.

Industrial effluents

There are no specific taxes for charging the load of pollution from industrial effluents if they obtain a permit for the discharge of their residual waters and if these discharges reach the standards of water quality fixed in the permit, according to specific pre-established quality parameters. If not, they must pay a penalty and the cost of the studies and work required to control the pollution problems created. An indemnity to the affected users is also considered.

Responsible agencies (Continental Portugal only)

Operation	Carried out by:
Water resources survey	Catchment for public supply - DGRN and municipalities
Water management policy	Surface and groundwater management - DGRN/DGQA Underground water protection - " Surface water protection monitoring - " Water pollution control - " Water resources storage and allocation - "
Drinking water production	Municipalities (EPAL in Lisbon)
Drinking water distribution	Municipalities (EPAL in Lisbon)
Drinking water quality	Permanent Control Municipalities (EPAL in Lisbon) Sanitary Surveillance DGCSP and Health Centres
Recreational water	Permanent control Municipalities ((EPAL in Lisbon) Sanitary Surveillance DGCSP and Health Centres
Agricultural irrigation	DGQA and Ministério da Agricultura
Industrial water supply	Private enterprise, except for some small industries, which are supplied by domiciliary distribution networks.

Water resource availability and management

Rainfall

The mean annual rainfall in Portugal is about 900 mm. The country is subject to a temperate, maritime climate dominated by west and north winds, which, together with the topographic form of the country, generates a rainfall gradient from mean values in excess of 1300 mm, in the upland areas in the north of the country, to less than 700 mm in the south. The Tejo River coincides with the isohyet of 1000 mm and delineates two climatic zones; to the north of the Tejo the climate is generally wet, while to the south it is dry.

Topography

The land forms of Portugal vary widely in relation to this limited area. A broad distinction can be made between the hilly area north of the Tejo, about half of which is above 400 m, and that to the south which is flat (97% below 400 m). Generally speaking, Portugal's eastern border is at the edge of the Iberian meseta and the land shelves from there down to the Atlantic seaboard. The land frontier is partly defined by mountains and partly by the four main rivers, the Minho, the Douro, the Tejo and the Guadiana, and some of their affluent rivers.

Population/water resources

The abstraction of groundwater is predominant, compared with that of surface water: 94% and 6%, respectively.

Although the proportion of groundwater used is slightly lower north of the Tejo River (92% compared with 98% in the south), the amount of groundwater used is far greater because 6/7ths of the total population live there.

Future trends for water resources

It seems that the future trend is to have greater incidence on the abstraction of surface water using multipurpose reservoirs. Some of these reservoirs are already supplying many cities. This is planned by DGQA in collaboration with municipalities and/or municipal water supply companies. "Greater Lisbon" (Lisbon and about 10 surrounding municipalities) are, in this case, supplied by water for domestic supplies from the "Castelo de Bode" reservoir (some 80 km outside Lisbon, placed in the Zézere River, a Tejo subsidiary).

General statistics

Population

Population in urban[a] areas	43.0%
Population in rural[a] areas	57.0%

Drinking-water supply

Total piped supply for drinking purposes	710 Ml/d[b]
Total population served by a piped public water supply	58.0%
Urban population served by a house connection	97.0%
Urban population without house connections but with reasonable access to public standposts	3.0%
Rural population served by piped public or private water supply systems at home	50.0%
Rural population served by other systems or having reasonable access to public standposts	50.0%

Drinking water supply uses

Water supplied for domestic and commercial use	76.0%
Water supplied for industrial use	24.0%
Other uses	0.0%

Industrial water supply: direct abstractions

Total supplied from inland waters for industrial use (1985)	2 816 528 x $10^3 m^3/y$
Used for industrial cooling water	2.0%
Usage as industrial process water	95.0%
Total coastal water used	25.0%

Agricultural use: direct abstractions

Total amount abstracted for irrigation (1985)	4 279 690 x $10^3 m^3/y$
Other agricultural uses including fish ponds c.	400 000 x $10^3 m^3/y$

[a] For the purpose of this survey, areas with a single supply serving over 2000 inhabitants have been termed urban.

[b] 1 Ml/d = 1 million litres/day.

Wastewater disposal services

(a)	% of urban population served by a sewerage network	83.0%
(b)	% of urban population served by other adequate means	17.0%
(c)	% of urban population lacking adequate disposal means	0.0%
(d)	% of rural population served by a sewerage network	9.0%
(e)	% of rural population served by other adequate means	91.0%
(f)	% of rural population lacking adequate disposal means	0.0%

Sewage treatment

(g)	% of sewerage systems receiving primary treatment only	20.0%
(h)	% of sewerage systems receiving secondary treatment	23.0%
(i)	% of sewerage systems receiving tertiary treatment	2.0%
(j)	% of sewerage systems receiving no treatment (raw discharge)	55.0%

Discharge of treated sewage

(k)	% discharged into the sea	34.0%
(l)	% discharged into surface water bodies	65.0%
(m)	% discharged onto farmland	1.0%

Discharge of untreated sewage

(n)	% discharged into the sea	42.0%
(o)	% discharged into surface water bodies	43.0%
(p)	% discharged onto farmland	15.0%

Sludge disposal

(q)	% of sludge disposed into the sea	2.0%
(r)	% of sludge disposed into surface water bodies	59.0%
(s)	% of sludge disposed onto farmland	11.0%
(t)	% of sludge disposed as landfill	28.0%
(u)	% of sludge incinerated	0.0%

Useful contact points

Direcçao-Geral dos Recursos e Aproveitamentos Hidraulicos - DGRAH
Av. Almirante Gago Coutinho, Lote 1619 - 5P
P-1000 Lisbon (INSTITUTION ABOLISHED IN 1987 AND REPLACED BY DGQA)

Tel. 807626

Direcçao-Geral do Saneamento Basico - DGSB
R. Antero de Quental, 44
P-1100 Lisbon (INSTITUTION ABOLISHED IN 1987) AND REPLACED BY DGRN)

Tel. 543544

Direcçao-Geral da Qualidade do Ambiente - DGQA
(General Directorate for the Quality of the Environment)
Rua do Seculo 51-7
P-1200 Lisbon

Tel. 362751

Direcçao-Geral dos Recursos Naturais - DGRN
(General Directorate for Natural Resources)
Av. Gago Coutinho, 30-40
Lisbon

Tel. 808001

Secretaria de Estado do Ambiente
Pr. Duque de Saldanha, 31-2°
P-1000 Lisbon

Tel. 544025

Direcçao-Geral dos Cuidados de Saude Primarios - DGCSP
Alameda D. Afonso Henriques, 45
P-1056 Lisbon Codex

Tel. 575503

Directorate for Sanitary Engineering Services
(DGCSP)
Rua Pinheiro Chagas 69-2°
P-1000 Lisbon

Tel. 539054

Professor A. Lobato de Faria
Director
National School of Public Health
Avenido Padre Cruz
Lisbon

Tel. 792461

Universidade Nova de Lisboa, Faculdade de Ciencias e Tecnologia
Departamento de Ciencias do Ambiente
Quinta da Torre
P-2825 Monte da Caparica

Tel. 2954987

Laboratorio Nacional de Engenharia Civil - LNEC
Av. Brasil 101
P-1700 Lisbon

Tel. 882131

Laboratorio Nacional de Engenharia e Tecnologia Industrial - LNETI
R. S. Pedro de Alcantara, 79
P-1200 Lisbon

Tel. 368856

Instituto Hidrografico (National Defence Ministry)
R. das Trinas, 49
P-1200 Lisbon

Tel. 601191

Instituto Nacional de Investigaçao das Pescas
Doca de Pedrouços
P-1400 Lisbon

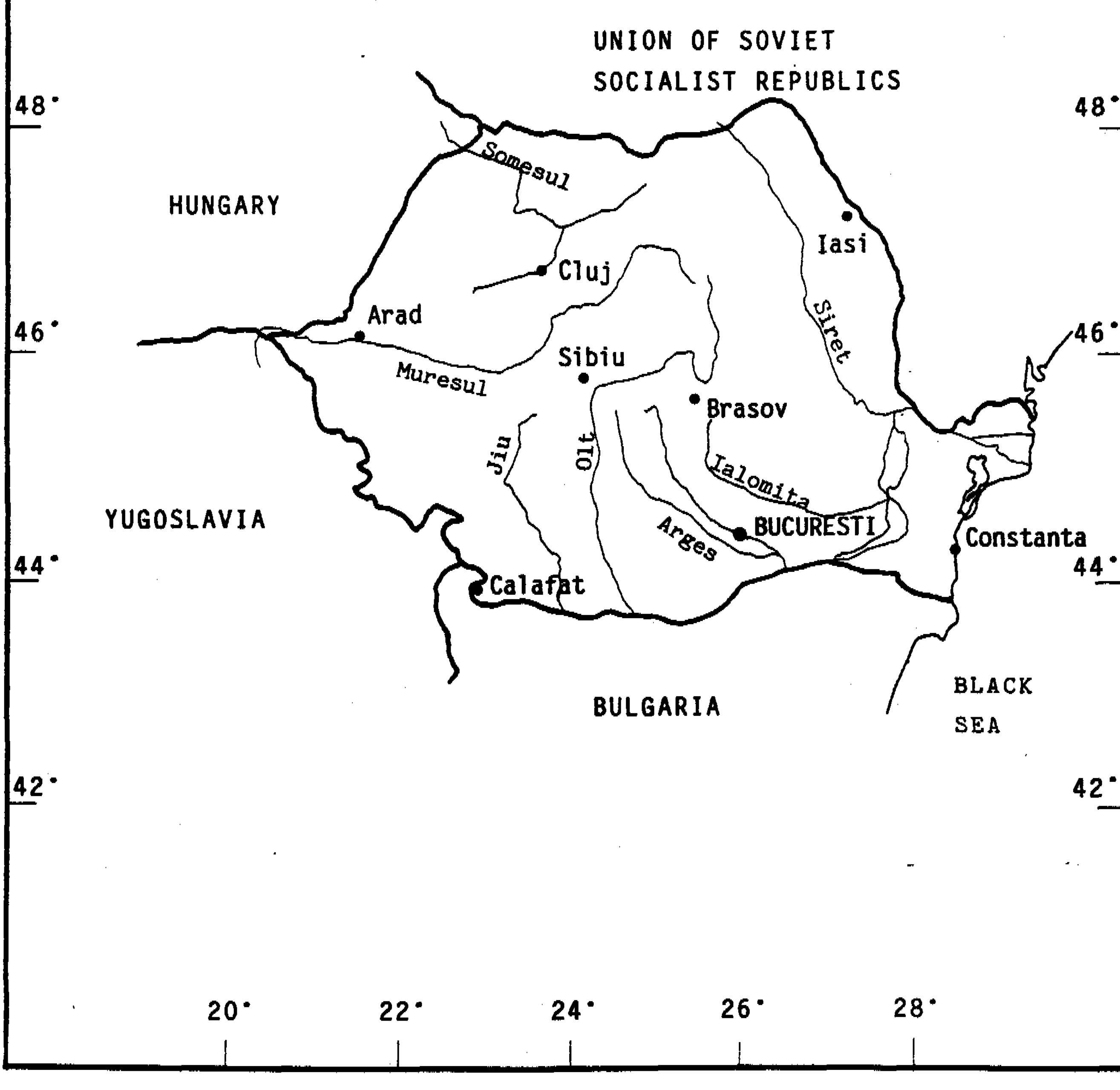
Tel. 610814

STATE OF POPULATION

Census: Families and population, by districts and autonomous regions

Districts and autonomous regions	Present population			Resident population			Number of families		
	1970	1981	Variation %	1970	1981	Variation %	1970	1981	Variation %
1	2	3	4	5	6	7	8	9	10
CONTINENT, AZORES AND MADEIRA	8629.3	9852.8	+14.2	8648.4	8833.0	+13.7	2330.8	2924.4	+25.5
CONTINENT	8089.0	9344.5	+ 1.5	8108.2	9336.8	+15.2	2209.7	2803.0	+26.8
Aveiro	542.8	620.0	+14.2	548.0	623.0	+13.7	131.6	164.2	+24.8
Beja	202.4	184.3	- 8.9	204.8	188.4	- 8.0	61.6	62.4	+ 1.3
Braga	611.9	709.8	+16.0	612.7	708.9	+15.7	129.0	167.6	+29.9
Bragança	177.9	181.4	+ 2.0	179.8	184 3.	+ 2.5	47.7	54.7	+14.7
Castelo Branca	252.2	233.0	- 7.6	255.6	234.2	- 8.3	76.9	79.7	+ 3.6
Coimbra	402.2	441.0	+ 9.7	401.2	436.3	+ 8.8	117.5	138.7	+18.0
Evora	175.3	179.2	+ 2.2	178.5	180.3	+ 1.0	55.1	62.1	+12.7
Faro	267.1	328.6	+23.0	268.4	323.5	+20.6	84.6	107.1	+26.6
Guarda	210.4	205.4	- 2.4	213.5	205.6	- 3.7	64.1	68.6	+ 7.0
Leiria	378.8	418.9	+10.6	379.4	420.2	+10.8	107.2	130.3	+21.6
Lisbon	1592.5	2085.9	+31.0	1577.4	2069.5	+31.2	466.5	681.5	+46.0
Portalegre	145.1	142.1	- 2.0	145.9	142.9	- 2.0	47.3	50.0	+ 5.7
Porto	1306.4	1561.3	+19.5	1312.4	1562.3	+19.0	309.0	414.4	+34.1
Santarém	432.5	458.2	+ 5.9	430.9	454.1	+ 5.4	132.1	147.8	+11.9
Setubal	465.4	654.3	+40.6	467.9	658.3	+40.7	139.3	209.8	+50.6
Viana do Castelo	250.8	255.4	+ 1.8	251.2	256.8	+ 2.2	63.2	70.0	+10.8
Vila Real	264.8	264.0	- 0.3	267.1	264.4	- 1.0	66.7	72.5	+ 8.7
Viseu	410.5	421.7	+ 2.7	413.4	423.6	+ 2.5	110.3	121.8	+10.4
AZORES	289.6	249.1	-14.0	289.1	243.4	-15.8	66.5	62.2	- 6.5
MADEIRA	250.7	259.2	+ 3.4	251.1	252.8	+ 0.7	54.4	59.2	+ 8.8
City of Lisbon	775.6	828.9	+ 6.2	769.0	807.2	+ 5.0	233.6	286.0	+22.4
City of Porto	309.5	335.9	+ 8.5	306.2	327.4	+ 6.9	81.2	97.6	+20.2

ROMANIA


UNION OF SOVIET
SOCIALIST REPUBLICS
HUNGARY
YUGOSLAVIA
BULGARIA
BLACK
SEA
Somesul
Muresul
Jiu
Olt
Arges
Ialomita
Siret
Cluj
Arad
Sibiu
Brasov
Iasi
BUCURESTI
Constanta
Calafat
48°
46°
44°
42°
20°
22°
24°
26°
28°

ROMANIA

Romania is situated in south-eastern Europe. To the south-east it borders the Black Sea, to the north and north-east the USSR, to the north-west Hungary, to the south-west Yugoslavia and to the south Bulgaria.

Romania has an area of 237 500 km^2; in 1986 the population was 22 724 836 with a density of 95.7 inhabitants per km^2. Bucharest has 6 districts with 2 239 493 inhabitants (and 12 suburban villages included).

Government

Under the 1965 Constitution, the supreme organ of state power is the single-chamber National Assembly. The Assembly elects the President of the Republic and, from its own members, the State Council and the Council of Ministers, which is the highest state administrative body but responsible to the Assembly.

In 1968, the local government structure was reorganized and the country was divided into 40 districts (including the capital, Bucharest, which has a special status and structure). In 1983, there were 237 cities and towns and some 2705 rural villages. Bucharest had six districts with 1 995 156 inhabitants and 12 suburban villages with 232 412 inhabitants. Each district, town or village was coordinated by an elected Popular Council, with commissions for various problems. Town and village councils were subordinated to the District Popular Council, which was directly responsible to the National Assembly and the State Council.

Following the 1968 reorganization, the councils and other governmental bodies were changed in order to increase local autonomy and encourage broader public participation.

Administrative organization of water services

The National Water Council (CNA) is responsible, at the national level, for water resources management. The CNA acts, at the district level, through water resources directorates that cover fifteen river basins. It is to be noted that most Romanian rivers are Danube tributaries. The responsibility for drinking-water supply and sewerage lies with the municipalities or local communities, who act through municipal water agencies supervised by local municipal councils.

The river basin water directorates, through water inspectors, are responsible for the control of water pollution.

Role of the health department with regard to water quality

Public health officers and public health services are responsible for the monitoring and surveillance of drinking-water quality. They are also responsible for the epidemiological surveillance of waterborne diseases.

Water and related legislation

The Water Management Act of 20 April 1973 covers all groundwater, surface and boundary water, except where international conventions provide otherwise. It lays down general principles such as that water should be used rationally;

the needs of the population take precedence over other uses; groundwater, including springs, should be reserved for drinking-water, fire-fighting and special manufacturing processes that require water of this quality. It provides that all uses of water shall be subject to a permit. Earlier regulations exempted domestic use from this requirement. The 1973 Water Management Act prohibits all pollution of surface water and groundwater that makes the water unfit for the purposes that it would normally be used for. The Water Act of 28 March 1974 repealed the Water Management Act of 1973 and through the Official Bulletin No. 31 of 1974 set up the National Water Council under the Ministry of Agriculture and the Food Industry. The Council is responsible for the implementation of laws regarding water supply and pollution control and it lays down the tasks of water management authorities. These are responsible for data collection and the supervision of water quality. Water quality supervisory commissions were established to deal with rivers where special measures are required to coordinate protection efforts. These commissions function at the local level with representatives of all users and potential polluters under the guidance of the National Water Council. Decree No. 414 of 1979 establishes threshold values for the principal polluting substances in wastewater prior to discharge. The Ministry of Health is responsible for setting standards for drinking-water. The local people's councils are responsible for the protection of drinking-water supplies and the disposal of wastewater. The Environnmental Protection Act states that sewage effluent should be used for agriculture in the summer months and should not be discharged into the sea. It also provides for subsidies to treatment plants to prevent sea pollution.

Standard No. 1342 of 1984 specifies drinking water quality conditions.

Water research

A central institute for research and study of water resource management has been established. In addition, there are four public health institutes that have a water quality department: Bucharest, Clwj-Napoca, Jassy and Timisoara. Several other institutes undertake the design of waterworks.

Responsible agencies:

Operation	Carried out by:
Water resources survey	Hydrological and Meteorological Institute
Water management policy	National Water Council
Drinking-water production	Local councils through local water agencies
Drinking-water distribution	Local water agencies
Drinking-water quality surveillance	Public health services
Agricultural irrigation	Ministry of Agriculture
Industrial water supply	Industrial ministries
Underground water protection	National Water Council
Surface water protection and monitoring	National Water Council through river basin water directorates
Water pollution control	National Water Council through river basin water directorates
Water resources storage and allocation	Mostly the National Water Council; however, when a dam is built for energy production purposes, the Ministry of Energy is responsible for stored water allocation

Water resource availability and management

Rainfall and climate

Precipitation decreases from west to east and from the mountains to the lowlands of Moldavia and Muntenia. The average rainfall on the Dobrovdja Coast in the south-east extremity of the country is the 400 mm per year, while the Carpathian zone receives up to 1200 mm per year. The national average rainfall is 710 mm per year. Romania's climate is of a continental type, moderately humid with big seasonal and regional variations. The country has hot summers and cold winters. In the summer the average temperature is 21°C and in winter -2°C.

Topography

The Carpathians form the predominant feature of Romania. They run in a great arc from the junction of the Hungarian and USSR frontiers in the north to the Danube at the gorge of the Iron Gate in Romania, form a link between the Alps proper and the Balkan ranges of Yugoslavia and Bulgaria.

In Romania, the mountains are characterized mainly by their penetrability. The rivers, which drain entirely towards the Danube, by cutting back into the numerous upland basins, e.g. that of Brasov, provide routes linking the hills and plains on either side. Most of the summits are remarkably uniform in height, and the formation of what is almost a plain has resulted in gently rounded plateaux, forming the plaiu (way) or high alpine meadows above the deep forest-shrouded upper valleys. Sharp mountain peaks, such as those of the Fagaras mountains, are more the exception than the rule.

Within the arc of the Carpathians and abutting against the hard core of the Bihorului mountains lie the Tertiary rocks of the Transylvanian basin, a much-folded upland basin of sandstones and clays eroded into a country of hilly relief by the mountain-fed streams, the soft banks of which are much given to landslides. The outer edge of the mountain belt is ringed by the sub-Carpathian foothill zone bordering Moldavia and Muntenia.

The lowlands of Valachia and Moldavia consist in reality of plateaux of various elevations composed of horizontal or slightly tilted sedimentary strata of the Tertiary period, overlaid by a covering of recent deposits. These recent deposits, particularly in Moldavia, consist largely of the wind-borne loess, from which the rich black earth, or chernozem, soils are derived. The plateaux are crossed by the rivers descending from the Carpathian mountains. These streams are often deeply entrenched into the general level and are usually dry in the late summer when acute droughts are common. The Danube itself flows in a broad flood plain known as the Balta, characterized by numerous swamps and abandoned arms of the river, between bluffs marking the edge of the plateaux and the edge of the sub-Balkan platform of Bulgaria.

The Dobruja (Dobrogea), a unique region forming part of the sub-Balkan platform, consists of a core of folded crystalline rocks which are exposed in the northern hills (up to 400 m), but mainly concealed by a layer of chalk and recent deposits of loess. Dry valleys dissect this hill region, which by its northward projection accounts for the diversion of the Danube in its lower course.

Population/water resources

22 478 000 inhabitants (1982). 40×10^6 Ml/year.

Future trends of water resources

Shortage of water occurs during dry summer months in southern parts of the country. Additional supplies will need to be sought.

Finance

Since the Second World War, the economy of the country has changed, and it is now dominated by industry. However, agriculture is still important: 60% of the land area is agricultural and 38% of the working population are employed in agriculture.

Cereals and fruits make a large contribution to the export trade, Romania being an important grape-producing country. Other important products are wheat, maize, rye, sunflower seed, sugar beet, potatoes, plums, apples and eggs. The food industry accounts for about 15% of total exports.

Revenue income

The agencies responsible for drinking-water supply are not profit-making. However, they need to recover their costs.

Water charges

Potable water supply. ROL.46 per m^3 to ROL.85 per m^3 (official rate - ROL 14.2 = US $1 in 1988).

Sewage charges.

ROL 8.5 per month per connection (per family).

Industrial effluents

Individual industries are responsible for treating their own industrial effluent. There is no further charge, however, for discharging treated industrial effluent.

General statistics

Population (as at 1 July 1986)

Population in urban areas	53.5%
Population in rural areas	46.5%

Drinking-water supply

Total piped supply for drinking purposes	6.7×10^3 Ml/d[a]
Total population served by a piped public water supply	52.3%
Urban population served by a house connection (11 063 586)	91.0%
Urban population without house connections but with reasonable access to public standposts (1 094 201)	9.0%
Rural population served by house connections (public and private: 830 800)	17.0%
Rural population without house connections but with reasonable access to public standposts (4 056 262)	83.0%

Drinking water supply uses (as at 1 July 1986)

Water supplied for domestic and commercial use	60.0%
Water supplied for industrial use	40.0%
Other uses	0.0%

Industrial water supply: direct abstractions

Total supplied from inland waters for industrial use	30.1×10^3 Ml/d
Used for industrial cooling water	60 %[b]
Usage as industrial process water	40 %
Total coastal water used	NA Ml/d

Agricultural use: direct abstrations

Total amount abstracted for irrigation	6.3×10^3 Ml/d
Other agricultural uses including fish ponds	7.8×10^3 Ml/d

Wastewater disposal services

(a)	% of urban population served by a sewerage network	73.0%
(b)	% of urban population served by other adequate means	27.0%
(c)	% of urban population lacking adequate disposal means	0.0%
(d)	% of rural population served by a sewerage network	14.0%
(e)	% of rural population served by other adequate means	86.0%
(f)	% of rural population lacking adequate disposal means	0.0%

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[a] 1 Ml/d = 1 million litres/day.

[b] NA = Not available

Sewage treatment

(g)	% of sewerage systems receiving primary treatment only	18.0%
(h)	% of sewerage systems receiving secondary treatment	62.0%
(i)	% of sewerage systems receiving tertiary treatment	0.0%
(j)	% of sewerage systems receiving no treatment (raw discharge)	20.0%

Discharge of treated sewage

(k)	% discharged into the sea	0.0%
(l)	% discharged into surface water bodies	80.0%
(m)	% discharged onto farmland	20.0%

Discharge of untreated sewage

(n)	% discharged into the sea	0.0%
(o)	% discharged into surface water bodies	100.0%
(p)	% discharged onto farmland	0.0%

Sludge disposal

(q)	% of sludge disposed into the sea	0.0%
(r)	% of sludge disposed into surface water bodies	0.0%
(s)	% of sludge disposed onto farmland	20.0%
(t)	% of sludge disposed as landfill	80.0%
(u)	% of sludge incinerated	0.0%

Useful addresses

Governmental

National Water Council (CNA)
Negustori Street 35
Bucharest SRR

Water industry

Bucharest Water Supply Agency (ICAB)
Splaiul Independentei
Bucharest SRR

Water research

Institute for Research and Water Resources Management (ICPGA)
Splaiul Independentei 294
Bucharest 6 SRR

Tel: 492037

Drinking Water Quality Surveillance

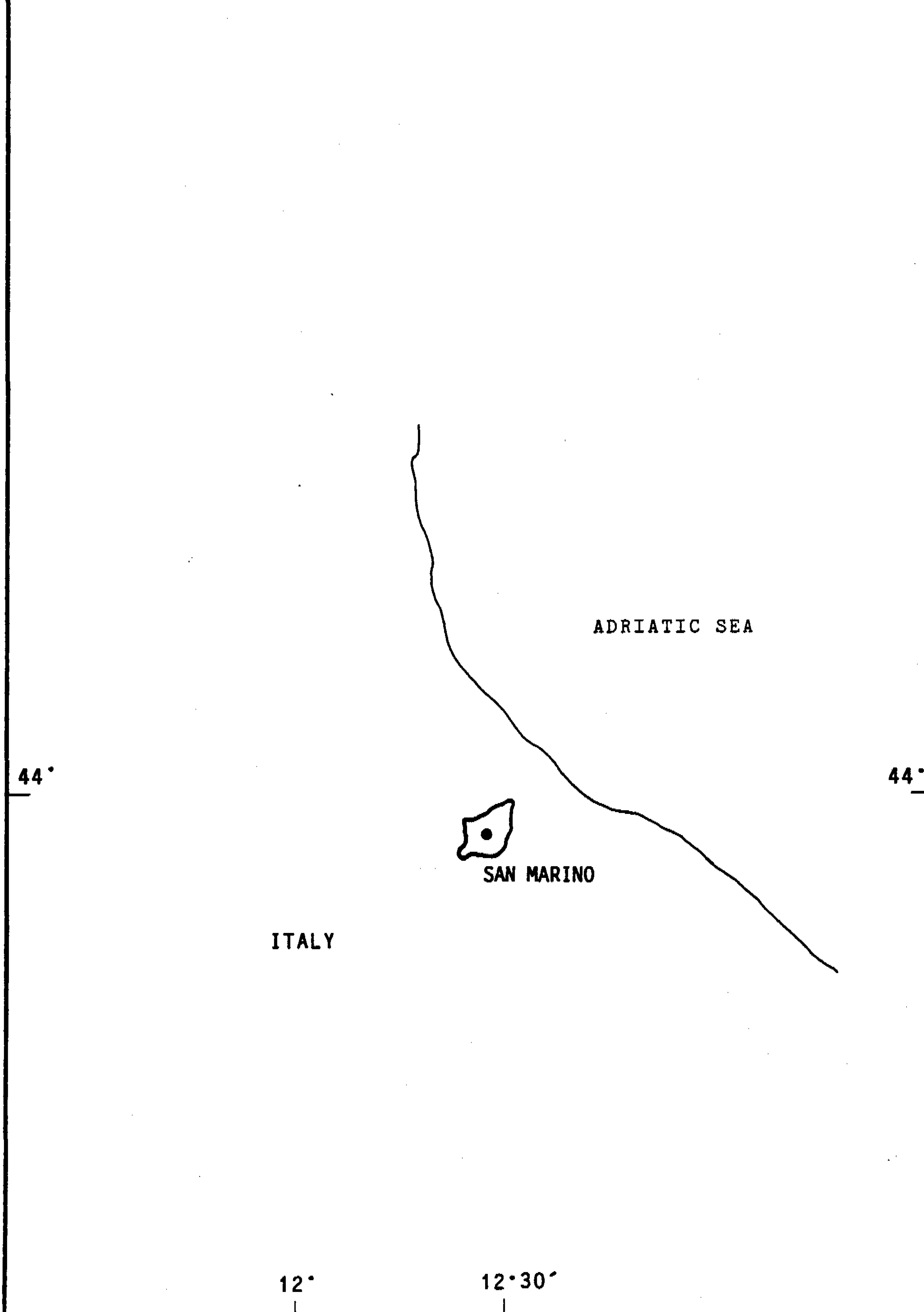
Central State Health Inspectorate
Ilfov Str. 6
Bucharest SRR

Tel: 134230
Telex: 11468a

Institute of Hygiene and Public Health
Dr Leonte Str. 1-3
Bucharest 6 SRR

Tel: 494030

SAN MARINO



SAN MARINO

San Marino is a land-locked state in the north-eastern part of Italy, located on the Titano mount (750 m above the sea) 22 km south of the Adriatic coastal city of Rimini and 100 km from Bologna, between the Italian regions of Emilia-Romagna to the north-west and Marché-Montefeltro to the south-west.

The State has a total area of 60.6 km^2 and is divided into 9 "Castelli" (castles) which correspond to the old parishes of the Republic. On 31 December 1986 the resident population reached a total of 22 418. The average density of population is 361.4 per km^2, the birth rate is 9.8 per thousand and the death rate is 7.5 per thousand. Approximately the same number of its citizens live abroad, but mainly in Italy.

Government

The Republic of San Marino remained independent when modern Italy was consolidated as a kingdom. A treaty of friendship and a de facto customs union with Italy was concluded on 22 March 1862 and renewed in 1872, 1897 and 1939 with several subsequent amendments (1972).

Legislative power is vested in the Great and General Council which has 60 members elected by the population every five years, two of whom are appointed to serve as regents with executive power for six-month terms. Executive power is exercised by the State Congress, composed of three secretaries (Secretary of State for Foreign and Political Affairs; Secretary of State for Home Affairs; Secretary of State for Finance and Budget) and seven Deputies, heads of the following Departments: Education, Culture and Civil Rights; Territory and Environment; Health and Social Security; Trade, Tourism, Sport and Agriculture; Industry and Handicrafts; Employment and Cooperation; Relations with the State Autonomous Administration; Communication, Transport and Relations with the Castle Committees. Every Castle is presided over by a Castle Captain and an Auxiliary Council which remain in power for two years.

Law is administered by a Commissioner for civil and commercial cases and a Commissioner for criminal cases (acting with a penal judge) from whom appeals can be made to a civil appeals judge and a criminal appeals judge respectively. The highest legal authority is, in certain cases, the Consiglio dei XII.

Régulations and standards follow Italian examples to the extent that is appropriate to this small country.

Administrative organization of water services

For its bulk water supply, San Marino relies on resources in Italy, with responsibility for distribution, collection and treatment of wastewaters prior to discharge resting with the state authorities.

Role of the health department with regard to water quality

In 1956, following the example of Great Britain and of those countries of northern Europe, the National Sanitary Service (I.S.S.) was created in San

Marino (this Institute for Social Security monopolies the sanitary and social-sanitary services: medical care, hospital, chemists shop, old-age pension, disability pension, etc.).

The Institute of Social Security was initially set up as an autonomous body subject to the control of the Public Assistance Board and administered by the Director-General, who represented it until 1964. In that year, the institution of the obligatory system of social security was accompanied by the establishment of a new management structure presided over by the Minister of social Security, Hygiene and Health, who is the legal representative of the Institute. The other management bodies comprise a General Commission, Executive Commissions, the Director-General of the Institute and, since 1975, the Chairman of the General Commission and Executive Commissions.

The Law of 24 March 1983, reforming the I.S.S., redefined these bodies and their powers by conferring greater managerial autonomy on the State Congress, which exercises supervision through the Minister of Health and Social Security, and through a wider representation of social forces in the various bodies.

Water and related legislation

The entry into force of Law No. 42 of 22 December 1955, establishing the system of social security, guaranteed for all citizens, whatever their income, the right to health services and temporary or long-term economic assistance. The basic medical services are provided by three health centres, each covering a third of the population, which are coordinated by a single management board.

The present Environmental Hygiene Department (set up under Law No. 36 of 16 May 1981) carries out activities connected with prevention of environmental pollution, supervision of the environment and workplaces, and the control of foods and beverages.

Supervision of hygiene and control of drinking water, food and beverages, including food and animal origin, is carried out with the help of the veterinary service.

Water research

No information available.

Finance

No information available.

Water charges

No information available.

Sewage charges

No information available.

Responsible agencies

Operation	Carried out by
Water resources survey	No information available
Water management polity	No information available
Drinking-water production	No information available
Drinking-water distribution	No information available
Drinking-water quality surveillance	No information available
Industrial water supply	No information available
Marine pollution control	No information available
Underground water protection	No information available
Wastewater collection and treatment	No information available

Water resource availability and management

No information available.

Climate

The climate is temperate without extreme heat in summer or cold in winter (the average yearly temperature is +16°C; winter temperature ranges from +10°C to -2°C rarely descending to -6°C; spring temperature from +12°C to +24°C; summer temperature ranges from +20°C to +30°C, rarely reaching the maximum of +35°C; autumn temperature ranges from +20°C to +10°C). The sky is mostly clear with occasional brief showers. There is little snow except during some winters. The air is very clean and healthy typical of low mountain and hill country and influenced by sea breezes.

Topography

The territory of San Marino is mostly hill country, roughly square-shaped with Mount Titano in the centre (lat. 43°, 56', 06'' - long. east of Greenwich 12°, 26', 56'' - 750 metres high and 10 km as the crow flies from the Adriatic Coast).

General statistics

Population

San Marino has a total population of 22 418 inhabitants divided up as follows: the capital of the same name 4516; Serravalle 6888; Borgo Maggiore 4269; Faetano 770; Domagnano 1891; Chiesanuova 714; Acquaviva 1134; Fiorentino 1418; Montegiardino 606 (31/12/83).

Population in urban areas (1986)	22 418
Population in rural areas	0

Drinking-water supply

Total piped supply for drinking purposes	NA[a]
Total population served by a piped public water supply	100.0%
Urban population served by a house connection	100.0%
Urban population without house connections but with reasonable access to public standposts	0.0%
Rural population served by house connections (public or private)	None
Rural population without house connections but with reasonable access to public standposts	None

Drinking-water supply uses

Water supplied for domestic and commercial use	NA
Water supplied for industrial use	NA
Other uses	NA

Wastewater disposal services

(a) % of urban population served by a sewerage network	100.0%
(b) % of urban population served by other adequate means	0.0%
(c) % of urban population lacking adequate disposal means	0.0%
(d) % of rural population served by a sewerage network	None
(e) % of rural population served by other adequate means	None
(f) % of rural population lacking adequate disposal means	None

Sewage treatment

(g) % of sewerage systems receiving primary treatment only	NA
(h) % of sewerage systems receiving secondary treatment	NA
(i) % of sewerage systems receiving tertiary treatment	NA
(j) % of sewerage systems receiving no treatment (raw discharge)	NA

[a] NA = Information not available

<u>Discharge of treated sewage</u>

(k) % discharged into surface water bodies NA
(l) % discharged onto farmland NA

<u>Discharge of untreated sewage</u>

(m) % discharged into surface water bodies NA
(n) % discharged onto farmland NA

<u>Sludge disposal</u>

(o) % of sludge disposed into surface water bodies NA
(p) % of sludge disposed onto farmland NA
(q) % of sludge disposed as landfill NA
(r) % of sludge incinerated NA

Useful addresses

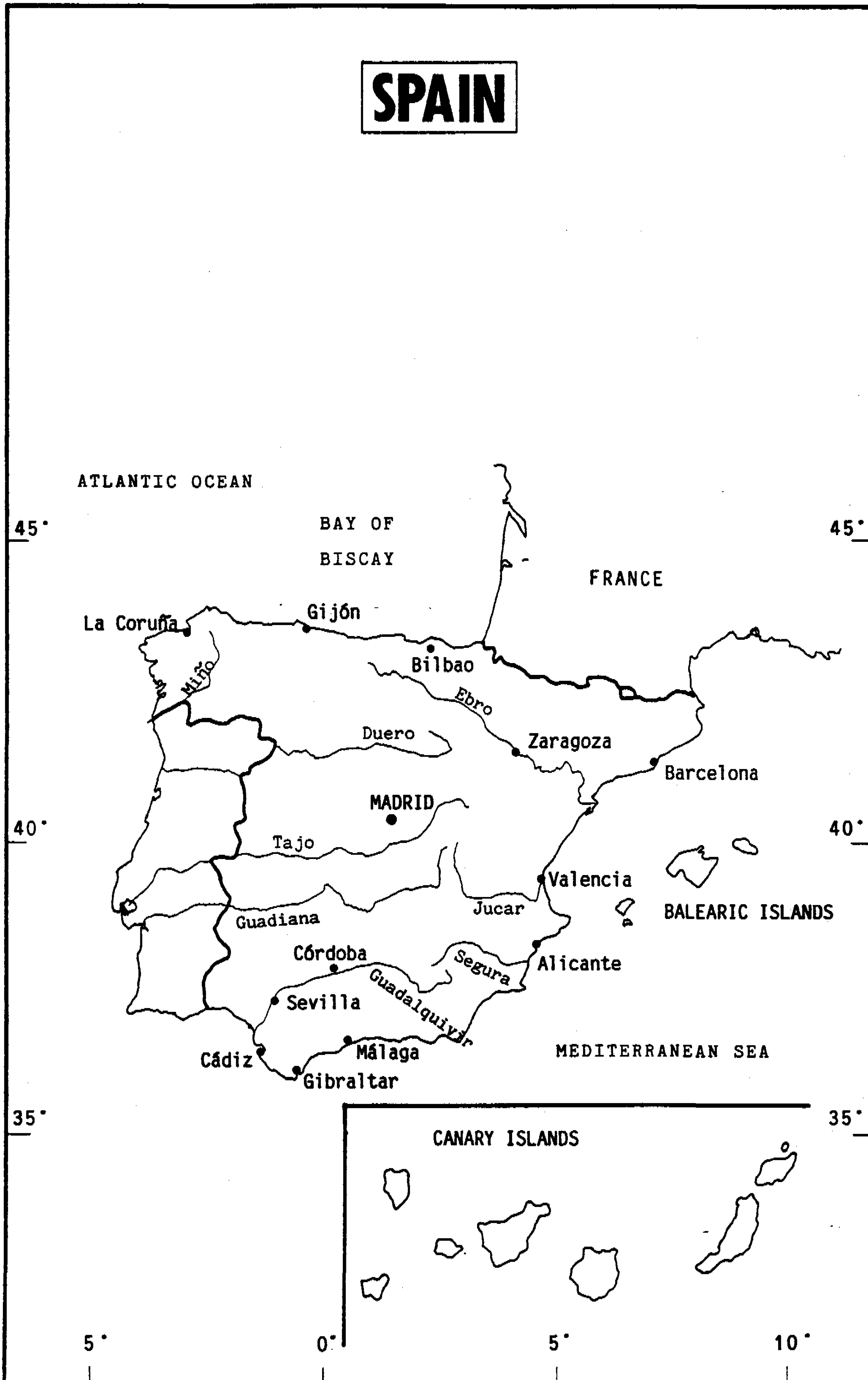
Governmental

Secretary of State for Foreign Affairs
Palazzo Begni-Belluzzi
San Marino

Tel. 99 23 45

Department of Health
Via la Toscana
Cailungo
San Marino

Tel. 90 44 54


SPAIN
ATLANTIC OCEAN
BAY OF
BISCAY
FRANCE
La Coruña
Gijón
Bilbao
Miño
Ebro
Duero
Zaragoza
Barcelona
MADRID
Tajo
Valencia
Jucar
BALEARIC ISLANDS
Guadiana
Córdoba
Segura
Alicante
Guadalquivir
Sevilla
Málaga
Cádiz
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SPAIN

The Kingdom of Spain, a member of the European Community since 1 January 1986, is located in south-west Europe. Its territory of 504 750 km^2 is peninsular territory (Iberian Peninsula), the remainder being island territory. The Balearic Islands have an area of 5014 km^2 and the Canary Islands 7272 km^2. Peninsular Spain is bordered on the north by France and the Bay of Biscay; on the west by Portugal and the Atlantic Ocean; and on the south and west by the Mediterranean Sea.

In its entirety, peninsular Spain has a compact look, and its 3904 km of coastline is very regular with the exception of the north-west region. Low grounds make up a narrow coastal strip which widens in the Guadalquivir River Valley and the final stretch of the Tajo River. The Central Plateau makes up three-fourths of the peninsular land surface. It has an average height of 600 metres and is surrounded by chains of mountains (Cantabrian, Iberian and Andalusian).

The hydrographic characteristics of peninsular Spain are the following: the North Slope is made up of river basins which empty into the Bay of Biscay and the Atlantic and represents an area of 53 804 km^2, with an average rainfall of 1353 mm and a fairly regular reservoir pattern. The Atlantic Slope includes the Duero, Tajo, Guadiana and Guadalquivir river basins, represents an area of 256 699 km^2 and has an average rainfall of 594 mm, with a pattern of sharply reduced water flow. The Mediterranean Slope is made up of the Ebro river basin (86 098 km^2 in area, with an average rainfall of 623 mm) and the rest of the river basins which empty into the Mediterranean. The area is characterized by irregular water flow and torrential phenomena.

Peninsular Spain has a moderate climate (temperatures average between 14 and 20°C for the greater part of the territory), with two well-defined climatic zones. One consists of the Galician, Cantabrian and Pyrenean regions, which experience little direct influence from subtropical high pressure. The other region consists of the rest of the Spanish Peninsula, where this high pressure is intense during the summer.

The population of Spain, as of 1 April 1985, was 39.3 million, with an average per capita density of 78 km^2.

The average per capita density is three times as great for peripheral regions as it is for the interior. 45% of the population is concentrated in 80 cities of more than 50 000 inhabitants.

Government

By virtue of its 1978 Constitution, Spain is a democratic state governed by law, whose political system is a parliamentary monarchy. The head of state is the King. Legislative power is exercised by the Spanish Parliament, which consists of the Congress of Deputies and the Senate, elected for four years by universal suffrage. Executive power is exercised by the National Government, made up of the President, Vice-presidents and Ministers. The President is appointed by the King, but with the prior approval of the Congress of Deputies. The exercising of juridical power is the exclusive domain of the courts.

The Spanish state is territorially organized into municipalities, provinces (52) and autonomous communities (17). The municipality is a legal local entity, governed and administrated by its city government, which consists of the mayor and town councillors. They are elected by universal suffrage of the residents of the municipality. The province is a legal entity, made up of municipalities, which complements the activities of the national government on a territorial level. Its government and administration are entrusted to representative delegations and other associations. The autonomous communities, made up of one or several provinces with common historic, cultural or economic characteristics, use their statutes of autonomy as their basic institutional governing framework. The statutes establish the functions and responsibilities of each autonomous community and structure its legislative, executive and juridical powers.

Administrative organization of water services

In accordance with regulations laid down in Law of Waters, 29/85, of 2 August 1985, the management of continental waters for the entire peninsular territory is entrusted to the Ministry of Public Works and City Planning. This is done through Hydrographic Confederations which act within the territorial boundary defined by hydrographic basins and other administrative guidelines for the territory they occupy.

In accordance with the Law of the Bases for Local Rule, 7/85, of 2 April 1985, municipalities are responsible for supplying drinking water to those people who consent to it. In the legal application of Law 14/86, of 25 April 1986, the Health General of the Ministry of Health and Consumer Affairs, establishes the basic standards regarding the supply and quality control of drinking water for public consumption. In accordance with what is provided in the Statutes of Autonomy and their decrees for transfer of responsibilities regarding public health, autonomous administrations have responsibility for health control of drinking water for public consumption and for sewage.

The role of the Department of Health in relation to water quality

Under the current Spanish legal arrangement, the responsibilities of the Ministry of Health and Consumer Affairs in relation to drinking water for public consumption and waters for recreational use are limited, at state level, to the tasks of enforcing the basic standards. The Ministry exercises the powers of inspection, coordination among the autonomous administrations, gathering of statistics of national interest and representing the national government in matters involving third parties.

Water and specific legislation

The basic legislation in force on the subject of water policy is the following:

- Royal Decree 1423/82, of 18 June 1982 (Presidency of the Government), approving the Technical Health Regulation for the Supply and Quality Control of Drinking Water for Public Consumption. (B.O.E. of 19-6-82).

- Order of 27 July 1983 (Ministry of Health and Consumer Affairs), which established the Official Methods for Microbiological Analysis of Drinking Water for Public Consumption. (B.O.E. of 13-8-1983).

- Resolution of 23 April 1984 (Ministry of Health and Consumer Affairs), approving the Positive List of Additives and Technological Adjuvants Authorized for Drinking Water for Public Consumption (B.O.E. of 29-5-1984).

- Law of Waters, 29/1985, of 2 August 1985 (Department of State). (B.O.E. of 8-8-1985).

- Royal Decree 849/86, of 11 April 1986 (Ministry of Public Works and City Planning), approving the Regulation of the Public Hydraulic Domain, which develops the Preliminary Titles I, IV, V, VI and VII of Law of Waters, 29/1985, of 1 August 1985. (B.O.E. of 30-4-1986).

- Law 14/1986, of 25 April 1986 (Department of State, Health General). (B.O.E. of 29-4-1986).

Water research

Water research is carried out by several official institutions working under the various ministries authorized to oversee the supplying of water.

The main laboratory undertaking water research is the Centre for Hydrographic Studies, operated by the Ministry of Public Works and City Planning. This laboratory studies water treatment and river basin stability. Other ministries have laboratories which deal more specifically with research on water quality. The most important of these laboratories are those operated by the Carlos III Institute of Health (Ministry of Health and Consumer Affairs), and those of the Centre for Water Research (Ministry of Education and Science).

Finance

Revenue income

The local authorities obtain the necessary funds for water services from the charges paid by residents connected to the water distribution and sewage networks.

Service charges

Potable water supply

The charges are based, in the majority of cases, on water consumption; in addition a fixed amount covering the connection to the network is levied. The price covers both water supply and sewage services.

Sewerage

The charges that correspond to sewage treatment consist, in general, of a tax payable for sewage systems, plus a supplement price per cubic metre paid for water.

Industrial effluent

In general, charges for trade effluents do not take into account the nature and volume of the effluent, although there are plans to institute these charges in large centres of population in the near future.

Responsible agencies

Operation	Carried out by
Water resources survey	Ministry of Public Works
Water management policy	Ministry of Public Works
Drinking-water production	Ministry of Public Works Local organizations
Drinking-water distribution	Local organizations
Drinking-water quality surveillance	Ministry of Health and Consumer Affairs
Agricultural irrigation	Ministry of Agriculture and Fisheries
Industrial water supply	Ministry of Public Works
Underground water protection	Ministry of Public Works Ministry of Health and Consumer Affairs Ministry of Industry
Surface water protection monitoring	Ministry of Public Works Ministry of Health and Consumer Affairs
Water pollution control	Ministry of Public Works
Water resources storage and allocation	Ministry of Public Works

(In autonomous regions, some of these have been transferred to the corresponding body in the regional administration)

Water resources availability and management

Rainfall

Rainfall is extremely variable both in terms of geographical extension and seasonal changes.

The average rainfall for the entire country is approximately 700 mm per year. The maximum occurs in the northern river basin with approximately 1400 mm per year and the minimum in the south-eastern river basins with approximately 350 mm per year. Seasonally, the rainfall varies from 90 mm per month in the spring to 20 mm per month in the summer.

Topography

The topography of the nation is dominated by the central plateau (Meseta Central) an ancient earth block consisting mostly of flat-lying strata, broken and eroded. The Meseta slopes gradually from north to south and from west to east, its average altitude being about 700 m. On the north it is bordered by the Cantabrian mountains. The Meseta is divided by a central cordillera into northern and southern submesetas, consisting of a series of crust-block mountains formed by successive fractures and vertical movements.

The Meseta is composed by Archaean, Palaeozoic and eruptive rocks partly concealed by a covering of Tertiary strata but characterized by the absence, excepting in its margins, of any marine deposits of Mesozoic age and bordered on the north, east and south by zones of folding in which the Mesozoic and early Tertiary beds are involved.

Population/water resources

The population is centred mainly on the borders of the nation, with three main nuclei in Barcelona, Bilbao and Valencia. Outstanding inland centres of population are Madrid in the centre of the country and Seville in the Andalusian region.

Most of the water used is derived from surface waters. Because of the wide variations in flow rates of many of the rivers, there has been widescale construction of reservoirs for regulating river flow. There are approximately 400 dams over 15 m high in use.

Future trends of water resources

The regulation of surface waters will be extended including the transference of water from one basin to another. In addition, it is planned to make greater use of underground water resources.

General statistics

Population

Population in urban areas	70%
Population in rural areas	30%

Drinking-water supply

Total piped supply for drinking purposes	7 650 Ml/d[a]
Total population served by a piped public water supply	80.0%
Urban population served by a house connection	90.0%
Urban population without house connections but with reasonable access to public standposts	10.0%
Rural population served by piped public water supply system at home	50.0%
Rural population served by private systems or having reasonable access to public standposts	50.0%

Drinking water supply uses

Water supplied for domestic and commercial use	80.0%
Water supplied for industrial use	20.0%
Other uses	0.0%

Industrial water supply: direct abstractions

Total supplied from inland waters for industrial use	41 000 Ml/d
Used for industrial cooling water	2.0%
Usage as industrial process water	90.0%
Total coastal water used	NA[b]

Agricultural use: direct abstractions

Total amount abstracted for irrigation	NA
Other agricultural uses including fish ponds	NA

[a] 1 Ml/d = 1 million litres/day.

[b] NA = Not available

Wastewater disposal services

(a)	% of urban population served by a sewerage network	80.0%
(b)	% of urban population served by other adequate means	20.0%
(c)	% of urban population lacking adequate disposal means	0.0%
(d)	% of rural population served by a sewerage network	40.0%*
(e)	% of rural population served by other adequate means	60.0%*
(f)	% of rural population lacking adequate disposal means	0.0%

Sewage treatment

(g)	% of sewerage systems receiving primary treatment only	17.0%
(h)	% of sewerage systems receiving secondary treatment	9.0%
(i)	% of sewerage systems receiving tertiary treatment	NA
(j)	% of sewerage systems receiving no treatment (raw discharge)	NA

Discharge of treated sewage

(k)	% discharged into the sea	NA
(l)	% discharged into surface water bodies	NA
(m)	% discharged onto farmland	NA

Discharge of untreated sewage

(n)	% discharged into the sea	NA
(o)	% discharged into surface water bodies	NA
(p)	% discharged onto farmland	NA

Sludge disposal

(q)	% of sludge disposed into the sea	NA
(r)	% of sludge disposed into surface water bodies	NA
(s)	% of sludge disposed onto farmland	NA
(t)	% of sludge disposed as landfill	NA
(u)	% of sludge incinerated	NA

* Information provided at the IDWSSD Evaluation Meeting in Nancy, France, November 1987

Useful addresses

Governmental

General Directorate of Hydraulic Works
(Direccion General de Obras Hidraulicas)
Ministry of Public Works and Town Planning
(Ministerio de Obras Publicas y Urbanismo (MOPU))
Paseo de la Castellana 66
Madrid 3

Tel. 233 4900

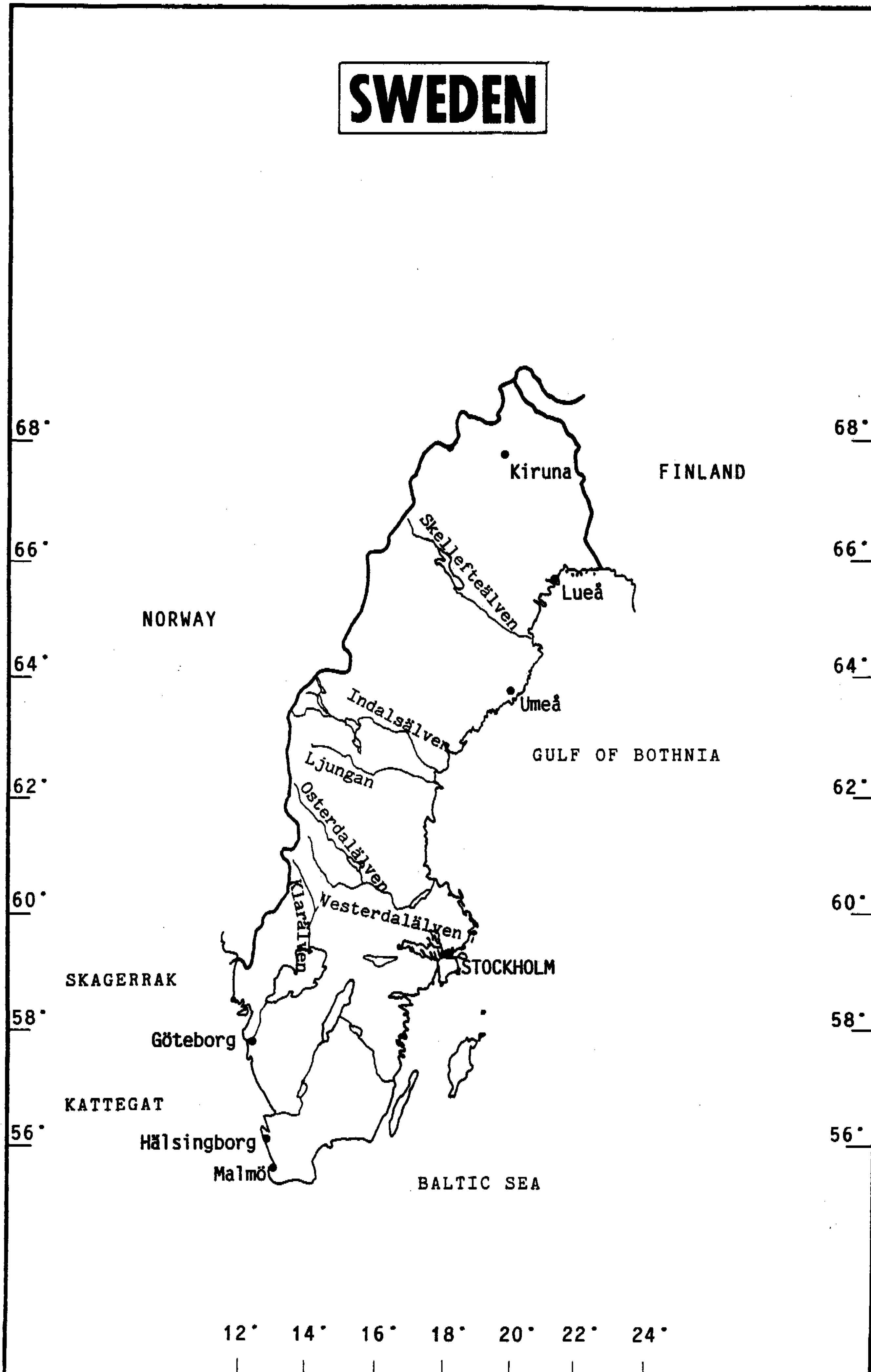
Water research

Centre of Hydrographic Studies
Paseo Bajo de la Virgen del Puerto 3
Madrid 5

Tel. 265 6800

Direccion General de Salud Alimentaria y
Proteccion de los Consumidores
Ministerio de Sanidad y Consumo
Paseo del Prado, 18-20
Madrid 28014

Tel. 239 70 00



SWEDEN
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Kiruna
FINLAND
Skellefteälven
Lueå
NORWAY
Umeå
Indalsälven
GULF OF BOTHNIA
Ljungan
Österdalälven
Klarälven
Westerdalälven
STOCKHOLM
SKAGERRAK
Göteborg
KATTEGAT
Hälsingborg
Malmö
BALTIC SEA
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24°

SWEDEN

Sweden covers the eastern and southern parts of the Scandinavian peninsula, bordering on Norway to the west, Finland to the north-east, the Baltic Sea to the east and south and the Kattegat to the west. The country extends about 1600 km from north to south with extensive archipelagos. Sweden is a country abounding in water. Sweden has an area of 449 964 km^2 and had a population of 8 331 000 in 1983. Ninety per cent of the population live in the southern half of the country. Population density therefore varies considerably, being as high as 231 per km^2 in Stockholm, and as low as 3-4 per km^2 in the northern counties. The average density is 18.5 per km^2, one of the lowest in Europe.

Government

Sweden is a representative and parliamentary democracy. The King is Head of State but has representational and ceremonial duties only. The Parliament (Riksdag) has 349 members elected by universal suffrage for three years. The country is governed by the cabinet, which is responsible to Parliament.

The Cabinet takes collective responsibility for all government policy decisions. Its members include the Prime Minister, who serves as its guiding and coordinating power, and approximately 15 ministers. Since 1971, Sweden has had a one-chamber Parliament. The main task of the Parliament is to scrutinize the Government's annual budget and its legislative proposals.

Central administrative agencies and the 24 county administrations execute the law. Country councils are popularly elected; they can impose taxes, and are mainly responsible for health and medical care. Each council appoints an executive committee. At the next level are the communes of which there were 284 in 1984. Each has a directly elected council which is the decision-making body and appoints boards for administrative and executive duties. Each commune is required to appoint certain special local bodies, including a public and environmental health committee, on which are devolved particular responsibilities.

Administrative organization of water services

The responsibility for the management of water resources is divided between a relative large number of national institutions: Geological Institute, Meteorological and Hydrological Institute, National Environment Protection Board, National Board of Fisheries, National Food Administration, etc.

Public water supplies in Sweden are managed almost exclusively by local authorities. There are 284 municipalities in Sweden and in each municipality there is generally only one public water supply authority. This authority very often runs geographically separated networks including treatment plants. For the metropolitan areas of Stockholm, Gothenburg and Malmo, there are special regional associations. Water supply administration is generally linked with sewage handling; only the regional associations deal exclusively with either water supply or sewage.

At government level, the overall responsibility for drinking-water quality has been shifted from the Ministry of Health and Social Affairs to the Ministry of Agriculture (National Food Administration). One of the reasons for this shift is to simplify the handling of environmental protection and drinking-water quality. At government level, the main responsibility for environment protection is vested in the Ministry of Agriculture.

The National Environmental Protection Board (SNV), which is the central board for the administration of environmental protection in Sweden, and the National Franchise Board for Environmental Protection, which decides on applications for permission for pollutant discharges from industrial facilities and municipalities (above 50 000 persons), come under the authority of the Ministry of Agriculture.

The Swedish Meteorological and Hydrological Institute (SMHI) and the Geological Survey of Sweden (SGU) are central agencies for the survey of surface water and groundwater respectively. This includes national networks, data archives and calculation methods to provide the Swedish society with data and information on surface water and groundwater resources.

At county level, matters concerning environmental protection are handled by special environmental protection units in the county administrations. The county administrations are responsible for the regional planning of environmental protection; they decide on various matters in the environmental sector and they are responsible for the enforcement of environmental regulations.

Role of the health department with regard to water quality

The Public Health Act (1958 and revised in 1975) and the Food Act set out the roles of the organizations responsible for drinking-water quality. A more recent Public Health Protection Act (1982) states that each household shall have access to water of acceptable quality. The Act enables the Public and Environmental Health Committees and the National Environmental Protection Board to issue regulations for the protection of ground water.

The 284 municipalities handle matters concerning the general maintenance of public health. The quality of public water supplies is evaluated by bacteriological and physical/chemical analyses of both raw and treated water. In case of any unresolved differences between the water consumer and the local authority, a certain water and sewerage jury should be notified. This jury can in principle be compared with a court, and appeals against its decisions may be made to higher courts.

The central board responsible for supervising drinking-water quality is the National Food Administration. Physical and chemical investigations of water quality may be performed only by the National Environmental Protection Board or by other agencies approved by the National Food Administration. Bacteriological investigations of drinking-water quality may be performed only by the National Environmental Protection Board, the National Bacteriological Laboratory or by other agencies approved by the National Food Administration.

Two laboratories, the National Institute of Environmental Medicine and the National Bacteriological Laboratory, come under the authority of the National Board of Health and Welfare. At these laboratories, research and development on drinking-water quality is performed to help the central authority. The laboratories also take an active part, for instance, in investigations of incidents of waterborne diseases.

Water and related legislation

The Water Act of 1918 contains a wide variety of regulations with a bearing on nature conservation. The rules regarding construction in water, the use of groundwater supplies, etc., all prescribe the consideration of nature conservation in judging the admissibility of such activities. This Act has been amended and enlarged on several occasions.

Legislation concerning discharge of wastewater into lakes and rivers has been in existence in Sweden since the end of the 1930s. A new law, the Environmental Protection Act, No. 387, came into force in July 1969 (IDHL, 21: 173) and considerably tightened regulations. It was substantially revised by Act No. 420 of 1981 and Ordinance No. 574 of 1981.

The Environmental Protection Act applies to what are termed "polluting activities", i.e. the discharge of effluents, solids or gases from land, buildings, or installations, or the use of such property in a manner liable to cause water pollution, atmospheric pollution, noise, vibration, the emission of light, etc., if the nuisance thus caused is more than temporary.

The chief principle of the Act is to prevent environmental disturbances as far as possible. The precautionary measures, such as effective methods of wastewater treatment, shall be "economically feasible" and "technically practicable".

The Water Associations Act of 1976 stipulates that a water association may be formed with the objective of promoting the purposeful use of water by means of purification, water regulation schemes or other water management measures.

Sewage from locations with 200 inhabitants or more must not be emitted without a permit. Sewage from less than 200 inhabitants must not be emitted before an announcement has been made to the county administration. A special board, the National Franchise Board for Environmental Protection, is responsible for the granting of permits to plants serving more than 50 000 persons and the county administrations to plants serving less than 50 000 persons.

The aim of municipal wastewater pollution control is to reduce to innocuous levels not only substances with a high biochemical oxygen demand (BOD) and turbidity but all toxic materials, as well as to make significant reductions in algal nutrients that promote eutrophication. Ordinance No. 1075 of 1976 permits the use of lime (a toxic substance within the law) to neutralize acidity in lakes. Acidity that kills fish is caused by sulfur and nitrogen oxides in combustion gases, 75% of which come from sources outside Sweden. The National Board of Fisheries can award grants for the liming of lakes.

The National Board of Health and Welfare, under the authority of the Public Health Act No. 663 of 1958 (IDHL, 11: 473), issues regulations on substances in drinking-water that are injurious to health. Act No. 107 of 1962 authorizing the addition of fluorine to water to prevent dental caries was repealed nine years later by Act No. 859 of 1971 (IDHL, 14: 492 and 24: 399). Instead, the National Board of Health and Welfare now recommends the use of fluoride tablets or topical applications (Order No. 26 of 24 May 1977, IDHL, 29: 452).

Drinking-water standards in Sweden have legal status for a small number of biological and chemical/physical parameters. Four groups of water content are given as criteria for the evaluation of drinking-water quality:

- contents which, if a certain level is exceeded, make the water strictly unsuitable for potable use;

- contents which, if a certain level is exceeded, make the water questionable for potable use;

- contents which are technically worthy of comment, but do not affect the suitability of a water for drinking purposes;

- contents which, if a certain level is exceeded, are hygienically questionable; in this case, special investigations have to be made about the origin of the contents of the water.

Special provisions against the pollution of the sea by oil are administered by the National Administration of Shipping and Navigation and the Swedish Customs Board. Act No. 6 of 1976 implements the Helsinki Convention of 22 March 1974 on the Protection of the Marine Environment of the Baltic Sea Area. Acts No. 7 and No. 8 of 1976 and Ordinance No. 573 of 1976 supplement conventions on the prevention of pollution of the seas. Act No. 850 of 1971 deals with the control of the pollution of boundary waters with Norway and Finland.

Water research

The financial support and control of applied research and development in the broad field of water research involve many levels of governmental and institutional organizations and interdisciplinary units in both governmental and private institutions.

Financial support

Water research is funded primarily by the State, but private industry support for water research is substantial. The principal sources of financial support from the State are the following five agencies:

- the Natural Science Research Council (NFR), which mainly carries out basic research on the hydrological cycle;

- the National Swedish Environmental Protection Board which is concerned with applied research on water quality in lakes, rivers, coastal waters and groundwaters, and the effect of waste discharge and pollutants on the recipients and on beneficial use by the recipients;

- the Swedish Board for Technical Development (STU), which mainly undertakes research on instrumentation, water and wastewater treatment and disposal systems.

- the Council for Building Research (BFR), which concentrates on applied research on urban hydrology, water and wastewater transport and disposal systems;

- the Swedish Water and Wastewater Works Association (VAV), which carries out applied research on design and operation of water pipes and sewers and water and wastewater treatment plants.

The total financial support from the State for water research is about S.kr. 40 million per year.

Universities and technical institutes

Universities and institutes of technology carry out water investigations as part of their educational and research role and for various funding agencies.

The major academic research effort is undertaken by the Department of Oceanography, University of Gothenburg; the Department of Limnology, Lund University; and the Department of Hydrology and the Department of Limnology, Uppsala University.

At the university in Linkoping, a special multidisciplinary department was recently set up to deal with water in the environment and society. The major divisions and departments at the four institutes of technology that are involved in water research and the main topics on which they are working are as follows:

- Gothenburg (CTH): Division of Hydraulics (water resources, urban hydrology, hydraulic and ocean engineering) and Department of Water Supply and Sewerage Engineering (water resources, urban hydrology, water supply, water and wastewater treatment and disposal);

- Lund (LTH): Department of Water Resources Engineering (water resources management, urban hydrology, hydraulic engineering, wastewater treatment and disposal) and Department of Automatic Control (instrumentation and automation of wastewater treatment processes);

- Stockholm (KTH): Department of Hydraulics (water resources, urban hydrology, hydraulic and ocean engineering), Department of Water Resources Engineering (water resources, urban hydrology, wastewater treatment and disposal) and Department of Land Reclamation and Drainage; -

- Lulea (LuTH): Division of Water Resources Engineering (water resources, urban hydrology, hydraulics, problems of urban hydrology and water and wastewater treatment in an arctic climate).

Organizations conducting research and special purpose research institutes

Of the six agencies funding water research in Sweden (other than the special-purpose research institutes), only two (SNV and VAV) fund contract research at universities, technical institutes and special research institutes and also conduct in-house research programmes.

There are four major special-purpose institutes performing water research, namely the Swedish Water and Air Pollution Research Laboratory (IVL), the Swedish Meteorological and Hydrological Institute (SMHI), the Geological Survey of Sweden (SGO) and the Swedish Institute for Surface Chemistry (YKI). In addition, several other institutes and organizations carry out water research studies.

Finance

Revenue income

According to Swedish law, a public water supply authority can recover all the costs of providing water supplies and other services, such as sewerage and sewage treatment from water charges. It is, however, not allowed to make a profit. It is allowed to keep water charges down by means of contributions from local tax revenues. This was fairly common ten years ago, but due to the present high level of local taxes, more and more of the costs are being recovered by water charges for political reasons.

Water charges

Potable water supply

About 95% of water consumption is measured by meters. Charges are based on the metered consumption. In addition, a standing charge may be made, based on the size of dwelling or garden area, for instance.

Sewage

Sewage charges are based on the metered water consumption. In addition, a standing charge may be made.

Industrial effluents

The charge for industrial or trade effluents is normally based on water consumption. Additional charges are normally made if the contents of organics, suspended solids and phosphorus exceed certain concentrations. For large industries, special agreements are often made. Certain industries such as mining or pulp and paper usually have their own treatment facilities.

Responsible agencies

Operation	Carried out by
Water resources survey	Meteorological and Hydrological Institute National Environmental Protection Board Geological Survey of Sweden
Water management policy	National Environmental Protection Board
Drinking-water production	Municipalities
Drinking-water distribution	Municipalities
Drinking water quality surveillance	Municipalities
Agricultural irrigation	National Board of Agriculture
Industrial water supply	Industry Municipal Authorities
Underground water protection	Each municipality and county administration
Surface water protection monitoring	National Environmental Protection Board
Water pollution control	Meteorological and Hydrological Institute National Environment Protection Board and county administration
Water resources storage and allocation	None designated, several institutions involved

Water resource availability and management

Rainfall

The average annual precipitation is 700 mm. The range is from 300 mm to 2000 mm, depending on the location.

The annual temperature in Sweden as a whole is +5°C. The annual averages range from -2°C to +8°C, depending on the location.

Topography

The backbone of Sweden is an ancient mountain range of which the crest line forms the Norwegian boundary. The country has four main physical divisions: the northern mountains and lake region district; the Smaland highlands in the south and southeast; and the plains of Skane, occupying the extreme south of the peninsula. The greatest heights lie along the boundary and several exceed 2000 m.

The lowlands resemble the coastal belt. There are fertile plains of clay, with innumerable lakes.

Granulite is the most important of the Archaean formations of Sweden. The rock is a very compact and fine-grained mixture of feldspar, quartz and mica, often grading into schist, quartzite and gneiss. The Cambrian and Ordovician strata occur in isolated patches. The deposits in most places are very little disturbed and form horizontal or slightly inclined layers. South of Vaner they are capped by thick beds of eruptive diabase. Conspicuous local features are the eskers or gravel ridges, 30-60 m in height. Their practical value lies in their excellent water supply and gravel.

Owing to the geological conditions in Sweden, with the exception of the eskers, only a limited amount of groundwater is locally extractable.

South of the central lowlands, the Smaland highlands lie in the heart of Gotaland and are a detached part of the highland. The Triassic formation in the northern part consists of sandstones and clay beds with coal.

<u>Population/water resources</u>

The population in Sweden was 8 331 000 inhabitants in 1984. There are few problems for the time being concerning the production of sufficient drinking-water in Sweden. There are some 100 000 lakes covering 40 000 km^2 or 8.6% of the country's total area. Total water production, which includes public water supply, industrial abstractions and agricultural irrigation, reaches 4000 million m^3, which corresponds to 7 mm precipitation. However, certain regions in Sweden can experience water shortages at certain periods due to unequal distribution of water supply and population.

<u>Future trends of water resources</u>

Projected total water abstraction for urban, rural, irrigation and industrial purposes indicates that the total demand will be fairly constant during the next 20 years. The export of water from Sweden to water-deficient areas on the European continent has been discussed, although there is no actual project at present.

General statistics

Population

Population in urban[a] areas	83.0%
Population in rural areas	17.0%

Drinking-water supply

Total piped supply for drinking purposes	975 Mm^3/y[b]
Total population served by a piped public water supply	86.0%
Urban population served by a house connection	100.0%
Urban population without house connections but with reasonable access to public standposts	0.0%
Rural population served by piped public water supply	18.0%
Rural population served by private systems at home or having reasonable access to public standposts	82.0%
Rural population with water at home (from private or public systems)	75.0%*

Drinking water supply uses

Water supplied for domestic and commercial use	68.0%
Water supplied for industrial use	14.0%
Other uses	18.0%

Industrial water supply: direct abstractions

Total supplied from inland waters for industrial use	133 Mm^3/y
Used for industrial cooling water	70.0%
Usage as industrial process water	%
Total coastal water used	Ml/d[c]

[a] Urban: Municipalities with more than 200 persons

[b] Mm^3/y = million m^3 per year

[c] Ml/d = 1 million litres/day

* Information provided at the IDWSSD Evaluation Meeting in Nancy, France, November 1987.

Note:

Data collected for 1970-1980 indicated that the water consumption for domestic and commercial use is rather constant, while the industrial water consumption from municipalities has decreased by about 1% per annum. The consumption at waterworks and losses has increased by about 2% per annum. It is now about 19% of the total water supply. The total drinking-water supply has been rather constant during the period 1970-1980.

Agricultural use: direct abstractions

Total amount abstracted for irrigation	600 Ml/d
Other agricultural uses including fish ponds	200 Ml/d

Wastewater disposal services

(a)	% of urban population served by a sewerage network	100.0%
(b)	% of urban population served by other adequate means	0.0%
(c)	% of urban population lacking adequate disposal means	0.0%
(d)	% of rural population served by a sewerage network	18.0%
(e)	% of rural population served by other adequate means	82.0%
(f)	% of rural population lacking adequate disposal means	0.0%

Sewage treatment

(g)	% of sewerage systems receiving primary treatment only	0.5%
(h)	% of sewerage systems receiving secondary treatment	23.2%
(i)	% of sewerage systems receiving tertiary treatment	76.3%
(j)	% of sewerage systems receiving no treatment (raw discharge)	0.0%

Discharge of treated sewage

(k)	% discharged into the sea	45.76%
(l)	% discharged into surface water bodies	54.24%
(m)	% discharged onto farmland	%

Discharge of untreated sewage

(n)	% discharged into the sea	%
(o)	% discharged into surface water bodies	%
(p)	% discharged onto farmland	%

Sludge disposal

(q)	% of sludge disposed into the sea	%
(r)	% of sludge disposed into surface water bodies	%
(s)	% of sludge disposed onto farmland	60.0%
(t)	% of sludge disposed as landfill	30.0%
(u)	% of sludge incinerated	%
(v)	% of sludge used for other purposes	10.0%

Useful addresses

Governmental

Ministry of Agriculture
(Jordbruksdepartementet)
S-103 33 Stockholm

Tel: (08) 763 10 00
Telex: 11461 loendep s

National Food Administration
Box 622
S-751 26 Uppsala

Tel: 018-17 55 00
Telex: 76121 SLVUPS S

National Evnironment Protection Board
Box 1302
S-171 25 Solna

Tel: 08-799 10 00
Telex: 11131 ENVIRON S

Water research

Swedish Water and Air Pollution Research Laboratory (IVL)
Box 210 60
100 31 Stockholm

Tel: (08) 24 96 80
Telex: 117 92 ivl s

Water industry

Swedish Water and Wastewater Works Association (VAV)
Regeringsgatan 86
111 39 Stockholm

Tel: (08) 23 29 35

Water survey

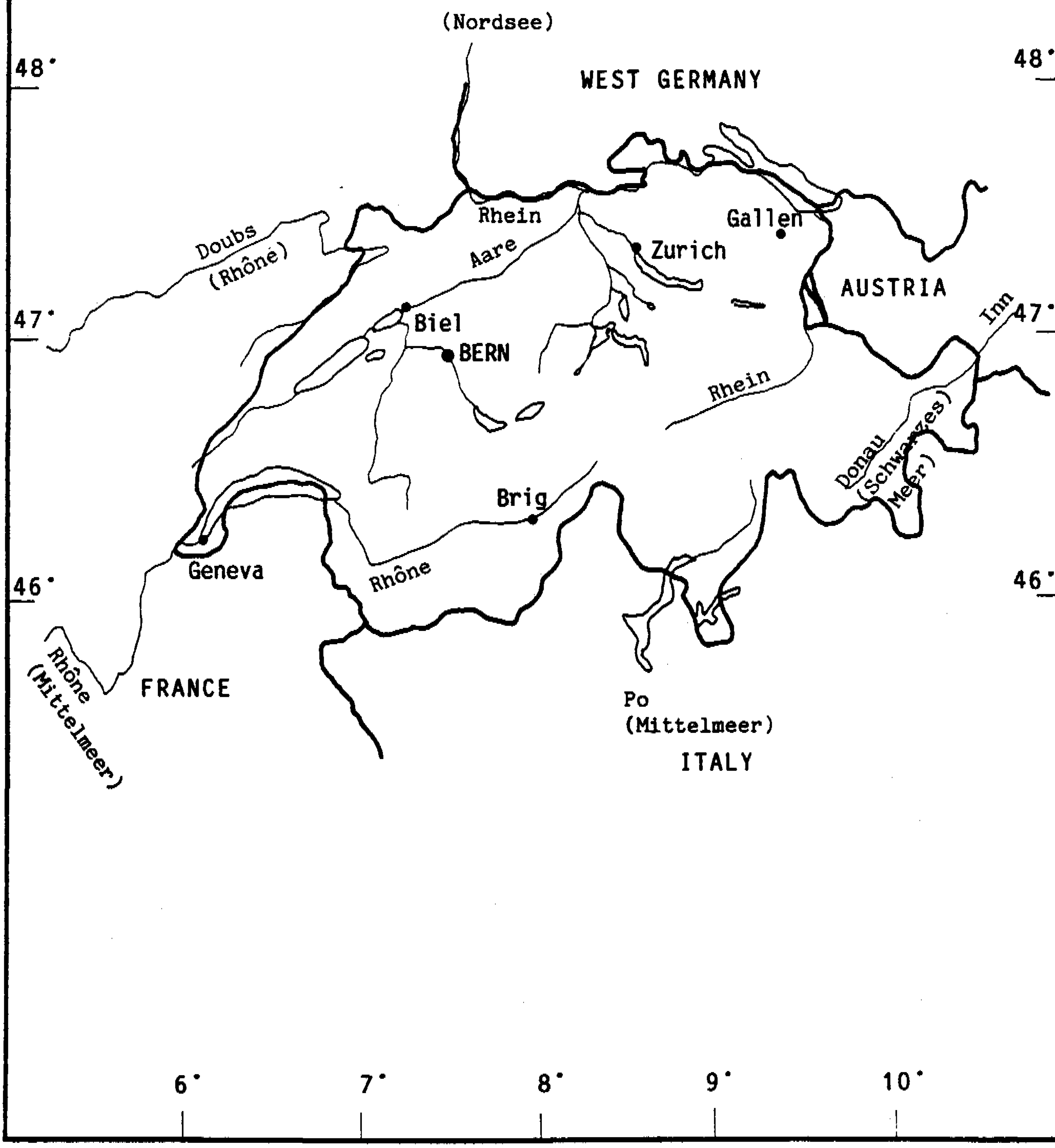
The Swedish Meteorological and Hydrological Institute (SMHI)
Box 293
60119 Norrköping

Tel: (011) 10 80 00
Telex: 64400 SMHIS

The Geological Survey of Sweden (SGU)
Box 670
75178 Uppsala

Tel: (018) 15 52 80

SWITZERLAND



SWITZERLAND

The Swiss Confederation (Confédération Helvétique) is situated in Central Europe, with France to the west, Italy to the south, Austria and Liechtenstein to the east and the Federal Republic of Germany to the north. It has an area of 41 293 km^2, of which half is of an altitude of over 1000 m. Switzerland is situated in the middle of the Alps and, as a consequence, although the weather is generally temperate, there are dramatic and rapid variations. In 1982, the population was 6 423 000 with a density of 156 inhabitants per km^2. It has three official languages: German (70% of the population), French (20%), Italian (9%).

Government

The Swiss Confederation, composed of 26 cantons has a republican federal constitution. Legislative power is held by the bicameral Federal Assembly: a Council of States representing the cantons elected for four years; and the National Council with 200 members directly elected by universal adult suffrage for four years, using proportional representation. Executive power is held by the Federal Council, which has seven members elected for four years by a joint session of the Federal Assembly. The Assembly also elects one of the Federal Councillors to be President of the Confederation (Head of State) for one year at a time.

National policy is the prerogative of the Federal Government, but considerable power is vested in the cantons. The Swiss citizen shares three distinct allegiances - communal, cantonal and national. Direct participation is very important in communal government, and all adult Swiss residents may take part in the communal assemblies or referenda that decide upon local affairs. Each canton has its own written constitution and government and legislative assembly. The referendum, which can be on a communal, cantonal or national scale, further ensures the possibility of direct public participation in decision-making.

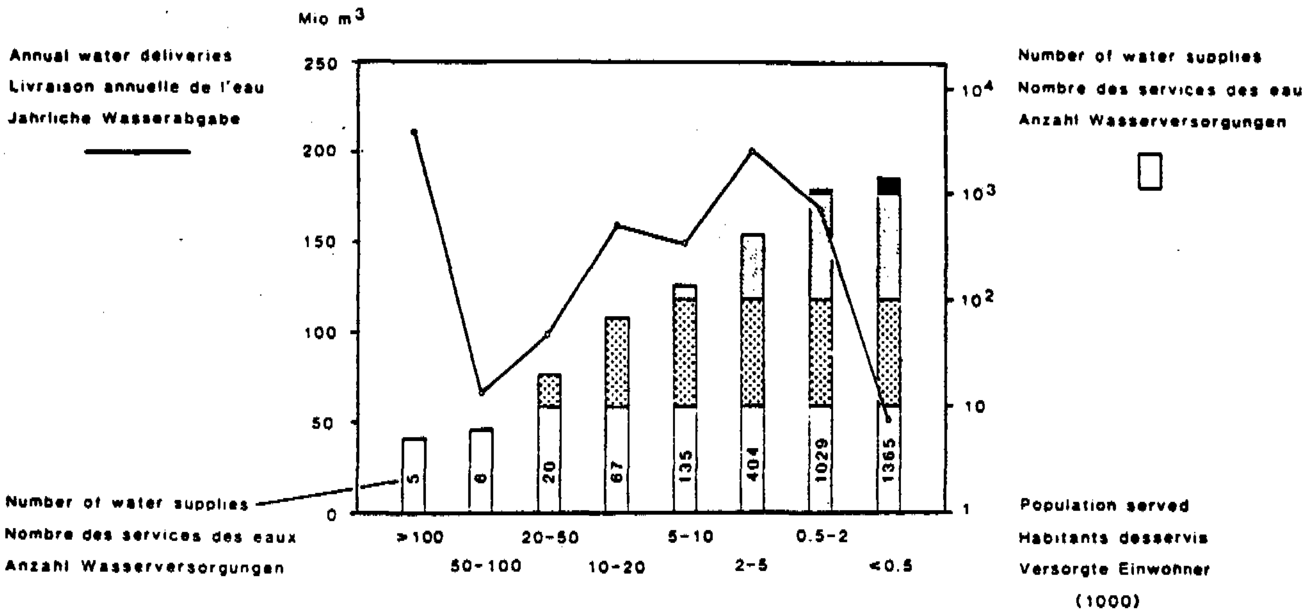
Administrative organization of water services

The administration in the water industry corresponds to the three-tiered, or in some cases four-tiered, administration in Switzerland as a whole.

The supply of potable and domestic water in Switzerland is the responsibility of the municipalities. There are approximately 3200 Swiss water supply companies, and apart from a few exceptions, these companies are owned and run by the municipal authorities. Where they still exist, the small private companies are gradually being taken over by the municipalities.

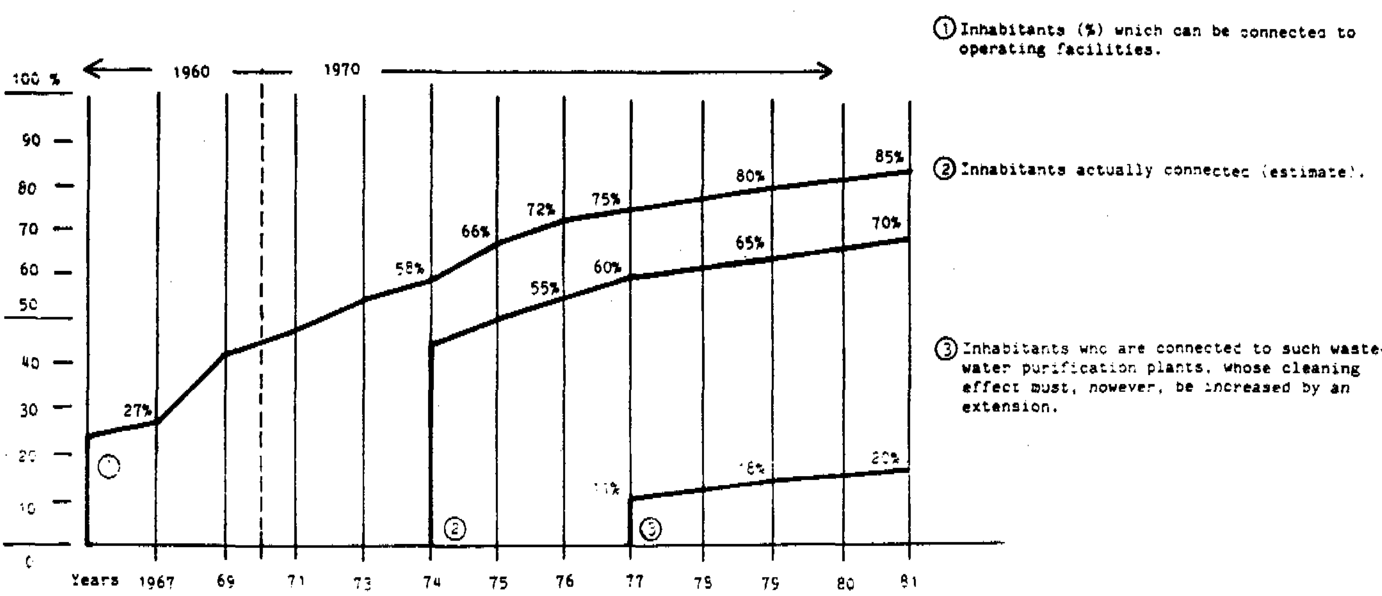
The water companies themselves are very diverse in nature, responding to the needs and resources available in each particular area. However, the majority of the companies are very small. Fifty-five per cent provide services for communities with 500 to 10.000 people, while only five companies (notably those in Basle and Zurich) provide services for more than 100 000. A breakdown of the number and size of these companies and the amount of water provided is given in Fig. 1.

Fig. 1. Number of water supply bodies



In addition to the water companies, there are 860 sewage purification plants, serving 90% of the population. Following the implementation of the Swiss Law of October 1971 on water pollution control (IDHL, 24: 403), strenuous efforts have been made to reorganize and expand the Swiss wastewater disposal system. Fig. 2 shows the outcome of this reorganization in terms of number of people now actually connected to a centralized sewage disposal system. It is unlikely that more than 95% of the population can be connected to a centralized system owing to the number of scattered and remote villages.

Fig. 2. Municipal wastewater purification in Switzerland



At the cantonal level, the cantonal water management administration existed to deal with the protection of water and river conservation. In recent times, however, these functions have been extended to include the planning and financing of water supply schemes. When dealing with such matters, the cantonal administration liaises closely with the municipal authorities (and, where they exist, the regional authorities).

At the federal level, water services are dealt with by the Federal Office for Environmental Protection. The Confederation is charged with the preservation and development of water resources, and the Federal Office of Public Health is responsible for maintaining water quality standards.

Role of the health office with regard to water quality

The Federal Office of Public Health is responsible for drafting and supervising the execution of federal laws and decrees appertaining to water quality.

Drinking-water comes under the Federal Law on the trade of foodstuffs and basic commodities, for which the Department is the main supervisory authority. The Ordinance of 26 May 1936 on foodstuffs and consumer goods, as amended in 1975, provides a definition of drinking-water (Paragraph 260) and lays down standards for equipment and methods used in water treatment (Paragraph 261). The required standards for water are in the Manuel Suisse des denrées alimentaires. Substances with a toxicological relevance are listed in the Ordinance of contaminants and naturally occurring substances. The microbiological requirements for drinking water are included in the Ordinance on hygienic-microbiological requirements for foodstuffs.

Responsibility for carrying out the law lies with the individual cantonal health services. They are very diverse in structure although they have a central administrative body, the cantonal health administration. The administration provides administrative and technical support to the cantonal health services. Each canton has its own laboratory, administered by the canton authorities. Water supplies for the municipalities of the canton are periodically tested in the laboratories to verify that quality standards are being maintained.

Water and related legislation

The 1954 constitutional amendment to Article 34-4 on the control of water pollution was implemented by the Federal Law of 16 March 1955 (IDHL, 8: 507). The law states that account must be taken of the technical possibilities for removing pollutants and the self-purification of surface water and groundwater. Financial and economic costs should also be taken into account, except where the quality of drinking-water or industrial water is involved. The cantons were given authority, subject to federal supervision, to control discharges and to set standards and charges necessary to ensure adequate and lasting protection against pollution.

The Water Protection Law of 8 October 1971, based on Constitution Article 24-4, repeals earlier water laws but retains many of their provisions. It obliges the cantons to exercise their jurisdiction over watercourses by implementing the regulations and measures necessary to prevent pollution. The law came into force on 1 July 1972 and the cantons were required to ensure that existing sewers and other pipelines carrying polluting substances complied with federal regulations within 10 years. The deadline was extended to 1 July 1987 by the Amendment of 20 June 1980 (IDHL, 32: 318). Sewage must be purified before discharge. The law also contains provisions against depositing solids, such as sewage sludge and municipal and industrial waste, in or beside watercourses or on the ground where they might leach into groundwater. Violation of the regulations can lead to suits for damage and provision is made for liability insurance, especially for private house-owners.

Ordinances implementing this law include that of 19 June 1972 (IDHL, 24: 412) on water protection, as amended on 6 November 1974 (IDHL, 27: 648), which establishes that the Federal Office for Environmental Protection shall provide a technical and supervisory service for water protection with advice from the Federal Commission for Water Protection, a new technical advisory body set up under the Department of the Interior. Cantonal plans for water protection must be submitted for examination and approval to the Federal Office for Environmental Protection, which may, where necessary, order the plans to be modified or supplemented.

The control of the pollution of groundwater from liquids, especially oil and sewage, liable to cause a deterioration of water quality is dealt with by the Ordinance of 28 September 1981 (IDHL, 24: 415). The cantons are required to divide their areas into water protection zones depending on the degree of risk to groundwater. The Sewage Sludge Ordinance of April 1981 limits the heavy metal and bacteria in sewage sludge that is to be applied to grazing land and requires its pasteurization, composting or chemical disinfection before it can be used for such purposes.

The Ordinance of 8 December 1975 (IDHL, 27: 652) on the discharge of wastewater sets forth quality and quantity standards for receiving waters. It provides for more stringent conditions for discharges from heavily populated or industrialized areas or where water quality objectives are not being met by the standard conditions. It also provides for less stringent conditions in the case of isolated buildings with few inhabitants and other situations that have a low potential for causing pollution.

The biodegradability and phosphate content of detergents is regulated by two Ordinances of 13 and 15 June 1977 (IDHL, 29: 477 and 478). The Federal Laboratory for Materials Testing and Research for Industry, Building and Arts and Crafts determines whether detergents comply with the regulations (new in Annex 4 of the Ordinance of 9 June 1986).

Water research

There are a number of organizations carrying out research in Switzerland.

The Federal Institute for the Supply, Treatment and Protection of Water (EAWAG), situated in Dübendorf, is associated with the Swiss Federal Institutes of Technology at Lausanne and Zürich. Its main objectives are research, teaching and consulting, with the teaching activities being integrated into the educational programme of the institutes. It provides advisory services to the Federal Government, cantons, municipalities and industry.

The main offices and laboratories are located at Dübendorf and Zürich. In addition, there are two field stations: an engineering experimental station for pilot plant research on water and waste treatment, and a lake research station for limnological studies at Kastanienbaum (Lake Lucerne).

Water pollution control is the main area of research at EAWAG. However, there are also projects related to aquatic ecosystems, technical systems, drinking-water supply and solid wastes, and analytical methodology.

The Federal Institute of Material Testing and Research (EMPA) carries out research into corrosion.

The Institute of Hydromechanics and Water Management (IHW) is a section of the Federal Institute of Technology, Zürich, and carries out research into the treatment of groundwater problems and prepares water demand forecasts. It also undertakes research into corrosion.

The Federal Institutes of Technology at Lausanne and Zurich specialize in natural sciences. Other such institutes specialize in engineering sciences.

A number of the above institutes are currently involved in the Nation Research Programme, working on a project entitled "Basic Problems of the Swiss Water Cycle". The project is divided into 11 sub-projects, with a three-man management team supervising and coordinating the different aspects of the project. The research covers a wide range of problems, including eutrophication of lakes, exploration for groundwater, and the behaviour of matter contained in water during filtration. This project is supported by the Swiss National Fund for Scientific Research.

Finance

The water authorities are required to be autonomous. In order to carry out their task, the water authorities can levy the following charges.

Water charges

Development charges

Initial contributions towards the cost of the supply mains.

Connection charges

Initial charges for the basic development investment as stipulated by the water authorities' infrastructure.

Recurring charges for the user

Recurring charges consist in general of the flat rate (service charge) and the metered charge (operational costs).

The flat rate is based on the insurance value of the building and the size of the water meter. The meter rate is charged on the amount of water used as measured by the water meter.

On average the price per cubic metre of drinking-water in Switzerland is S.fr. 0.8. The average household uses 229 l/habitant/day or 83.6 m^3 per year. This amounts to S.fr. 66.9 per person/year. This represents 0.25% of the gross national product, which amounted to S.fr. 26 800 per head in 1980. The total average daily consumption of water is about 470-500 litres with a maximum of 650-700 lites per capita per day. This consumption is distributed as follows: 50-55% on households and small scale commercial enterprises, 25% in commercial and industrial uses, 5-10% public uses (fountains, etc), 2-3% water works internal uses, and 10-25% as water loss.

Sewerage charges

Assessed on the amount the sewerage cost is about S.fr. 0.50 per m^3. This is often collected with the water charges.

Responsible agencies

Operation	Carried out by
Water resources survey	Federal Office for Environmental Protection Cantonal authorities
Water management policy	Local authorities
Drinking-water production	Specific local administration units
Drinking-water distribution	Specific local administration units
Drinking-water quality surveillance	Federal Office of Public Health Cantonal laboratories
Agricultural irrigation	Cantonal authorities
Industrial water supply	Cantonal authorities
Underground water protection	Federal Office for Environmental Protection Cantonal authorities
Surface water protection monitoring	Federal Office for Environmental Protection Cantonal authorities
Water pollution control	Federal Office for Environmental Protection Cantonal authorities
Water resources storage and allocation	Federal Office for Environmental Protection Cantonal authorities

Water resource availability and management

Rainfall

Average rainfall measured over 60 years has ranged from 592 mm (Sion) to 2480 mm (Säntis), the figures for different Swiss towns during this period being as follows:

Zürich	1128 mm
Basle	790 mm
Berne	1000 mm
Geneva	930 mm
Lausanne	1064 mm
Sion	592 mm
Lucerne	1154 mm
St. Gallen	1300 mm
Chur	840 mm
Lugano	1736 mm

The yield from an annual average rainfall of 1470 mm, with an evaporation rate of 30%, amounts to about 42 000 million m^3 per year. To this can be added 8000 million m^3 per year that are transferred from the Danube catchment area to that of the Rhine through the three pumping stations, bringing the annual total to 50 000 million m^3. The public demand for water amounts to around 1200 million m^3 per year.

Topography

The highest point in Switzerland is the Dufourspitze in the Monte Rosa at an altitude of 4634 m, and the lowest the shore of Lake Maggiore in the canton of Ticino at 193 m.

Switzerland is divided into three geological units: the Alps, the Jura and Mittelland.

The geological build of the Alps has been proved to be exceedingly complex; the contorted, folded and even overfolded recent rocks have been fractured, exposing old crystalline cores to denudation; the Jura are much less complicated in their folding and in their exposures. Much of the central hummocky plain is covered with undisturbed very recent rocks of Oligocene and Miocene age, many of which are marine deposits.

The helvetic nappes and the central massif make up virtually the whole of the sector of the Northern Alps situated in Switzerland, with the limestone of the nappe forming the northern ridge of the alpine range. From that formation rises the old crystalline core of the central massif, the Gotthard massif and the Aiguilles Rouges-Mount Blanc massif. Lying to the south and east are the nappes of the Pennine and East Alps which, unlike the helvetic nappe, have a partly crystalline core with only a very thin layer of sediment.

The Swiss Jura comprise the Falten-Jura (consisting mainly of folds) and the Tafel-Jura (consisting of a partly overthrust but otherwise only slightly disturbed sediment table). This region is composed primarily of limestone and secondarily of strata rich in clay.

In the second half of the tertiary era, large quantities of debris from the Alps were deposited in what is now Mittelland. This hardened in the course of time to form molasse. The moraines that characterize the landscape of Mittelland today are the result of glacial activity during the Ice Ages. Large quantities of glaciofluvial gravel are found along the river courses. Gravel and sand were carried to their present locations by runoff from glaciers during the interglacial periods and after the Ice Ages.

Because of the geological structure, most of the water supplies in the Jura and the Alps are derived from springs. In the limestone areas, the sources are usually karstic, while mainly fissure water is found in the crystalline areas. In the cantons of Valais and Ticino Rivers are occasionally used as sources of supply.

Most of the supplies in Mittelland are derived from groundwater and lake water. Ten lakes are used for this purpose, the most important being Bodensee, Zürichsee, Vierwaldstättersee and the Lake of Geneva. 40%-50% of the total annual water supply is provided by spring water, 35-40% is pure groundwater and approximately 20-25% is treated surface water or artificially recharged ground water. Artificial recharging plants have been built in several places so as not to overtap the groundwater reserves, which are mainly located in gravel strata.

General statistics

Population

Population in urban areas	57.0%[a]
Population in rural areas	43.0%

Drinking-water supply

Total piped supply for drinking purposes	1.2 Bm^3/y[b]
Total population served by a piped public water supply	99.0%
Urban population served by a house connection	100.0%
Urban population without house connections but with reasonable access to public standposts	0.0%
Rural population served by a piped public water supply at home	99.0%
Rural population served by a private system or having reasonable access to public standposts	1.0%

Drinking water supply uses

Water supplied for domestic and commercial use	71.0%
Water supplied for industrial use	29.0%
Other uses	%

Industrial water supply: direct abstractions

Total supplied from inland waters for industrial use	2150 Ml/d[c]
Used for industrial cooling water	55.0%
Usage as industrial process water	45.0%
Total coastal water used	None

Agricultural use: direct abstractions

Total amount abstracted for irrigation	Ml/d
Other agricultural uses including fish ponds	Ml/d

[a] Municipalities with more than 10 000 inhabitants.

[b] Bm^3/y = billion m^3 per year.

[c] 1 Ml/d = 1 million litres/day.

Wastewater disposal services

(a)	% of urban population served by a sewerage network	100.0%
(b)	% of urban population served by other adequate means	%
(c)	% of urban population lacking adequate disposal means	0.0%
(d)	% of rural population served by a sewerage network	81.4%
(e)	% of rural population served by other adequate means	18.6%
(f)	% of rural population lacking adequate disposal means	0.0%

Sewage treatment

(g)	% of sewerage systems receiving primary treatment only	0.0%
(h)	% of sewerage systems receiving secondary treatment	28.0%
(i)	% of sewerage systems receiving tertiary treatment	55.0%
(j)	% of sewerage systems receiving no treatment (raw discharge)	17.0%

Discharge of treated sewage

(k)	% discharged into the sea	%
(l)	% discharged into surface water bodies	100.0%
(m)	% discharged onto farmland	%

Discharge of untreated sewage (17% of total sewage produced)

(n)	% discharged into the sea	%
(o)	% discharged into surface water bodies	100.0%
(p)	% discharged onto farmland	%

Sludge disposal (170 000 lt dry per annum)

(q)	% of sludge disposed into the sea	%
(r)	% of sludge disposed into surface water bodies	%
(s)	% of sludge disposed onto farmland	60.0%
(t)	% of sludge disposed as landfill	4.0%
(u)	% of sludge incinerated	36.0%

Useful addresses

Governmental

Federal Office of Environmental Protection
(Bundesamt für Umweltschutz)
Hallwylstrasse 4
CH-3005 Berne

Water industry

Swiss Gas and Water Association
(Schweizerischer Verein des Gas- und Wasserfaches)
Postfach 658
CH-8027 Zürich

Tel. (01) 201 56 36
Telex Sgas 58 727

Water research

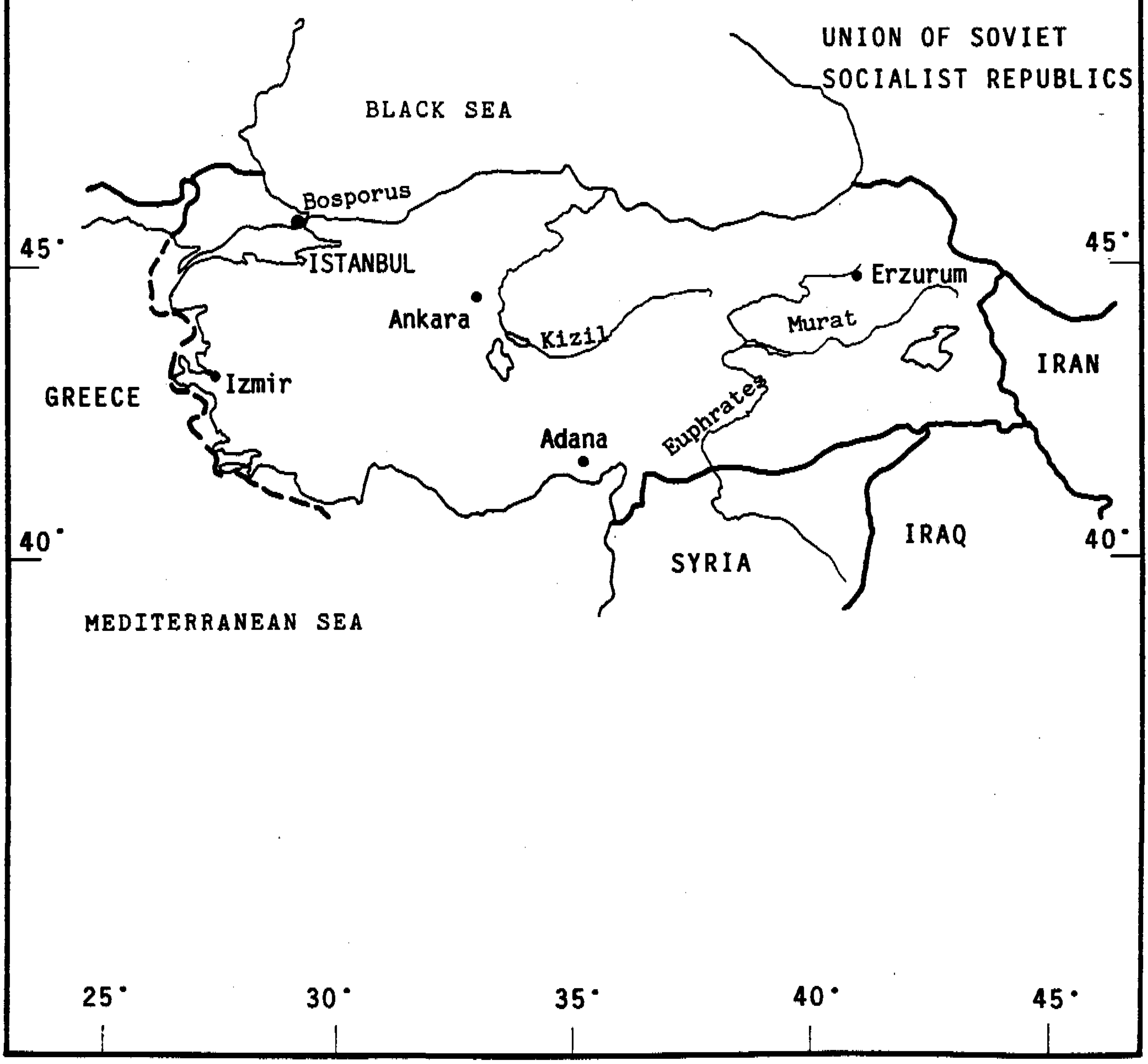
Swiss Federal Institute for Water Resources and Water Pollution Control
(Eidgenössiche Anstalt für Wasserversorgung, Abwasserreinigung und Gewässerschutz) (EAWAG)
CH-8600 Dübendorf

Tel. (01) 823 55 11
Telex 53 817

Office Fédéral de la Santé publique
Bollwerk 27
CH-3001 Berne

Tel. (031) 61 95 11
Telex 912 963
Telefax 61 3507
Postal Address: Postfach 2644
CH-3001 Berne

TURKEY


UNION OF SOVIET
SOCIALIST REPUBLICS
BLACK SEA
Bosporus
ISTANBUL
Ankara
Kizil
Erzurum
Murat
IRAN
GREECE
Izmir
Euphrates
Adana
SYRIA
IRAQ
MEDITERRANEAN SEA
45°
40°
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TURKEY

Part of the Republic of Turkey (Thrace) is in Europe and part (Anatolia) in Asia, the two parts being separated by the Bosphorus, the Sea of Marmara and the Dardanelles, which link the Black Sea to the Mediterranean Sea. Most of Turkey is in Asia, where it is bordered on the north by the Black Sea, in the east by Iran and the USSR, and in the south by Iraq, Syria and the Mediterranean Sea. The European part is bounded by Bulgaria and Greece.

Turkey has a total land area of 780 576 km^2 and in 1987 the estimated population was 51 090 000 with a density of 65 inhabitants per km^2.

The climate of European Turkey is Mediterranean, with mild winters and warm summers. Asiatic Turkey has a much more variable climate, reflected by its extreme annual temperatures, varying from -43°C in the east in winter to +46°C in the south in summer.

Government

Turkey is a democratic republic, legislative power being vested in the Grand National Assembly. The President appoints the Prime Minister, who in turn appoints the Council of Ministers.

The country is divided into 67 provinces (vilayet), which are subdivided into 572 districts (kaza) and about 1800 municipalities. Governors of provinces are appointed by the central government. The Governor is the administrative head with authority over the mayors of the municipalities in his province. The Deputy Governor for Districts (kaymakam) coordinates district matters.

Administrative organization of water services

Responsibility for planning, financing and constructing municipal water supply systems in urban areas is shared by two government agencies which respond to requested assistance from the individual municipalities. These agencies are the State Hydraulic Works (DSI) and the Bank of Provinces (Iller Bankasi), both operating under the Ministry of Settlement and Reconstruction.

DSI is the national water resources and development agency concerned with appropriate user policies and preservation practices. Only 15% of its work concerns public waterworks in urban communities. At present it has a staff of 25 000-30 000, including temporary staff. Some 3480 engineers and technical experts in many fields represent the agency's backbone, over 610 residing in Ankara (where DSI's headquarters are located) and 2870 working through 25 regional offices. The staff concerned with community water supply totals approximately 3000, of whom 160 are engineers and 75 technicians.

Iller Bankasi is an autonomous corporation in which the municipalities are shareholders. It assists municipalities in mapping and town planning and the planning, design and construction of water supply, sewerage and electric power systems and public buildings such as hotels, markets, bath-houses, etc. It is the only agency responsible for providing municipal sewerage systems. Almost 50% of its work concerns municipal water supply and sewerage; a staff of 3800, of whom 2900 are engineers and technicians, are employed in the headquarters in Ankara and in 18 regional offices.

After the water supply and sewerage systems are constructed by Iller Bankasi and DSI, they are handed over to the municipalities who are responsible for their operation and maintenance. Overall responsibility for reviewing and examining projects for urban water supply and sewerage is held by the Ministry of Reconstruction and Settlement.

The provision of water to the rural community is the responsibility of the General Directorate of Village Affairs (GDVA), through its different departments in charge of the construction of communication roads between villages, rural water works and rural electricity systems. The rural water programme includes community water supply but excludes wastewater disposal and village sanitation. The rural subsector covers some 35 600 villages. The GDVA employs a staff of 10 270 persons for all services, of whom 2943 are engineers. 250 engineers and 450 technicians are employed in the Water Supply Department. The headquarters is in Ankara, with a staff of 313 engineers providing policy guidance to 21 regional offices, which in turn provide policy guidance to 67 provincial offices in establishing programmes, designing schemes and hiring contractors for project implementation.

An urban settlement is defined as having a population of at least 3000 inhabitants. Iller Bankasi responds to demands from any municipality, while DSI deals only with municipalities of over 10 000 inhabitants. Rural settlements are defined as having less than 3000 inhabitants. However, the municipalization of a settlement begins when the population exceeds 2000. There is no national agency at present that has responsibility for rural sanitation.

Role of the health department with regard to water quality

The Ministry of Health and Social Assistance operates in the sector through its Environmental Health Division. This division has 10 engineers and 516 environmental health technicians working within a network of provincial offices; they undertake surveillance and epidemiological interventions, but as yet are not equipped fully for preventive action and quality control related to water and sanitation.

Water and related legislation

The Public Health Act of 1930 includes requirements for the safety of drinking-water supplies. Article 242 restricts the intentional pollution of surface waters and springs and prohibits industrial effluents that could cause pollution. Article 244 applies to municipal sewage. Licences for industrial discharges are granted by the Ministry of Health and Social Assistance with guidance from the Ministry of Commerce. The Water Act of 10 May 1926 dealt with the local management of water supplies. An Amendment of January 1935 empowers the municipalities or local councils to prohibit agricultural operations liable to pollute water supplies.

Law No. 4759 of 1945 established Iller Bankasi as the responsible agency for providing municipalities with water. Law No. 5237 of 1948 contains provisions for sewer construction in land development plans. Law No. 7478 of 16 December 1960 lays down the criteria for selection of water projects, stipulates that village councils have responsibility to operate and maintain the completed water systems. The Regulation of 20 July 1961 under this Act requires that proper measures be taken to prevent pollution of surface water or groundwater.

Law No. 1053 of 1963 provides for the intervention of the State Hydraulic Affairs Administration (Devlet Su Isleri) to assist cities with a population of over 100 000 in overcoming their water supply problems. The Ministry of Health Regulation No. 251 deals with various types of waste disposal measures in non-sewered areas.

A number of regulations deal with various aspects of spring water and drinking-water: No. 12043 of 8 July 1965; No. 12378 of 18 August 1966; No. 12958 of 4 July 1968; No. 13393 of 7 January 1970; No. 14918 of 17 June 1974; and No. 15282 of 1 July 1975. The Regulation for the Disinfection of Drinking-Water and Water for Ordinary Use was published as No. 12264 on 30 March 1966. The Health Regulation of 1967 states that all urban water supply systems should be disinfected.

Article 20 of the Law on Products No. 1380 of 1971 is concerned with the protection of commercially valuable aquatic life, especially fish and crayfish. Turkey has a large export market for crayfish. Ordinance No. 14607 of 27 July 1973 under this Law sets discharge limits for nearly 200 substances. The discharge of untreated sewage or radioactive substances is forbidden. The ordinance requires municipalities to treat their sewage before it is discharged, but this requirement has not yet been implemented and there are, as yet, no municipal sewage treatment plants. Offences against Article 20 of the law are dealt with by the principal criminal courts.

Water research

Turkey has a number of institutes carrying out research. These include the Istanbul Technical University, the Middle East Technical University and the Bosphorus University. The three already cooperate on projects, but it is hoped to extend this cooperation as well as encourage the provision of resources and the establishment of research units within the implementing agencies and the universities.

Finance

Most funds for investment purposes are made available to the agencies through central government appropriations with the approval of the State Planning Organization. For the funding of municipal projects, DSI and Iller Bankasi use a combination of grant and loan finance. In the case of the DGVA, which only finances schemes in the form of grants, some small local contribution in cash or kind in the range of 5-10% as a matching effort in the project cost was mandatory and was taken into consideration during project selection procedures.

Municipalities and village councils are in charge of the operation and continued maintenance of completed schemes are expected to raise the necessary funds through general taxation or, in the case of municipalities, through water tariffs.

Water charges

Potable water supply

City councils determine water charges, which are subject to approval by the provincial governor or subprefect. Water charges vary from place to place, ranging from TL 200 to TL 400 per m^3 (up to 20 m^3 per month), with little escalation for large-scale consumers. Rates hardly ever cover more than part of the current cost.

Sewage charges. Data not available.

Trade effluent. Data not available.

Responsible agencies

Operation	Carried out by
Water resources survey	DSI, Iller Bankasi, GDVA
Water management policy	Ministry of Reconstruction and Settlement, DSI, Iller Bankasi, and the General Directorate of Village Affairs (GDVA)
Drinking-water production	DSI, Iller Bankasi, GDVA
Drinking-water distribution	Municipalities and Village Councils
Drinking-water quality surveillance	Ministry of Health and Social Assistance Environmental Health Division
Agricultural irrigation	DSI and GDVA
Industrial water supply	DSI, Iller Bankasi
Underground water protection	DSI, Iller Bankasi
Surface water protection monitoring	DSI, Iller Bankasi Ministry of Health and Social Assistance
Water pollution control	DSI, Iller Bankasi Ministry of Health and Social Assistance
Water resources storage and allocation	DSI, Iller Bankasi, GDVA

Water resource availability and management

Rainfall

The total yearly rainfall ranges from less than 300 mm in the inland up to more than 3000 mm at the Black Sea shore. Yearly average rainfall is 528×10^9 m^3 (679 mm), but only 181×10^9 m^3 (36%) create surface runoff. The total water potential of Turkey is estimated at 104.4×10^9 m^3 per year, of which 95×10^9 m^3 per year from surface water resources and 9.4×10^9 m^3 per year from groundwater. The average temperature ranges during the year from 4°C in the eastern part of the country (Kars) up to the maximum of 20°C in the southeast of Anatolia (Anamur). The result of this is that in some parts of the country there is a surplus of water, while in others there is an absolute dearth.

Topography

European Turkey is composed mainly of a low-lying central plain, fringed in the north and south with mountains. Asiatic Turkey has three main features, the dominant one being the Anatolian Plateau. It has an elevation of 1000 m and is mostly semi-desert or steppe. There are numerous depressions and basins, the largest being a salt lake, Tuz Golu in the centre of the plateau. The second feature is a ring of mountains almost encircling the plateau, the Pontine mountains to the north and to Taurus mountain to the south. The third feature is to the east, an almost entirely mountainous region which becomes progressively wilder and more rugged up to the frontiers with the USSR and Iran.

Population/water resources

Turkey is a country with an abundance of water resources. The country is covered by an extensive network of surface waters, and underground water is generally available in large quantities. There are, however, areas of scarcity or even areas of heavy local scarcity. Therefore, availability of supply has to be considered case by case, for each community or location. At the present moment, most of the water used for drinking and industrial supplies is derived from groundwater sources, with little use being made of the large quantities of surface runoff. Included in the groundwater resources are waters of river alluvia, artesian waters and natural springs. The latter are found in considerable numbers in the hilly regions, particularly in sandstone or limestone formations, and are technically simple to harness for rural/village supply but are seldom, if ever, of sufficient yield or suitably located to be harnessed for urban use. As migration to the towns continues, further pressure will be put on urban water supply and sanitation systems. The urban population, which now amounts to 48% of the population, is expected to rise to 64% by 1990.

To date, no comprehensive water resource inventory has been made, nor have measurements of sources been undertaken over a sufficiently long period to confirm, with a sufficient degree of confidence, the minimum yields (measurements over two successive dry years). It is therefore not possible to determine with what degree of efficiency the nation's water resources are being utilized.

Future trends of water resources

One of the aims of the fourth five-year plan (1979-1983) is to develop an inventory so that distribution of water will be in accord with the needs of the national economy.

General statistics

Population

Population in urban[a] areas	51.7%
Population in rural[a] areas	48.3%

Drinking-water supply

Total piped supply for drinking purposes	7700 Ml/d[b]
Total population served by a piped public water supply	69.0%
Urban population served by a house connection	72.8%
Urban population without house connections but with reasonable access to public standposts	25.2%
Urban population making use of an entirely private system (well, cisterns, other installations at home)	2.0%
Rural population served by house connections (public or private)	66.0%
Rural population without house connections but with reasonable access to public standposts	18.0%
Rural population with difficult access to drinking-water installations	16.0%

Drinking water supply uses

Water supplied for domestic and commercial use	75.0%
Water supplied for industrial use	15.0%
Other uses	10.0%

Industrial water supply: direct abstractions

Total supplied from inland waters for industrial use	NA Ml/d
Used for industrial cooling water	NA %[c]
Used as industrial process water	NA %
Total coastal water used	NA Ml/d

Agricultural use: direct abstractions

Total amount abstracted for irrigation	NA Ml/d
Other agricultural uses including fish ponds	NA Ml/d

[a] Urban area = settlement of 3000 inhabitants or more; rural area = settlement of less than 3000 inhabitants.

[b] Ml/d = 1 million litres/day

[c] NA = Not available

Wastewater disposal services

(a)	% of urban population served by a sewerage network	69.0%
(b)	% of urban population served by other adequate means	31.0%
(c)	% of urban population lacking adequate disposal means	0.0%
(d)	% of rural population served by a sewerage network	20.0%
(e)	% of rural population served by other adequate means	70.0%
(f)	% of rural population lacking adequate disposal means	10.0%

Sewage treatment

(g)	% of sewerage systems receiving primary treatment only	14.5%
(h)	% of sewerage systems receiving secondary treatment	15.5%
(i)	% of sewerage systems receiving tertiary treatment	0.1%
(j)	% of sewerage systems receiving no treatment (raw discharge)	69.9%

Discharge of treated sewage

(k)	% discharged into the sea	50.0%
(l)	% discharged into surface water bodies	45.0%
(m)	% discharged onto farmland	5.0%

Discharge of untreated sewage

(n)	% discharged into the sea	0.6%
(o)	% discharged into surface water bodies	7.0%
(p)	% discharged onto farmland	92.4%

Sludge disposal

(q)	% of sludge disposed into the sea	NA %
(r)	% of sludge disposed into surface water bodies	NA %
(s)	% of sludge disposed onto farmland	NA %
(t)	% of sludge disposed as landfill	NA %
(u)	% of sludge incinerated	NA %

-

Useful addresses

Governmental

State Hydraulic Works
(Devlet Su Isleri) (DSI)
Yücetepe
Ankara

Tel: 33 92 30
Telex: 42305 DSIM T

Iller Bankasi
Bank of Provinces
Genel Müdürlük
Atatürk Bulvari 21
06053 Opera - Ankara

Tel: 25 24 37
Telex: 24723 gnmd tr

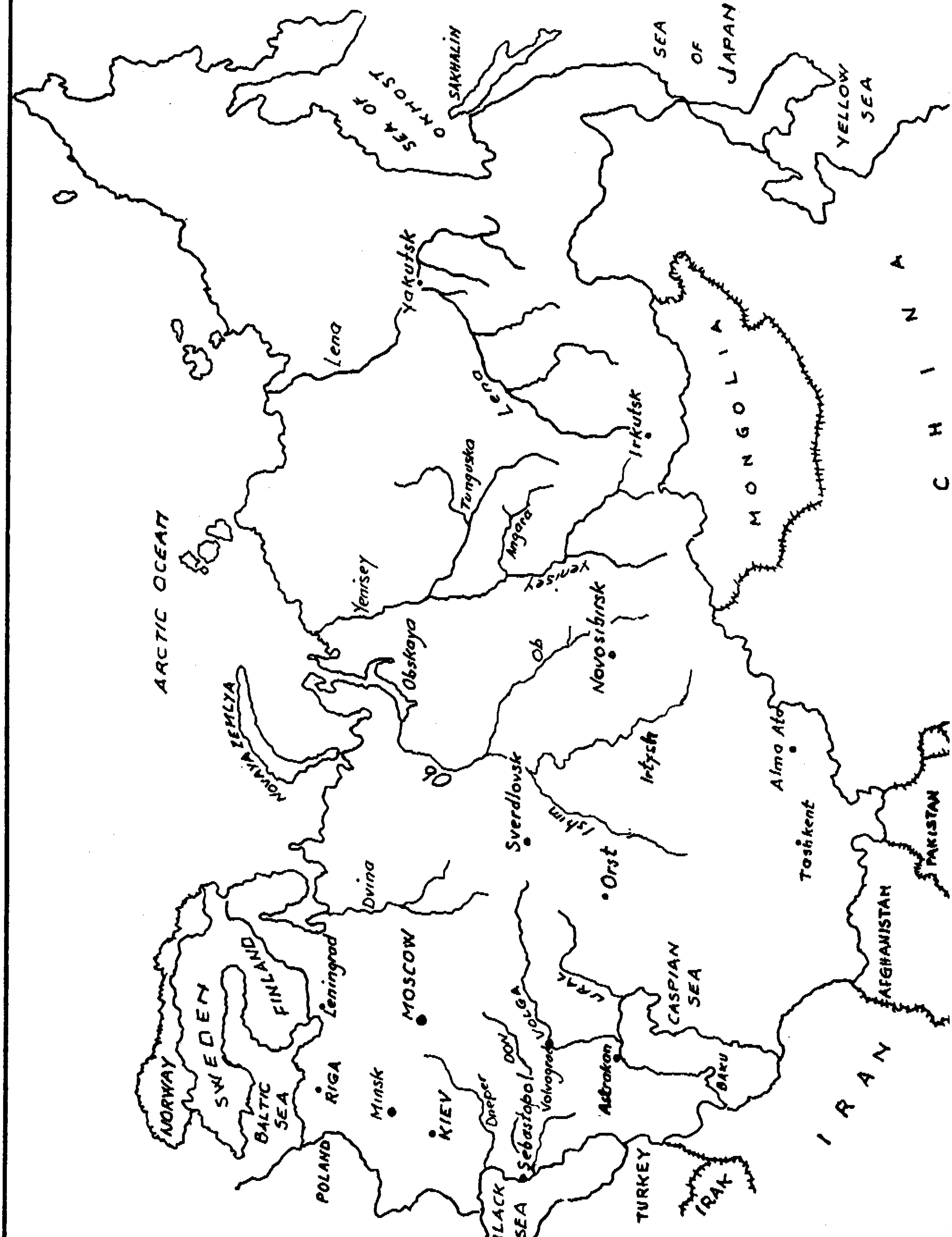
State Planning Organization
Mesizitiyet cad. no. 10
Ankara

Tel: 308720

The Ministry of Health
Ankara

Tel: 134 2962
Telex 0607-42770 ssyb tr
Fax: 1314879

UNION OF SOVIET SOCIALIST REPUBLICS



USSR

The USSR, the largest country in the world, stretches from the Baltic Sea in the west to the Pacific Ocean in the east, and from the Arctic Ocean in the north to the Black Sea in the south. The country is bordered by Czechoslovakia, Finland, Hungary, Norway, Poland and Romania in the west, by Afghanistan, China, Iran, Mongolia, Turkey in the south and the People's Democratic Republic of Korea in the east.

In 1987, it had a population of 283 100 000 in an area of 22 402 200 km^2, with a population density of approximately 12 inhabitants per km^2.

Government

Under the 1977 Constitution, the USSR is a single federal State comprising 15 Union republics of equal status. Some of the Union republics contain autonomous republics, regions (oblasts) and okrugs. For example, the Russian Soviet Federative Socialist Republic (RSFSR) has 16 autonomous republics and five autonomous oblasts.

The highest legislative organ is the Supreme Soviet of the USSR, which consists of two equal chambers, the Soviet of the Union and the Soviet of Nationalities. At a joint session, the members elect the Presidium of the Supreme Soviet as the permanent working body. The Chairman of the Presidium is Head of State. The Supreme Soviet appoints the Council of Ministers, headed by a Chairman, which forms the supreme executive and administrative organ of state authority and is responsible to the Supreme Soviet.

Each of the Union republics has its own constitution and administrative and territorial structure, with a single-chamber Supreme Soviet and a Council of Ministers that deals with matters coming within the jurisdiction of a Union republic. The Supreme Soviets of the USSR and of Union and autonomous republics are elected for a period of five years.

The 15 Union republics are divided into 20 autonomous republics, 8 autonomous oblasts and 10 national autonomous okrugs, 129 territories (krajs) and oblasts, 3225 districts (rayons), 2176 towns, 42 599 rural councils and 3992 urban-type settlements. Self-government is exercised in these administrative areas. Although they differ considerably in population and the area they cover, their structures, organization and responsibilities are all similar.

The local councils, comprising deputies elected every 2 years, constitute the organs of state authority in these administrative units. The rights and responsibilities of the councils are prescribed by law. Within the limits of their powers, the local councils deal with matters of local importance, implement the decisions of higher state organs, take part in discussions on subjects of concern at the republic and Union levels and put forward their own proposals.

Each council elects an executive committee from among the deputies. This committee is the executive and administrative organ of the council and implements its decisions. Each of the larger executive committees has departments and divisions that exercise direct control over the various services in a given area, such as health, social security and education.

Administrative structure of water services

In January 1988 the Government of the USSR decided to establish the USSR State Committee on Nature Conservation, entrusting it with the functions of exercising state management and control with regard to nature conservation and use. The Committee has also been given responsibility for state control of the rational use and protection of surface water and groundwater from pollution and exhaustion; these duties are currently discharged by the Ministry of Land Improvement and Water Economy and the Ministry of Geology of the USSR.

At the same time, the Ministry of Land Improvement and Water Economy of the USSR is responsible for resolving questions related to the planning, construction and operation of land improvement systems and the use of water for irrigation of agricultural land, as well as of agricultural water supply matters (in conjunction with the State Committee for Agricultural Production), including domestic/drinking water supplies to the rural population.

The USSR State Committee on Hydrometeorology remains responsible for supervising the condition of bodies of water and for carrying out state water surveys.

Organizations operating domestic/drinking water supply installations are responsible for the sanitary and technical conditions of those systems and for their uninterrupted functioning, as well as for the quality of water supplied to the population. In so doing, they must comply with GOST 2874-82 "Drinking water", which stipulates that systematic laboratory control must be carried out by production (departmental) laboratories.

The planning and construction of domestic/drinking water supply systems are financed by local councils, communal services or other organizations under various ministries and departments. In the majority of cities and urban settlements, the water supply system is operated primarily by the communal services linked to the Republic Ministries of Housing and Municipal Economy.

Agencies and establishments of the health and epidemiology services carry out state sanitary inspection of the execution of measures aimed at eliminating and preventing the pollution of surface water and groundwater used to meet the population's drinking, domestic, sanitary and other needs.

In addition, state sanitary inspection is carried out on the quality of water in centralized domestic/drinking water supply systems and in bodies of water at sites of use by the population, by means of selective laboratory tests in accordance with the programme and at intervals laid down by local agencies of the health and epidemiology service.

Environment and Health

Standards of hygiene and sanitary rules for the quality of the environment have been drawn up and endorsed by the Public Health Ministry of the USSR in accordance with the law of "The Fundamentals of Legislation in the Union of Soviet Socialist Republics and Constituent Republics on Health Protection". This law was adopted by the Supreme Soviet of the USSR on 19 December 1969.

The USSR has nationwide hygienic standards for the chemical, physical and biological factors (air, water and soil), affecting the conditions of inhabited settlements, apartment houses, public buildings, industrial enterprises and food products. There are standards for:

more than 1000 chemical substances in water reservoirs,
more than 600 substances contained in atmospheric air,
more than 1600 substances in the air of working places,
forty five substances in soil.

There are also about 2000 different hygienic standards for regulating the content of foreign matters in raw food and food products, and about 1000 hygienic standards for pesticides and polymer materials. In addition, the maximum permissible levels for physical parameters, such as noise, vibration, electromagnetic fields of various ranges, have also been established. A list of adopted laws is presented in Annex 1.

The country has two specialized, authorized agencies for exercising state control in the area of environmental protection, viz.:

a) The Sanitary Services of the Public Health Ministries of the USSR and constituent republics, and

b) The State Nature Protection Committee (founded in January 1988).

<u>Water legislation issues and the role of health service agencies</u>

Agriculture accounts for 52% of the total water use in the country, industry and power generation for 30%, and the municipal economy for 9%.

In accordance with the "Basic principles of water legislation in the Union of Soviet Socialist Republics and the Union Republics", all water in the USSR is the sole property of the state and user's rights are ceded.

Water resources are made available for the purpose of supplying drinking and domestic water and to meet other needs of the population, and the quality of the water therein meets the sanitary requirements laid down.

Surface water bodies may be used for the disposal of industrial, municipal/domestic, drainage and other waste water only with the permission of the agencies responsible for regulating water use and protection (the Ministry of Land Improvement and Water Economy) and after agreement with government sanitary surveillance agencies (the Ministry of Health) and agencies responsible for fish stocks and other interested agencies. Sewage disposal is permitted only when it does not lead to an increase in concentration of pollutants in the water body. Norms and limits for the conditions of disposal of sewage are laid down by the agencies responsible for regulating water uses and water quality protection. Maximum permissible disposal limits are established (MPD) to ensure that the maximum permissible concentration of pollutants (MPC) in water sources is not exceeded.

If the above-mentioned requirements are infringed, sewage disposal must be limited, interrupted or banned by the agencies responsible for regulating water use and protection, up to and including halting the operations of individual industrial plants, units and businesses. In cases where the health of the population is threatened, the above-mentioned functions are carried out by government sanitary surveillance agencies.

Where businesses, organizations and institutions that have an influence on water conditions do not observe the requirement to protect bodies of water from pollution, they are administratively and criminally responsible in accordance with the legislation of the USSR.

The nationwide character of the USSR's water legislation and of measures to protect water sources from pollution is determined by the need to elaborate uniform scientifically based national hygiene requirements and norms related to regulations for protecting surface water from pollution, and also to the quality of drinking water and of sources of water for domestic/drinking and recreational purposes.

Differentiated water quality norms for bodies of water for different uses (domestic/drinking, recreation and fish-farming) are governed by the existing "Regulations for the protection of surface waters from pollution by sewage", endorsed by the Ministry of Land Improvement and Water Economy of the USSR, the Ministry of Health of the USSR and the Ministry of Fisheries of the USSR.

Hygiene norms for maximum permissible concentrations of chemical substances in reservoirs and in drinking water are elaborated on the basis of methodological approaches and criteria endorsed by the Ministry of Health of the USSR for assessing safe levels for the effect of chemical substances on the body. MPCs have so far been laid down and endorsed by the Ministry of Health for 1127 substances; in this connection, all work on the establishment of hygiene norms done by national research establishments comes under the Section for Water Hygiene and Sanitary Protection of Reservoirs of the USSR Academy of Medical Sciences' Committee on the Scientific Bases of Environmental Health.

In accordance with the "Basic principles of health care legislation of the Union of Soviet Socialist Republics and the Union Republics" (Article 25) the quality of water used for domestic and drinking water supplies must meet the requirements of the state standards duly endorsed in recommendations issued by the Ministry of Health.

With the aim of protecting domestic/drinking water supply sources, water supply installations and the areas surrounding them from pollution (regardless of the department responsible), "sanitary protection zones" consisting of three "belts" have been established, within which the corresponding mode of operation must be observed. The document setting out these provisions is No. 2640-82, "Regulations governing the procedure for planning and exploitation of sanitary protection zones of sources of water supplied for domestic and drinking purposes", endorsed by the Chief State Sanitary Inspector of the USSR. That document sets out the scientific approaches and methods for estimating the limits of the belts in the sanitary protection zone and the basic water protection measures applicable to the purpose of each belt and incorporated into the building norms and regulations endorsed by the Ministry of Construction of the USSR.

The current state standard GOST 2874-82, "Drinking water, hygiene requirements and quality control" lays down the hygiene requirements for water in centralized domestic and drinking water supply systems: it must not be a vector of epidemics, its chemical composition must be harmless and it must have good organoleptic properties.

The safety of water as a vector of epidemics is accordingly determined by the total number of microorganisms (not more than 100 per cm^3) and the number of E. coli bacteria (not more than 3 per dm^3); toxicological and organoleptic indicators of water quality include norms for substances found in natural water, substances added to water during treatment (reagents) and those produced by pollution of water supply sources. The organoleptic indicator currently of the greatest relevance is the norm for turbidity (not more than 1.5 mg per dm^3); this information, while difficult to obtain, is of importance as an indirect indicator of the degree to which the water is free from viruses.

The above-mentioned standard lays down the procedure (scope and frequency) for laboratory tests and production measures to control the quality of water from the distribution network and from local water sources; these tests and measures are carried out by the organizations responsible for operating the water supply system.

Another state standard duly endorsed in a recommendation by the Ministry of Health of the USSR is GOST 2761-84: "Sources of centralized domestic and drinking water supply. Hygiene and technical requirements and regulations for selection". This lays down the requirements for selection and exploitation of water supply sources with regard to the current condition of bodies of water in the USSR and the technical potential for water treatment. Depending on the degree of pollution of water sources and the required scheme (methods) of water purification to bring water quality up to the values set out in GOST 2874-82 "Drinking water", bodies of water suitable for domestic/drinking water supply are assigned to one of three categories.

In addition to state standards governing the hygiene requirements for domestic and drinking water quality (both in the water supply network and in water sources), there is also GOST 17.1.5.02-80 "Hygiene requirements for areas of bodies of water used for recreational purposes", endorsed by the Ministry of Health of the USSR. The requirements in this standard cover the quality of water in bodies of water used for leisure and bathing.

Water research

Rational use of water in national economy is studied, in particular, the possibilities of transferring waters of northern rivers to the southern parts of the country. Studies of the toxicity of contaminants and the risk of contamination of water sources are being carried out. Criteria for epidemiological safety, water usage, methods of water quality conditioning are being improved, as, for example, methods of water desalination and methods for improving the efficiency of treatment of drinking-water and sewage water.

In general, research is being carried out in the following fields: (1) assessment of the pollution of water supplies and regulation of the factors involved; (2) assessment of the quality of water resources; (3) evaluation of the effectiveness of measures related to the protection of water supplies.

The first of these categories includes: improvement of methods for assessing the health aspects of pollution, establishment of maximum permissible concentrations (MPCs) of hazardous substances in water, study of the relationship between people's health and water quality, etc. In-depth research is currently being carried out to further improve the whole system of hygiene norms, and this work includes a study of possible long-range effects.

With the aim of finding ways of speeding up the intensive research required to lay down MPCs, development work is being done on computers, and rapid experimental methods for forecasting the toxicity parameters for chronic effects of chemical substances are also being investigated.

The criteria for epidemiological assessment of the safety of drinking water and recreational water use are being further upgraded. Studies of the possible effects of water on the population's health status and morbidity are being carried out in several regions.

The second category covers: improvement of criteria and methods for monitoring water quality, improvement of methods for forecasting the condition of water resources, and establishment of the bases for health recommendations concerning the protection of water resources. In addition to the above-mentioned line of research, work is being done on assessing the effectiveness of measures to protect water resources and of new methods of treating water in centralized domestic/drinking water supply systems, including methods of desalination of highly mineralized natural water sources.

In the third category, work is being done to improve methods of evaluating the effectiveness of measures to control water pollution, the efficiency of methods and facilities for wastewater disposal is being assessed, and other water protection measures are being evaluated.

Finance

Water supply and sewerage networks as well as water and wastewater treatment plants are financed with the local resources from different state institutions.

Business enterprises which pollute water sources are responsible for implementing water protection measures paid for from their own budgets. However, other schemes may also be applied.

Research is funded from the State budget.

Responsible agencies

Business and industrial enterprises are responsible for complying with water pollution standards during the construction and operation of their individual units.

The principal bodies which monitor and protect the environment are the State Committee for Hydrology and Environmental Protection, the Ministry of Land Improvement and Water Conservation and the Ministry of Health of the USSR, although other organizations may also carry out this function.

Water resources availability and management

Rainfall

The USSR as a whole has an abundance of water resources, but they are unequally distributed throughout the country. In a number of regions, e.g. Kazakhstan, Middle Asia and other areas, there is not enough water for economic and domestic use.

Obviously, in such a large country, climatic conditions vary considerably. Generally, the climate can be described as continental, with extremes being located in the north in winter (-70°C in north-eastern Siberia) and in the centre and south in summer (50°C in central Asia and Kazakhstan).

The USSR has an annual average precipitation of 530 mm, 37% of which runs off through the rivers into the sea. Taking into consideration the size of the country, rainfall is quite evenly distributed both throughout the country and throughout the year, ranging from 250 mm to 800 mm. Evapotranspiration varies between 200 mm in the extreme north and south to 500 mm in the central lowlands.

The Ministry of Land Improvement and Water Conservation is the body responsible for the management of national water resources. Activities related to water utilization and the protection of water resources are governed by the "Principles of water legislation of the USSR and the Union Republics".

Topography

In very general terms, the USSR can be described as having a massive central lowland, open to the Arctic in the north and surrounded on the east, south and west by mountains and high plateaux. The lowland can be divided into four regions, the east European plain and the west Siberian plain, which are separated by the Ural mountains, the Aralo-Caspian basin and the central Siberian plateau, which is dissected by streams draining to the Yenisei and Lena. The mountain ranges, which are all on or near the USSR frontiers, include the Carpathians, the Caucasus, the Kopet Dagh, the Pamir, the Tien-Shan, the Altai and Sayan mountains and the East Siberian highlands.

Population/water resources

The USSR has more than 3 million rivers, of which 260 are longer than 500 km. In addition, it has some 2.8 million lakes, the biggest being Lake Baikal, which accounts for some 20% of the world's entire freshwater resources.

Generally speaking, the Soviet Union has enough water to meet present and future needs although it is very unevenly divided. For example, 25% of the country's population live in the basin of the Volga River, which contains no more than 5% of the country's freshwater resources.

For their drinking-water supplies, the major cities such as Moscow depend almost entirely on surface waters, whereas groundwater sources are sufficient to meet the water supply needs of country districts and the smaller cities and towns. In all, 55% of water supplied comes from surface waters and 45% from groundwaters.

In the USSR, the average annual restored river water resources amount to 4.7 thousand cubic kilometres. The groundwater resources (subterranean) come to more than 330 cubic kilometres per year. Water intakes from natural resources is on average more than 300 cubic kilometres per year (360 cubic kilometres in 1987), or the equivalent to 6% of the total restored resources. However, in certain regions with intensive industrial and agricultural activities (irrigation), the amount of water extracted amounts to more than 40% of the restored resources.

The present tendency is to reduce water intakes for industrial purposes by introducing water recycling and water reutilization technologies. The volume of such waters reached 264.2 cubic kilometres. In 1987, the water recharged into water reservoirs amounted to 159 cubic kilometres, of which 20.6 cubic kilometres (12.9%) was polluted sewage waters. The hygienic standards of some important water reservoirs used for domestic and drinking consumption are not completely satisfactory, the ecological balance having been altered as a result of discharges of industrial and municipal wastewaters (i.e. Lakes Ladoga and Baikal).

General statistics

According to information from 1986, the quantity of water used for domestic and drinking purposes was 25 cubic kilometres. Thanks to the measures taken to improve the water supply systems in cities and towns, the number of piped water networks in the country is now approaching 100 000, of which approximately 97% use groundwater sources. The country's centralized water supply systems embraces 98% of the cities and towns, and 86% of the remaining settlements.

During the past decade, the population water consumption for domestic and drinking purposes has grown from 298 to 417 litres per day per person (an increase of 28.5%). In the same period, the sewerage systems have doubled and stands at 80% in cities and 50% in towns (90% of the total urban population).

In major cities such as Moscow, per capita consumption per day is approximately 650 l. For other cities and residential areas, per capita water consumption is as follows:

- 250-350 l/day for areas with central heating and individual bathrooms;
- 160-230 l/day for areas having baths and local boilers for hot water installations in houses;
- 125-160 l/day for areas having house water taps but no baths.

The ratio between average and peak use must not be more than 1:1 or 1:1.3, depending on urban development.

The qualitative indices of water are improving as a result of efficient control exercised by the responsible Sanitary Services. For instance, if the percentage of samples that did not comply with the bacteriological standard for drinking water was 14% in 1976, it is only 10% in 1988, with a large number of republics (Lithuania, Letvia, Byelorussia, Moldavia, etc.) showing a percentage that does not exceed 5 to 8.

Useful contacts

The State Committee of Science and Technology of the USSR and corresponding ministries with their leading institutions.

Requests for exchange of information and contacts concerning the medical and sanitary aspects of water supply administration may be addressed to the Central Board of Sanitation and Epidemiology of the Ministry of Health, or to the A.N. Sysin Institute of General and Community Hygiene of the Academy of Medical Sciences of the USSR, a WHO Collaborating Centre in the field of environmental hygiene.

General statistics

Population

Population in urban areas	64.0%
Population in rural areas	36.0%

Drinking-water supply*

Total piped supply for domestic drinking purposes	25 km^3 Ml/d[a]
Urban population served by a house connection	98.0%
Urban population without house connections but with reasonable access to public standposts	2.0%
Rural population served by piped public or private water supply system at home	86.0%
Rural population served by other systems or having reasonable access to public standposts	14.0%

Drinking water supply uses

Water supplied for domestic and commercial use	9.0%
Water supplied for industrial use	39.0%
Other uses	52.0%

Industrial water supply: direct abstractions

Total supplied from inland waters for industrial use (freshwater: surface and groundwater)	Ml/d
Used for industrial cooling water	%
Usage as industrial process water	%
Total coastal water used	NA[b]

Agricultural use: direct abstractions

Total amount abstracted for irrigation	Ml/d
Other agricultural uses including fish ponds	Ml/d

[a] 1 Ml/d = 1 million litres/day.

[b] NA = Not available

* Estimated figures from various sources of information. Official data not available.

Wastewater disposal services*

(a)	% of urban population served by a sewerage network	90.0%
(b)	% of urban population served by other adequate means	10.0%
(c)	% of urban population lacking adequate disposal means	0.0%
(d)	% of rural population served by a sewerage network	60.0%
(e)	% of rural population served by other adequate means	40.0%
(f)	% of rural population lacking adequate disposal means	0.0%

Sewage treatment

(g)	% of sewerage systems receiving primary treatment only	%
(h)	% of sewerage systems receiving secondary treatment	%
(i)	% of sewerage systems receiving tertiary treatment	%
(j)	% of sewerage systems receiving no treatment (raw discharge)	%

Discharge of treated sewage

(k) % discharged into the sea
(l) % discharged into surface water bodies
(m) % discharged onto farmland

Discharge of untreated sewage

(n) % discharged into the sea
(o) % discharged into surface water bodies
(p) % discharged onto farmland

Sludge disposal

(q)	% of sludge disposed into the sea	%
(r)	% of sludge disposed into surface water bodies	%
(s)	% of sludge disposed onto farmland	%
(t)	% of sludge disposed as landfill	%
(u)	% of sludge incinerated	%

* Estimated figures from various sources of information. Official data not available.

Useful addresses

A.N. SYSIN Institute of General
and Communal Hygiene
USSR Academy of Medical Sciences
Pogodinskaja 10
119121 Moscow

Tel: 246-34-15

Annex 1

1. Fundamental Agrarian Legislation of the USSR and Constituent Republics. 13.12.1968.

2. Fundamental Legislation of the USSR and Constituent Republics on Health Protection. 19.12.1969.

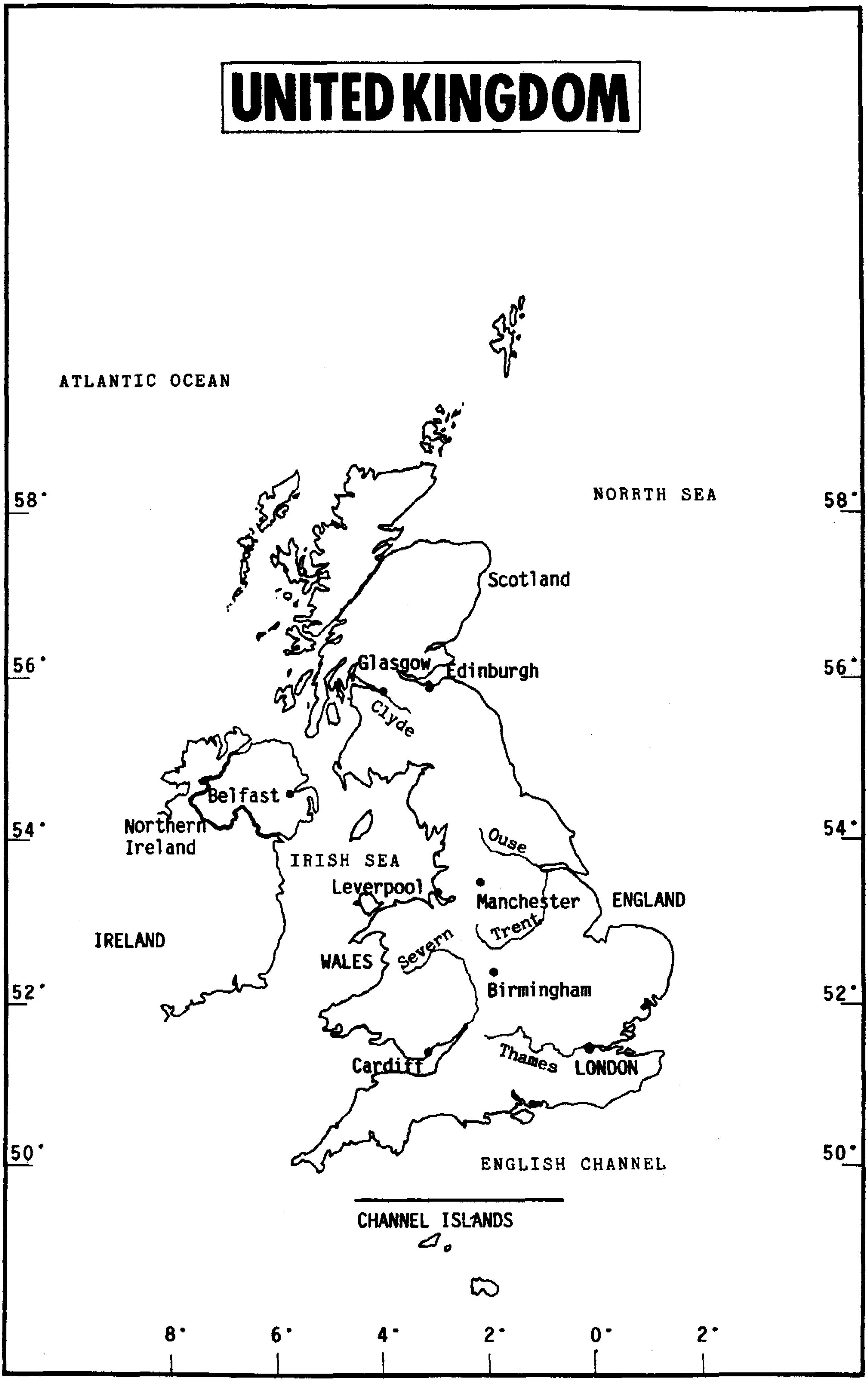
3. Fundamentals of Water Legislation in the USSR and Constituent Republics. 10.12.1970.

4. Fundamentals of Forestry Legislation in the USSR and Constituent Republics. 17.06.1977.

5. Law on "Protection of Atmospheric Air". 25.06.1980.

6. Decree of the Presidium of the USSR Supreme Soviet from 26.02.1974 "On increasing responsibility for pollution of the seas by substances hazardous to human health and living resources of the sea".

7. Decree of the Presidium of the USSR Supreme Soviet from 19.08.1982 "On administrative responsibility for violating the Law on Protection of Atmospheric Air".


UNITED KINGDOM
ATLANTIC OCEAN
NORRTH SEA
Scotland
Glasgow
Edinburgh
Clyde
Belfast
Northern Ireland
IRISH SEA
Ouse
Leverpool
Manchester
ENGLAND
Trent
IRELAND
WALES
Severn
Birmingham
Thames
LONDON
Cardiff
ENGLISH CHANNEL
CHANNEL ISLANDS
58°
56°
54°
52°
50°
8°
6°
4°
2°
0°
2°

UNITED KINGDOM

The United Kingdom of Great Britain and Northern Ireland lies in north-western Europe. Its only land boundary is with the Republic of Ireland. Northern Ireland is a constitutionally distinct part of the United Kingdom. Great Britain, consisting of one large island and many smaller ones, comprises England in the south and central part, Scotland to the north, and Wales to the west. It is separated from the coast of western Europe by the English Channel to the south and by the North Sea to the east. The northern and western shores are washed by the Atlantic Ocean. Ireland lies to the west across the Irish Sea.

The total land area is approximately 244.100 km^2, with a population of some 56.3 million. Some 88% of the population of England and Wales live in urban areas with corresponding figures of 9% and 3% for Scotland and Northern Ireland respectively. The population density is 232 inhabitants per km^2.

Government

The United Kingdom is a constitutional and hereditary monarchy. The two-chamber Parliament, comprising the House of Commons and the House of Lords, is the supreme legislative authority. Legislation may be initiated in either House; it is usually introduced in the House of Commons, but in any case requires the approval of both Houses. Executive responsibility rests with the Government, headed by the Prime Minister. Many government functions affecting Scotland, Wales and Northern Ireland are carried out by various departments of the Scottish and Welsh Offices and by Northern Ireland government departments respectively. The Northern Ireland Assembly, an elected body, has a consultative role.

Local government in England and Wales is carried out by 53 county councils, subdivided into 369 district councils, except for the Greater London area, which is divided into the City and 32 London boroughs. Scotland has 9 regional councils, 53 district councils and 3 all-purpose islands councils. Northern Ireland is divided into 26 district council areas. Many functions which in the rest of the United Kingdom would fall to local authorities are carried out by Northern Ireland government departments.

Administrative organization of water services

For the administration of water services, the United Kingdom can be considered as being composed of three distinct units: England and Wales, Scotland, and Northern Ireland (Fig. 1). Services in each of these units were the subject of considerable reorganization in the 1970s following the passing of major legislative changes.

England and Wales

The water industry in England and Wales is composed of 10 autonomous multifunctional water authorities. The geographical areas of the water authorities conform to river basins (Fig. 1), and within these areas each water authority is responsible for all aspects of the water cycle (Fig. 2). The boundaries of the Scottish Water Authorities (Regional and Islands Councils) are different from those of the River Purification Board (see Fig. 3).

Fig. 1. Map illustrating water administration units in the United Kingdom

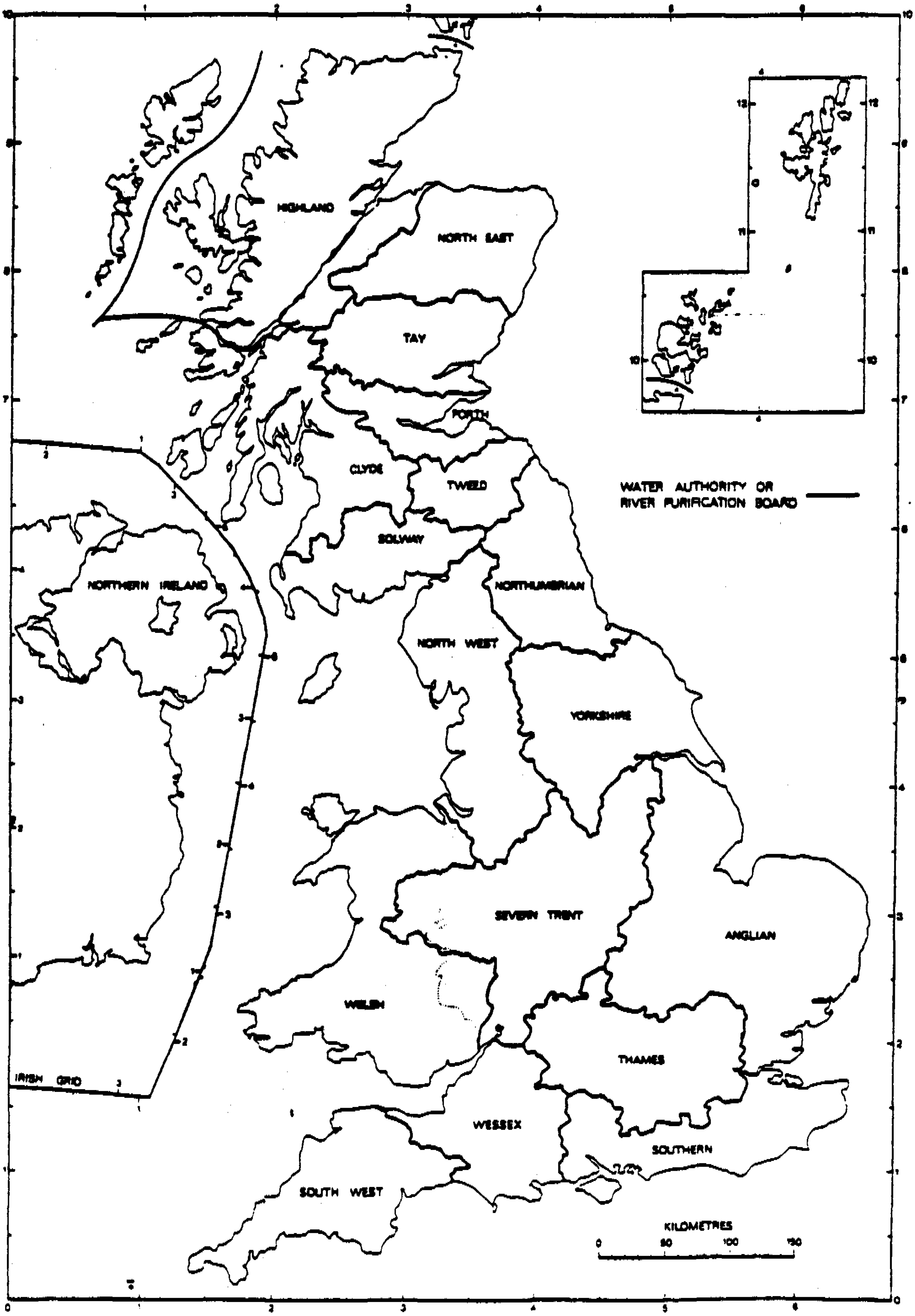
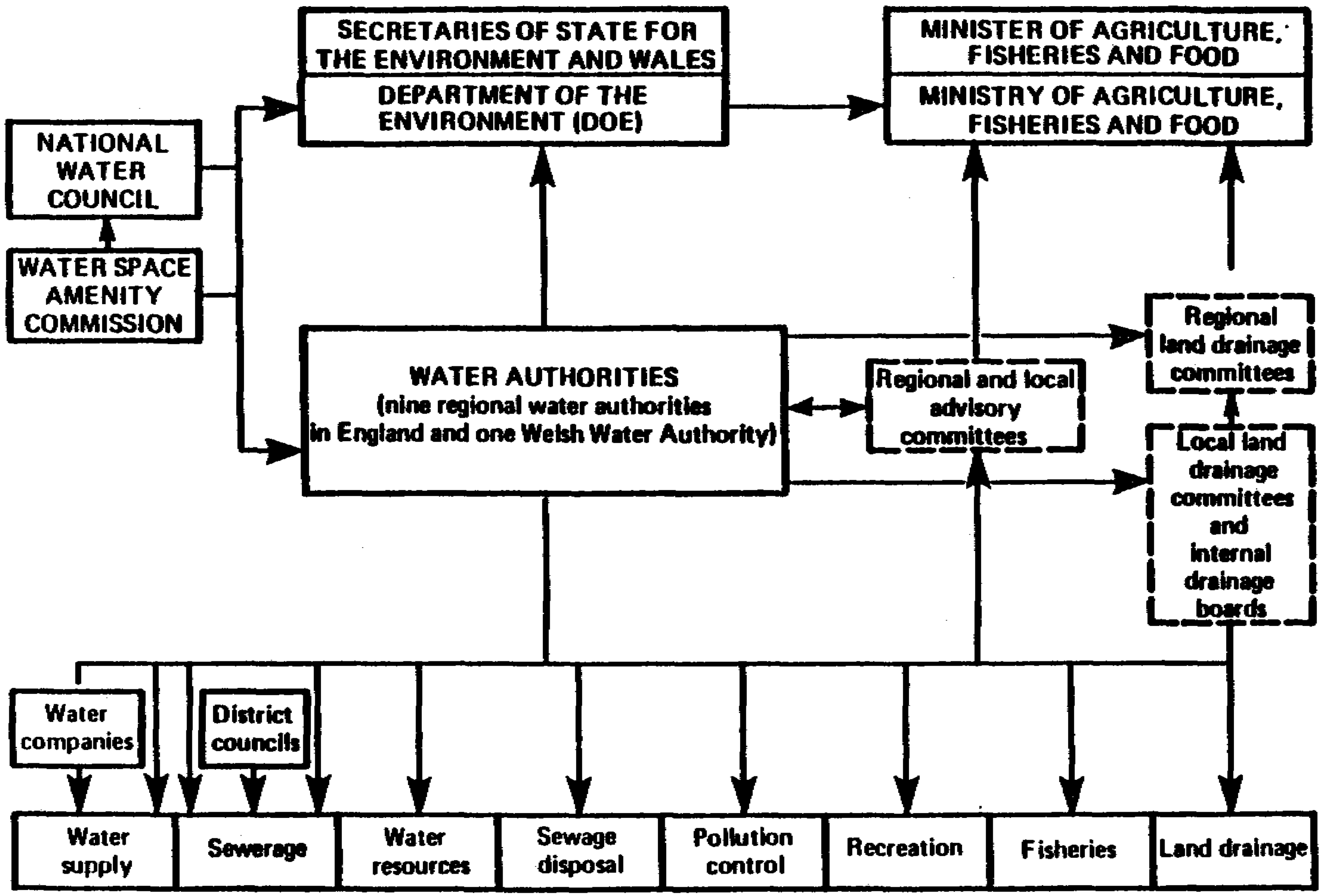


Fig. 2. The administration of the water services - chain of control in England and Wales



The administration of the water services—chain of control in England and Wales

In addition to the water authorities, there are 29 private water companies serving about one fifth of the population with potable water and three companies mainly concerned with industrial supplies.

There are known to be some 80 000 privately owned supplies in the UK, possibly more. Most are in rural areas serving a few properties each but there are some much larger supplies including some serving office blocks or factories, for example.

The Water Act 1983 reorganized the management structure of the water authorities, reducing the size of each board to between 9 and 15 members, all appointed by ministers. Matters of common concern to the water authorities in England and Wales are considered through the Water Authorities Association (WAA), an institution in which all the water authorities are equal shareholders. The WAA is a forum for discussion between the water authorities and other organizations, including the Government, and also coordinates any necessary joint action by water authorities such as negotiations on pay and public relations exercises. The Council of the WAA is made up of the chairmen of the 10 water authorities in England and Wales.

Overall responsibility for the promotion and securing of an effective national policy for water lies with the Secretary of State for the Environment at the Department of the Environment (DOE). Other ministers are also involved in this process, and these include the Secretary of State for Wales at the Welsh Office and the Minister of Agriculture, Fisheries and Food (Fig. 2). The Water Authorities are statutorily obliged to provide a range of services for their customers and are accountable to Parliament through the Secretary of State.

The Ministry of Agriculture, Fisheries and Food (MAFF) is responsible for land drainage and flood/sea defence policy in England. MAFF also has responsibility for all matters relating to fresh water and marine fisheries including management and conservation, fish farming, fish disease and prevention of marine pollution. Equivalent matters in Wales are dealt with by the Secretary of State of Wales.

In December 1987, the Government confirmed its intention to transfer the water supply, sewerage, and sewage treatment and disposal functions of the 10 Water Authorities in England and Wales to the private sector as part of its wider privatization programme. In addition, the Government is to establish a new public body, the National Rivers authority (NRA) to take responsibility for the Water Authorities regulatory and river management functions. The NRA will have full statutory responsibility for its functions although it will be required to ensure that as much of its work as possible is done on the basis of competitive tendering. Once the necessary legislation is in place, probably in Summer 1989, the NRA will be established and water authorities will be converted into water utility companies, wholly owned by the Secretary of State for the Environment, who will proceed to float them as rapidly as practicable.

<u>Scotland</u>

In contrast to the multifunctional water authorities in England and Wales, in Scotland responsibility for pollution prevention is separated from that of water supply, sewerage and sewage disposal.

Responsibility for pollution prevention lies with the river purification boards (7) and the islands councils (3) (see Fig. 4). The boards are responsible for the protection of surface waters. The boundaries of the boards' areas are based on river catchments. Their principal functions are to grant consents to discharge into the various waters and to carry out survey and sampling work as necessary to determine levels of pollution.

Responsibility for the functions of water supply, sewerage and sewage disposal lies with the regional (9) and islands councils. Boundaries of the regional councils are based on districts and not on catchments. However, those limits generally conform to the basin boundaries also.

In addition to the establishment of regional councils, there exists a Central Scotland Water Development Board, which is a separate bulk water supply authority supplying water to approximately 11% of the population in Scotland.

Overall responsibility for water policy lies with the Secretary of State for Scotland (Fig. 4). This responsibility is exercised mainly through the Scottish Development Department, one of the five departments that make up the Scottish Office. Another department, the Department of Agriculture and Fisheries for Scotland, is responsible for fisheries and certain aspects of land drainage.

Northern Ireland

The Water Service of the Department of the Environment for Northern Ireland (DOE-NI) is the sole water and sewerage authority. It comprises four multifunctional divisions, a central design unit for new works, and a headquarters division. In many respects, the Water Service resembles a water authority in England and Wales. The functions dealt with by the Water Service include water supply, control of water pollution, sewerage and sewage disposal. The Department of Agriculture for Northern Ireland is responsible for drainage works.

Role of the health department with regard to water quality

In England and Wales, the Water Act 1973 (IDHL, 25: 638) (effective from 1 April 1974) sets out the roles of the organizations responsible for drinking-water quality. Water undertakers (the water authorities and the water companies) have a statutory duty to provide adequate supplies of wholesome water for their consumers. The local authorities have the statutory duty of taking steps to ascertain the sufficiency and wholesomeness of water supplies within their areas and of notifying the water undertakers of any insufficiency or unwholesomeness in those supplies.

However, since 1974, the water undertakers have, in practice, become largely responsible for ascertaining if their supplies are wholesome, although in certain areas the local authorities rely on the Public Health Laboratory Service to undertake such checks on their behalf. In a limited number of areas, the sole responsibility for monitoring the bacterial quality of water, for both the water undertaking and the local authority, has been undertaken by the Public Health Laboratory Service.

Fig. 3. Map illustrating water authority areas in Scotland (Regional and Islands Councils)

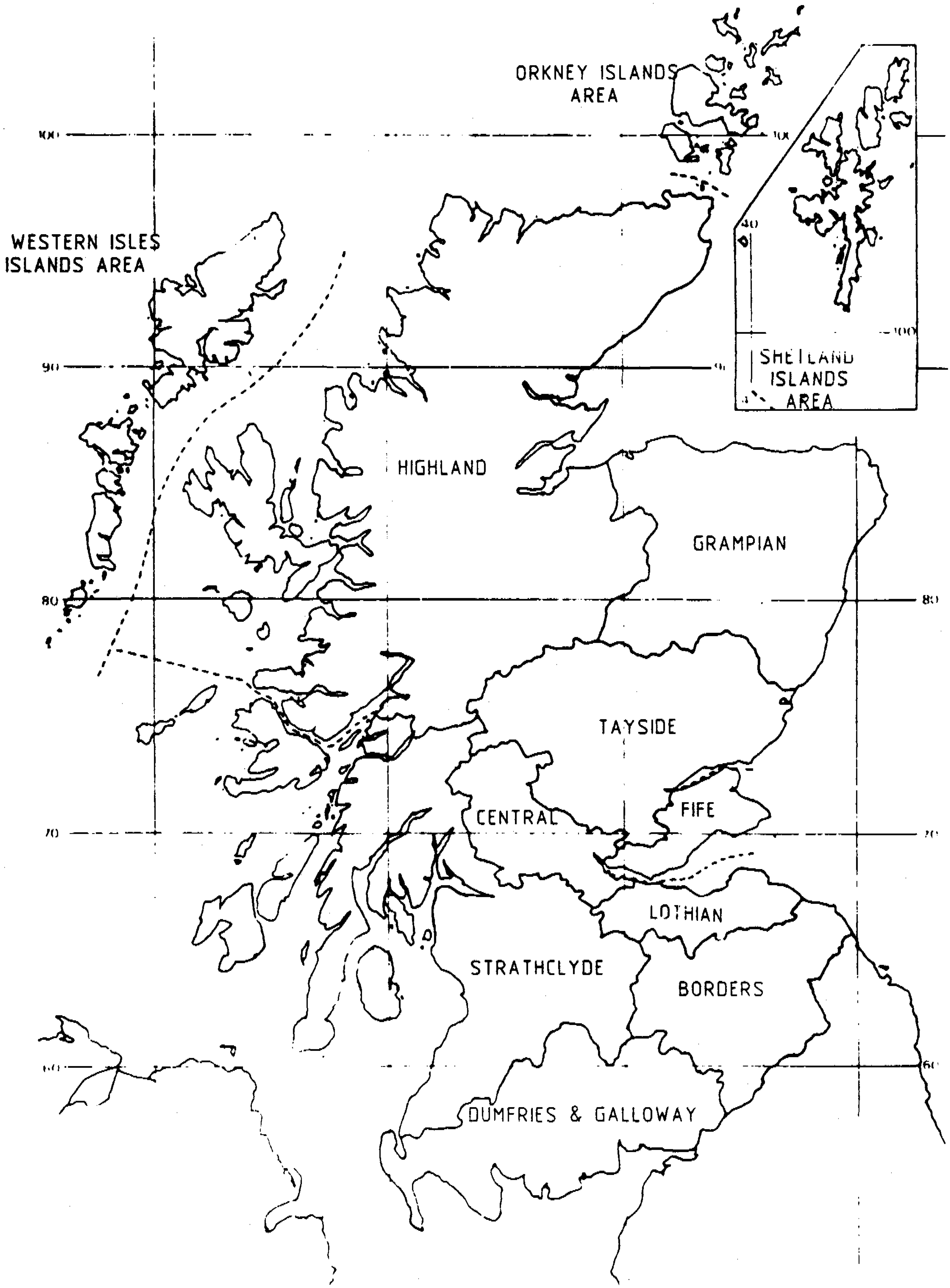
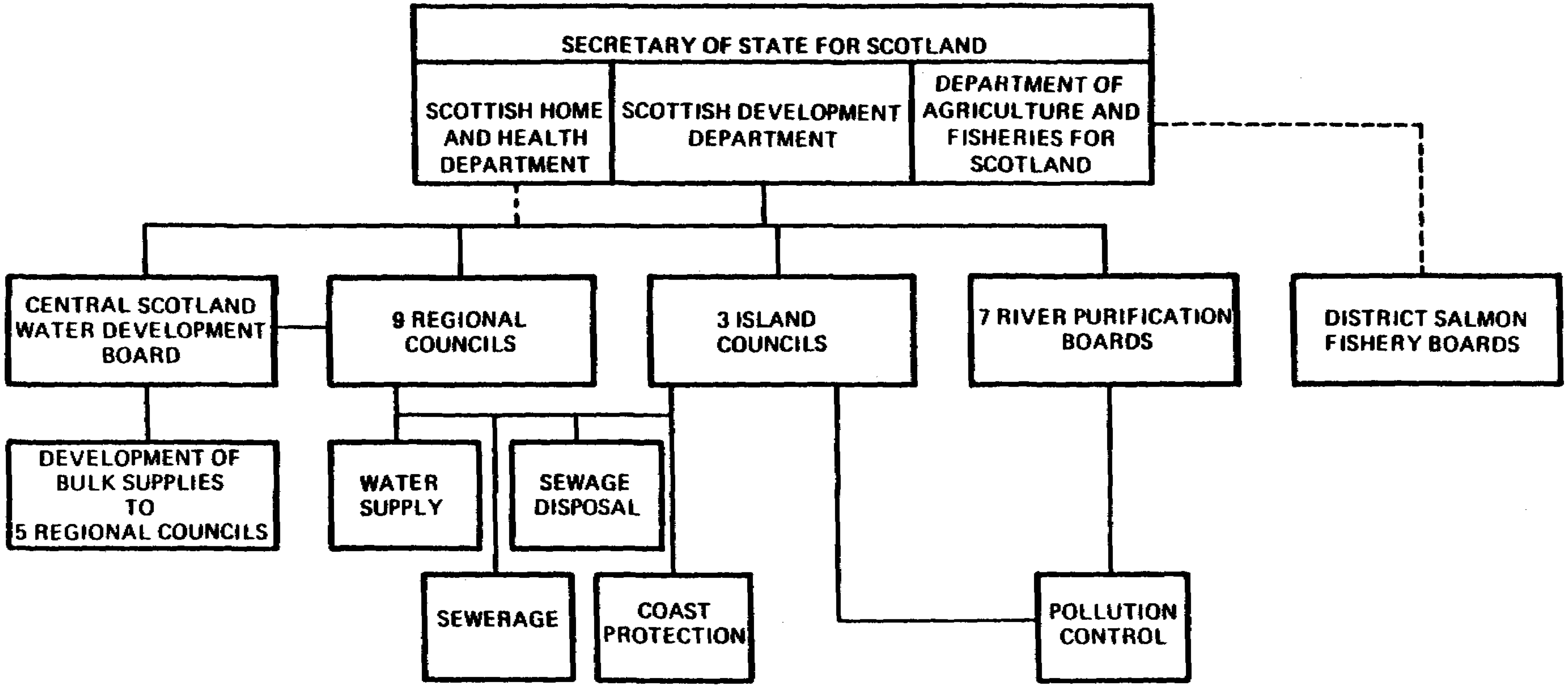


Fig. 4. The administration of the water services - chain of control in Scotland



The administration of the water services- chain of control in Scotland

Such an arrangement requires a considerable degree of liaison between the water undertakers and the local authority. Communication with the local authority should normally take place through the Chief Environmental Health Officer, but where communicable diseases are concerned communication should be with the Medical Officer for Environmental Health. On any other matter relating to health, both the Chief Environmental Health Officer and the Medical Officer for Environmental Health should be informed. Lists of the names and designation of the appropriate officer are available from the Department of Health and Social Security (DHSS). Water undertakers should furnish the Chief Environmental Health Officer with information on the quality of water in their areas and inform him and the Medical Officer for Environmental Health immediately of any incident or breakdown of plant that would jeopardize the safety of water supplies. For their part, the Chief Environmental Health Officer and the Medical Officer of Environmental Health should inform water undertakings of any incidents of disease of which they are aware that might be waterborne or of any operation or incident that could affect the quality of water supplies.

In the event of any unresolved differences between the water undertaker and the local authority, the Secretary of State for the Environment should be notified. In resolving such disputes, he will seek advice on aspects related to human health from the DHSS.

In Scotland, the Water (Scotland) Act 1980 lays a duty on every Scottish water authority to supply adequate quantities of wholesome water. Additionally, islands and district councils are empowered by the Act and by public health legislation to take action on water supplies that are so polluted as to be injurious or dangerous to health.

In the event of disputes concerning quality, reference is made to the Secretary of State for Scotland, who will resolve disputes in consultation with the Scottish Home and Health Department and the Scottish Development Department.

The legal requirement for wholesome water has not been defined. However, the WHO European standards for drinking-water and latterly the 1984 WHO Guidelines for Drinking Water Quality, supplemented by the comprehensive recommendations contained in the report The bacteriological examination of drinking water supplies 1982[a], have generally been used as guidelines to assess "wholesomeness". When the EEC directive 80/778/EEC relating to the quality of water intended for human consumption came into force in July 1985, it provided the basis for an accepted criterion of wholesomeness. The introduction of this directive did not alter the lines of communication between the water undertakings, the local authorities and the relevant government departments.

In Northern Ireland, the practice of monitoring water supplies for wholesomeness by the Department of the Environment for Northern Ireland is supplemented by the environmental health officers of the district councils routinely sampling supplies at the consumers' taps and having such samples examined by the Public Health Laboratory in Belfast.

Close liaison is required at local level to resolve differences between the Department and the district councils.

Water and related legislation

The United Kingdom became a member of the EEC on 1 January 1973, and since that time has been subject to Community law. Therefore, EEC law and, in particular, EEC directives have an increasing influence on the way in which water services operate.

The UK legislation enabling EEC legislation to be implemented and the UK legislation enacted before the United Kingdom gained membership of the EEC are both outlined below.

England and Wales

As a result of the Water Act of 1973, the water industry was restructured into 10 water authorities. This reorganization came into effect on 1 April 1974.

The 29 private water supply companies were continued under the Water Act, but water authorities were given the duty to make arrangements that provide for management of sources of supply, bulk supplies and the companies' charges for the supply of water.

In the 1973 Water Act, supplied potable water quality was simply defined as needing to be "wholesome", i.e. not causing any harm to public health. Since joining the EEC, however, the United Kingdom has been subject to Community law, which is very specific in its requirements regarding water quality.

Under Section 15 of the Water Act of 1973, local authorities have generally entered into agreement with water authorities to operate and maintain sewerage systems (but not sewage disposal) on behalf of water authorities, who reimburse the costs. Certain trunk sewers and pumping stations, and all sewage treatment works and coastal outfalls are the direct responsibility of water authorities, who also operate and maintain sewerage systems in areas where there are no arrangements with local authorities.

Pollution control legislation was consolidated in 1974 following the passing of the Control of Pollution Act. Part I of the Act is primarily concerned with waste disposal and reclamation and has already been implemented. Part II of the Act covers water pollution control and the substantive provisions of that part have also been implemented. This has facilitated the implementation of the EC directives dealing with pollution control.

Scotland

Under the Local Government (Scotland) Act of 1973, nine regional and three islands councils were established to be responsible for roads, education, water, sewerage and sewage disposal, strategic and, in some cases, all planning and a variety of other local authority functions. Responsibility for river pollution control in mainland Scotland lies with the seven river purification boards. The three islands councils are responsible for all local authority functions in their area (Fig. 4) and are themselves the river purification authorities.

Northern Ireland

In Northern Ireland, following the passing of the Water and Sewerage Services (Northern Ireland) Order 1973, the Department of the Environment for Northern Ireland became the sole water and sewerage authority in October 1973. Water policy is formulated within the Department and is promulgated through the normal government process. The functions dealt with by the Water Service of the Department include water supply, sewerage and sewage disposal. Pollution control is the responsibility of the Department's Conservation Division. Under the provisions of the Water Act (Northern Ireland) 1972, the Department is responsible for implementing in Northern Ireland the EC and international commitments of the United Kingdom Government in relation to water pollution control.

Under the Drainage (Northern Ireland) Order 1973, the Department of Agriculture is the statutory authority for the drainage of land (arterial drainage).

Water research

The Water Research Centre (WRc) was created in 1973 to meet the central research needs of the water authorities and water companies in the United Kingdom and also to serve the Government, industrial water users, consulting engineers, university departments and other bodies. It was formed by the amalgamation of the Water Research Association, the Water Pollution Research Laboratory and parts of the Water Resources Board. It is, however, designated a private company guaranteed by limited liability and has three main laboratories, one located at Stevenage concerned with process evaluation for potable and waste water, one located at Medmenham concerned with environmental protection; and one at Swindon concerned with instrumentation and the engineering (sewers and water mains) activities of the water industry. The WRc currently employs about 650 people and has an annual budget of approximately £21 million.

Many other bodies are also engaged in research into water or related matters. These include government departments such as the DOE, the MAFF, the Department of Trade and Industry (DTI), the Natural Environment Research Council (NERC) and the water authorities. In addition to supporting the work of their own laboratories, government departments commission research with various research bodies. For example, the DOE has contacts with the NERC laboratories, British Geological Survey, Institute of Hydrology, Freshwater Biological Association, Institute of Oceanographic Sciences, Plymouth Marine Laboratory, the WRc, universities, Hydraulics Research Ltd, and consultants.

The NERC receives research commissions from the DOE in addition to direct funding from the Department of Education and Science. The water authorities and water companies provide substantial funding to the WRc, and they also conduct operationally related research activities.

Finance

Revenue income

Water authorities derive their finance from charges to householders, businesses and farmers, for both water supply and other services such as sewerage and sewage treatment. The average bill per household per annum was £98.91 in 1987/88 in England and Wales. Scottish domestic consumers are not billed directly for water services, but the annual payment by an average household towards the cost of these services was of the order of £67.90 in 1987-1988.

Water charges

Potable water supply

Water charges are generally based on metered volumes for industrial users and on rateable values of properties for domestic consumers in England, Wales and Scotland. Arrangements for domestic consumers in England and Wales are being reviewed, and in many areas meters are being offered as an alternative to charges based on rateable value.

Sewage

Sewage charges are at present primarily based on rateable values, but for some commercial premises they are based on the metered amount of water supplied, and this could become more common in the future.

Industrial effluents

Charges for industrial effluents discharged into sewers are often calculated by a formula that takes into account the strength, nature and volume of the discharge. The policy for determining charges for industrial effluents varies between different water authorities.

Environmental services

In England and Wales, there is also an environmental services charge that represents about 2% of most bills, is levied on all properties (domestic, commercial and industrial) and is based on rateable value. This is to pay for the prevention of water pollution and the provision of recreation and fisheries. When the National Rivers Authority takes over responsibility from the water authorities, the environmental service charge will cease. It will be encouraged to seek the maximum possible recovery of its costs from direct charges such as licences. Additional support will be made available from central Government funds. In Scotland, the river purification boards are funded by charges (known as precepts) on regional councils. The control of fisheries and recreational waters is not part of their responsibilities.

Land drainage and flood protection

Revenue for these services in England and Wales is derived mainly from precepts on county council and internal drainage board funds. In Northern Ireland, these kinds of services are supported by the central Government, while in Scotland it is the responsibility of individual proprietors. Government grants may be available towards the cost of improvement works. Regional and islands councils have powers to carry out works to prevent or mitigate flooding of non-agricultural land.

Responsible agencies

Operation	Carried out by: England and Wales	Scotland	Northern Ireland
Water resources survey	WA	Scottish Development Department, regional councils, islands councils, Central Scotland Water Development Board	DOE-NI
Water management policy	DOE WA	Scottish Development Department (for legislation), local responsibility of regional and islands councils	DOE-NI
Drinking-water production	WA	Regional councils, islands councils, Central Scotland Water Development Board	DOE-NI
Drinking-water distribution	WA	Regional councils, islands councils	DOE-NI
Drinking-water quality surveillance	WA Local authorities-	Regional, islands councils, district for private systems	DOE-NI
Agricultural irrigation	WA/MAFF	None designated	Department of Agriculture for Northern Ireland
Industrial water supply	WA	Regional councils, islands councils and private supplies	DOE-NI
Underground water protection	WA	River purification boards	DOE-NI
Surface water protection monitoring	WA	River purification boards, islands councils	DOE-NI
Water pollution control	WA	River purification boards, islands councils	DOE-NI
Water resources storage and allocation	WA	Regional councils, islands councils, Central Scotland Water Development Board	DOE-NI

Water resource availability and management

Rainfall

The mean annual long-term rainfall for the United Kingdom is 910 mm. The country is subject to a cool, temperate, maritime climate dominated by westerly winds which, together with the topographic form of the islands, generates a rainfall gradient from mean values in excess of 1400 mm (on the upland areas forming the western and northern margins) to some 500 mm in parts of the eastern lowlands. Rainfall is relatively evenly distributed throughout the year. Losses by evapotranspiration are generally in the range of 300 mm to 500 mm, from north to south, which is a small percentage of the rainfall in upland and western regions to over 75% in the drier parts of the east. Summer and autumn soil moisture deficits in the south-east and east of the country may exceed 100 mm, while those in upland areas of the north-west are generally less than 10 mm.

Topography

The topography of the country reflects its geology, with the western and northern upland being composed predominantly of indurated rocks of Palaeozoic and Pre-Cambrian age. Much of these areas are also mantled by relatively impermeable glacial deposits, and a very high proportion of the effective rainfall appears as surface runoff in rivers. By contrast, the lowlands of the central, southern and eastern regions are underlain by sedimentary rocks of Mesozoic and Tertiary age, including the principal aquifers, the Triassic sandstone, Jurassic limestones and Cretaceous Chalk.

Population/water resources

The principal centres of population are located in the lowland areas of the English Midlands, the south and south-east and the eastern regions and in the Midland Valley of Scotland. Overall, some 65% of public water supplies are drawn from surface water and 35% from direct groundwater abstraction. The major gravity impoundments of headwater rivers are generally situated in the upland western regions, with transfer of water by pipeline and aqueducts to demand centres to the east. In recent years, more pumped impoundments have been constructed on impermeable strata in the eastern lowland region. The proportion of supply derived from surface sources varies from over 90% in the west and north to 20% or so in some eastern and southern areas, the balance being drawn from groundwater. In Scotland, however, only some 3% of supplies are from direct groundwater abstraction, the majority being drawn from upland natural or impounded reservoirs.

Future trends for water resources

Major schemes to regulate river flows by intermittent groundwater pumping have been initiated in the Thames, Great Ouse and Severn-Trent basins, with many smaller schemes now operational. In addition, the combined use of groundwater and surface water is practised in several river basin schemes of the Vale of Clwyd, North Wales, and in the Fylde area of Lancashire. From 1840 to 1965, abstraction of groundwater from the Chalk aquifer beneath London has lowered groundwater levels and generated aquifer storage space. Surplus treated water is now artificially recharged to the aquifer in east London to provide additional supplies at times of peak demand. However, problems are now occurring with the rise in groundwater levels in some urban areas such as Birmingham and London due to reduced groundwater abstraction and reduced recharge because of increased paved areas.

The present pattern of water resource development in Scotland is unlikely to change in the foreseeable future as available resources are generally ample.

General statistics

Population

Population in urban areas of England and Wales	90.0%
Population in rural areas of England and Wales	10.0%

Drinking-water supply

Total piped supply for drinking purposes	19 500 Ml/d[a]
Total population served by a piped public water supply	99.0%
Urban population served by a house connection	99.5%
Urban population without house connections but with reasonable access to public standposts	0.0%
Rural population served by a piped public water supply, at home	91.5%
Rural population served by private systems at home or having reasonable access to public standposts	8.5%

Drinking-water supply uses

Water supplied for domestic and commercial use	70.0%
Water supplied for industrial use	30.0%
Other uses	0.0%

Industrial water supply: direct abstractions[b]

Total supplied from inland waters for industrial use	23 000 Ml/d
Used for industrial cooling water	85.0%
Usage as industrial process water	15.0%
Total coastal water used	50 000 Ml/d

Agricultural use: direct abstractions[c]

Total amount abstracted for irrigation	100 Ml/d
Other agricultural uses including fish ponds	250 Ml/d

[a] Ml/d = one million litres per day.

[b] Industrial water use is decreasing by about 5% per annum, mainly due to increasing recycling and reuse of water.

[c] Agricultural water use is increasing by about 4% per annum.

Wastewater disposal services

(a)	% of urban population served by a sewerage network	99.0%
(b)	% of urban population served by other adequate means	1.0%
(c)	% of urban population lacking adequate disposal means	0.0%
(d)	% of rural population served by a sewerage network	90.0%
(e)	% of rural population served by other adequate means	10.0%
(f)	% of rural population lacking adequate disposal means	0.0%
	Sewage treatment	
(g)	% of sewerage systems receiving primary treatment only	10.0%
(h)	% of sewerage systems receiving secondary treatment	80.0%
(i)	% of sewerage systems receiving tertiary treatment	10.0%
(j)	% of sewerage systems receiving no treatment (raw discharge)	-
	Discharge of treated sewage	
(k)	% discharged into the sea	
(l)	% discharged into surface water bodies	
(m)	% discharged onto farmland	
	Discharge of untreated sewage	
(n)	% discharged into the sea	0.0%
(o)	% discharged into surface water bodies	0.0%
(p)	% discharged onto farmland	0.0%
	Sludge disposal	
(q)	% of sludge disposed into the sea	30.6%
(r)	% of sludge disposed into surface water bodies	
(s)	% of sludge disposed onto farmland	41.0%
(t)	% of sludge disposed as landfill	9.0%
(u)	% of sludge incinerated	3.4%
(v)	% of sludge sewage	11.0%
(w)	% unknown	5.0%

Useful addresses

Governmental

Department of the Environment
Water Directorate
Romney House, 43 Marsham Street
London SW1P 3PY

Tel: 01 212 3434

Water industry

Water Authorities Association
1 Queen Anne's Gate
London SW1H 9BT

Tel: 01 222 8111
Telex: 918518

Water research

Water Research Centre
WRc Environment
P.O. Box 16
Henley Road, Medmenham
Marlow, Bucks. SL7 2HD

Tel: (0491) 571531

Water Research Centre
WRc Processes
Stevenage Laboratory
Elder Way
Stevenage, Herts. SG1 1TH

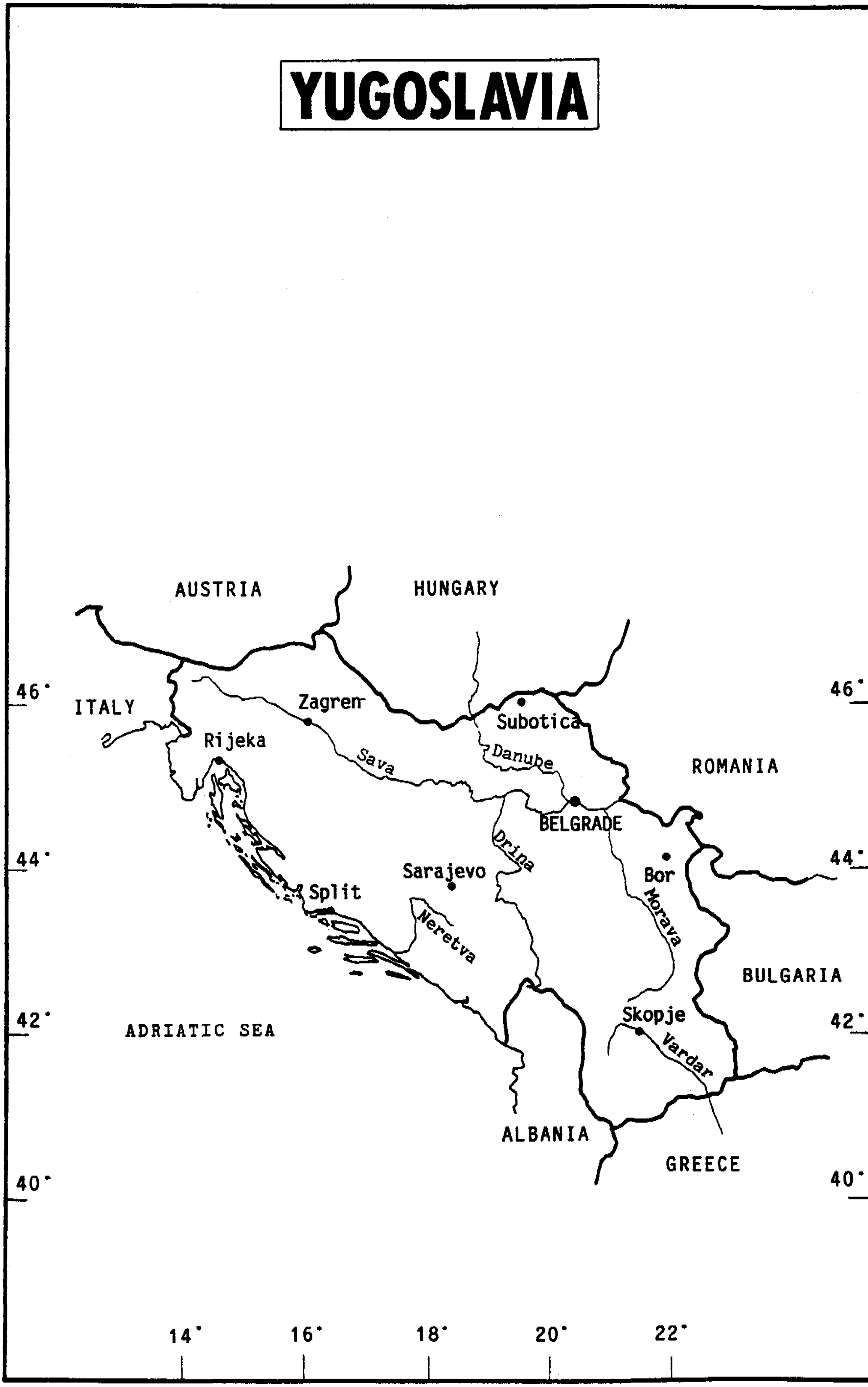
Tel: (0438) 312444

Water Research Centre
WRc Engineering
P.O. Box 85
Frankland Road, Blagrove
Swindon, Wilts. SN5 8YR

Tel: (0793) 488301

Department of Health and Social Security
Alexander Fleming House
Elephant and Castle
London SE1 6BY

Tel: 01 407 5522


YUGOSLAVIA
AUSTRIA
HUNGARY
ITALY
ROMANIA
BULGARIA
ALBANIA
GREECE
ADRIATIC SEA
Zagreb
Rijeka
Subotica
Sava
Danube
BELGRADE
Drina
Sarajevo
Split
Bor
Morava
Neretva
Skopje
Vardar
46°
44°
42°
40°
14°
16°
18°
20°
22°

YUGOSLAVIA

The Socialist Federal Republic of Yugoslavia (SFRY) is situated on the eastern side of the Adriatic Sea. It is bounded in the west by Italy, north by Austria and Hungary, north-east by Romania, east by Bulgaria and south by Greece and Albania.

The population in 1986 was 23 356 000. The area is 255 804 km^2, giving a population density of 91.30 inhabitants per km^2.

Government

The Socialist Federal Republic of Yugoslavia consists of the Socialist Republics of Bosnia-Herzegovina, Croatia, Macedonia, Montenegro, Serbia, Slovenia, the Socialist Autonomous Provinces of Vojvodina and Kosovo which are constituent parts of the Socialist Republic of Serbia.

The Assembly of the Socialist Federal Republic of Yugoslavia has two chambers: the Federal Chamber and the Chamber of Republics and Autonomous Provinces. The Federal Chamber consists of 30 delegates of self-managing organizations, communities and sociopolitical organizations from each republic, and 20 delegates from each autonomous province. The Chamber of Republics and Autonomous Provinces consists of 12 delegates from each republican assembly and of 8 delegates from each provincial assembly. In the Federal Chamber, the Board for Labour, Health and Social Welfare deals with problems related to health, social policy, labour relations, etc. It is also responsible for matters related to waters and potable water.

Each republican assembly has three chambers. Republics are subdivided into communes or municipalities, all of equal status. In each commune, the communal assembly has three chambers: the sociopolitical chamber formed by directly elected representatives of the commune; the chamber of associated labour, formed by elected representatives of the economic, cultural and welfare organizations and a variety of other organizations; and the chamber of local communities, elected by the communities.

Accordingly, the legislation on the administrative organization and utilization of water resources reflects the federal character of a state made up of equal constituents.

According to the Constitution (Article 281, paragraph 10), the Federation through its agencies, is responsible for the protection of the health of citizens from contagious diseases that may endanger the whole country. The Federation also regulates:

- the sale of poisons and the manufacture and sale of narcotics;
- the exploitation of water sources involving two or more republics or autonomous provinces;
- the conservation and improvement of the human environment of concern to the country as a whole and to the international community;
- the issue of standards, technical norms, and quality standards for products and services

- the enforcement of relevant federal regulations when this is in the interests of the country as a whole and so specified by federal statute;

- the organization of the collection, recording, and processing of statistical and other data concerning individuals or any social sector; i.e. demographic data, data on economic developments and other data of concern to the country as a whole.

The basic principles of the administration and utilization of waters are determined by the republics and the autonomous provinces; however, at community level, local regulations can be enacted.

Water management falls within the competence of sociopolitical communities (authorities). Waterways that intersect communal, republican or state borders are administered by the socialist republics and the socialist autonomous provinces. The management of other waterways is within the competence of the communes.

In accordance with the principles of socialist self-management, self-managed communal organizations having a common interest in the field of water management have been set up. Within the framework of their duties, they establish the relations between water consumers and service providers, formulating and implementing water development policies. They are also responsible for establishing the standards and norms for the conservation of waterways and maintenance of facilities, for determining prices of services, for procuring resources for expanded production, for deciding on the construction of new facilities and for controlling the selective use of resources. The assembly, the highest organ of self-managing communities, includes its delegates, delegations of workers, ordinary working people and citizens, and the water consumers.

The practical tasks related to water management such as the development of programmes and plans for the protection and utilization of waters, the execution of works for water protection, etc. are carried out by the water management organizations.

In addition to the above, there has recently been a trend within communes, labour associations and other organizations, to set up water protection communities, designed to protect specific lakes or rivers, for example, in the rivers Sava and Una. Communities can also sign legally binding social contracts and allocate funds and other resources to implement protective measures.

Water and related legislation

At the Federation level

The following are extracts from the SFRY Constitution and summaries of other legislation pertinent to water management:

- Article 85 of the Constitution provides that land, water, waterways and other resources, and any other goods of general interest, shall enjoy special protection and shall be used under the conditions specified by the law.

- Article 86 of the Constitution prescribes that natural resources must be used in conformity with statutorily defined general conditions which ensure their rational utilization and other general interests.

- Article 87 of the Constitution provides that all people and all sociopolitical and other self-managing organizations have the right and duty to ensure appropriate conditions for the conservation and improvement of natural and man-made values of the human environment. It also provides for the prevention and elimination of the harmful consequences of air, soil and water pollution, for noise reduction, and for the suppression of any other environmental conditions which may endanger these values and imperil the health and lives of people.

- Article 281 (item 10) of the Constitution provides that the Federation regulates the conservation and improvement of the human environment of concern to the country as a whole and to the international community; it also regulates the fundamentals of the systems for water exploitation of concern to two or more republics or autonomous provinces.

Federal legislation directly or indirectly related to waters and potable water.

A. Waters

- Official Gazette of the SFRY, No. 2 of 1974, Nos 4, 24 and 31 of 1976. Law regulating the use and regime of bodies of water of concern to two or more republics or autonomous provinces and on interstate waters.

- Official Gazette of the SFRY, No. 53 of 1977. Law on the uniform procedure for collecting, recording and processing data on mineral raw material reserves, on ground waters, and on the water resources reserve balance.

- Official Gazette of the SFRY, No. 6 of 1978. Ordinance on the classification of inter-republican waterways, interstate waters and waters of the territorial sea of Yugoslavia.

- Official Gazette of the SFRY, No. 8 of 1978. Order on the maximum permissible concentrations of radioactive and hazardous substances in inter-republican waterways, interstate, international and coastal waters.

- Official Gazette of the SFRY, No. 34 of 1979. Rules on classification, categorization and record-keeping of ground water reserves.

- Official Gazette of the SFRY, No. 62 of 1984. Law on the protection from ionizing radiation and special safety measures to be applied in the use of nuclear power.

Other regulations

- Official Gazette of the SFRY, No. 22 of 1978. Law on record-keeping in the field of health.

- Official Gazette of the SFRY, No. 20 of 1984. Law on manufacture and sale of poisons (Article 6) and Law on transportation of dangerous substances (Article 62).

B. Potable water

Laws

- Official Gazette of the SFRY, Nos 55 of 1978 and 58 of 1985. Law on health safety of food products and objects for general use.

- Official Gazette of the SFRY, No. 51 of 1984. Law on the protection of the population from communicable diseases endangering the country as a whole (Article 1, paragraph 1).

Rules

- Official Gazette of the SFRY, No. 33 of 1987. Rules on the hygienic quality of water used for public potable water supply and Rules on sampling and laboratory tests of potable water.

- Official Gazette of the SFRY, No. 59 of 1983. Rules on the maximum permissible concentrations of pesticides and other hazardous substances, hormones and antibiotics in food.

- Official Gazette of the SFRY, No. 23 of 1986. Rules on the requirements for the use of potable water supplies, for food consumption, and for the general use of objects which could be potentially contaminated by radioactive substances.

- Official Gazette of the SFRY, No. 8 of 1987. Rules on the maximum permissible levels of environmental radioactive contamination and on methods of decontamination.

- Official Gazette of the SFRY, No. 58 of 1973. Rules on the quality of natural mineral water.

- Official Gazette of the SFRY, No. 51 of 1985. Rules on health examination of persons placed under health surveillance for the control of communicable diseases.

Republics/provinces

All the republics and autonomous provinces have adopted basic regulations on waters; viz., the Water Law, the ordinance on the classification of waters, the ordinance on the categorization of waterways. There is an average of about 20 such regulations in each federal unit.

Some republics such as the Socialist Republic of Macedonia have passed laws on the protection of specific waters and lakes on their territories. For this purpose, separate communities having common interests have been formed into social agglomerations, as, for instance, the community for the Sava River, the Tara River, the Una River, etc.

The Socialist Republic of Serbia has also issued regulations on the protection and further development of potable water sources, on the fluoridation of drinking-water, and for the preparation of the basic plan for the use of water in the region.

Communes

Communes very frequently take concrete decisions on the protection of potable water sources either separately or within the framework of town planning schemes. They also decide on the conditions of the disposal of wastes, on the establishment and organization of services and on the setting up of work organizations for potable water supply and the disposal of wastes.

Association of communities in the field of water protection

Recently, communes and work organizations and other entities have tended to establish associations of communities for the protection of specific lakes or rivers (the rivers Sava, Una, Lake Ohrid, etc.) and for that purpose they have concluded legally binding social contracts.

In these communities, specific resources are provided for implementing measures for the protection of these localities. For example, for the protection of the Sava River, the largest river in the SFRY, a social contract was concluded by the commune and the work organizations concerned.

The SFRY is a signatory to a number of international agreements and documents for the protection of international rivers (the Mura, the Drava, the Danube) and seas (Mediterranean, Adriatic).

As a rule, drinking-water is supplied by the community and, less frequently, by regional organizations. Communities are responsible for the protection and maintenance of water sources, plants and water supply networks, for the quality of the drinking-water and, generally, for supplying wholesome potable water. They are also responsible for the sewerage systems; there are rarely separate organizations for this purpose.

Role of the health department with regard to water quality

Potable water

Regulations pertaining to the quality of potable water and applicable to the entire country are issued by the Federal Committee for Labour, Health and Social Welfare on the basis of the Law adopted by the Federal Assembly.

The republics and the autonomous provinces can also adopt regulations on the quality of potable water. However, they cannot lower the criteria set by the Federation. They may only expand the list of parameters determined by the federal law, establish protected zones around potable water supply sources, set out the conditions regarding the quality of the water supplied to consumers, and the principles governing the organizations responsible for the water supply.

Sanitary inspection authorities have the right and the responsibility to control the planning, construction, and operation of water supply plants, and to carry out measures for ensuring the quality of the water.

Health organizations control the quality of water and evaluate its quality (social control of potable water) and, if the water is found to be unsafe, they inform the authorities concerned.

Other waters

Health authorities control the hygienic quality of the surface waters, rivers, lakes, sea, and of groundwater. Hazardous substances in inter-republican and interstate waters and waterways and in the territorial waters of Yugoslavia are monitored by the Federal Institute of Public Health. Other waters fall within the competence of republican, provincial and regional (communal) health care institutes.

Wastes

The control of the disposal of wastewater and solid wastes from households and public facilities, and settlements in general, is carried out by local water management and health authorities. The republican health authorities are responsible for the control of the disposal of wastewater and solid wastes from industry.

Finance

Revenue income

All water consumers (industry, agriculture and others) are charged an appropriate amount for the utilization and consumption of water as well as for pollution control. These funds go to the water management communities. Domestic consumers served by a piped public water supply system are charged by the water supply company for the water used. As this revenue does not cover the real cost of the construction and maintenance of the supply network, special contributions are invited from consumers to cover it.

Charges for

Potable water supply

Users pay a connection charge to the communal authorities, in addition to paying for the water used.

Sewage

Only a connection charge is made. The cost of the service is included in the prices charged for water.

Industrial effluent

In 1980, the annual amount of industrial and mining wastewater was of the order $7 \times 10^3 m^3$. Of this amount, $2 \times 10^3 m^3$ was processed water, $4 \times 10^3 m^3$ cooling water and $0.4 \times 10^3 m^3$ was faecal wastewater annually.

Approximately $31 \times 10^6 m^3$ of water is purified annually, 50% of which is in addition purified biologically.

Responsible agencies

Operation	Carried out by:
Water resources survey	The organs of the sociopolitical community (authorities)
Water management policy	The department for public utilities affairs of the municipal assembly, the Secretariat (Committee) for Agriculture of the republic or the autonomous provinces The association of self-managed communities for water management of the republics or the autonomous provinces and the regional water management organizations
Drinking-water production	Water supply and sewerage enterprises (of the commune, town, region)
Drinking-water distribution	Water supply and sewerage enterprises (of the commune, town, region)
Drinking-water quality for surveillance	Water supply enterprises are responsible supplying wholesome water. The control of the quality of water can be carried out in their laboratories, but it can also be subcontracted to an authorized laboratory The wholesomeness of water is monitored on behalf of the social community by competent health care organizations, most frequently by institutes of public health The control of the sanitary and health standards applicable to the water supply facilities and the drinking-water itself is carried out by the sanitary inspection organs
Agricultural irrigation	A water-use permit is issued by the administrative organ competent for water management in the communal assembly or in the republic or the autonomous province, depending on the volume of water
Industrial water supply	The administrative organ for water management in the commune, the socialist republic, or the socialist autonomous province, depending on the volume of water

Underground water protection	The water management inspection unit of the communal assembly, sanitary inspection unit
Surface water protection monitoring	The hydrometeorological service of the public health organization (according to the waterway, regional, republican or federal institutions).
Water pollution control	The water management inspection unit of the republic of the autonomous province; sanitary inspection unit
Water resources storage and allocation	The administrative organ for water management and water management organizations

Water resources availability and management

Rainfall

Data on the mean annual long-term rainfall for Yugoslavia have been collected for more than 50 years, and the Statistical Yearbook of Yugoslavia (SGJ) publishes data on the mean rainfall in 50 settlements throughout the SFRY. According to the data for the year 1978/79, the mean annual rainfall in certain towns ranged from 365 mm (Stip, 1978) and 2993 mm (Niksic, 1979) and the number of rainy days from 73 (Ljubljana, 1978) to 166 (Sarajevo, 1979). Rainfall is unevenly distributed throughout the year.

Yugoslavia has over 1800 rivers, which have a total length of more than 120 000 km. Twenty-three of these rivers are more than 100 km long.

Topography

Approximately 70% of the territory of the SFRY is at more than 200 m above sea level. The principal mountain regions are south of the Sava River. They stretch from the north-west to the south-east of the country. The Alps are in the north-west of the country, while the Dinaric Alps cover the centre, and the Sar-Pindar and Rhodope Mountains continue along the Dinaric range into the south-east. The Carpathian and Balkan Mountains stretch north-east of the Rhodopes. The highest peak in Yugoslavia is Triglav (2864 m).

The lowlands cover the region around the Danube and its tributaries the Drava, Mura, Sava and Tisa, and make up part of the Pannonian plain. Along other larger rivers (the Morava, Vardar, around Skadar Lake, etc.), there are fertile lowlands and basins.

The Socialist Federal Republic of Yugoslavia is abundant in lakes (about 220 with a total surface of 1600 km^2), of which 28 have a surface area larger than 1.4 km^2. The largest is the Skadar Lake (391 km^2), followed by the Ohrid Lake (348 km^2), and the Prespan Lake (274 km^2).

The Adriatic coastal region as a geographic whole is composed of islands, a narrow coastal belt and the hinterland separated from continent Yugoslavia by the Dinaric mountains.

Population/water resources

The total available waters in the SFRY are estimated at 24.4×10^9 m^3/year, runoff is approximately 129×10^9 m^3, and inflowing waters, practically all in the Danube basin, account for 115×10^9 m^3 of water.

Yet in spite of an abundance of water, the SFRY is increasingly experiencing water shortages in certain regions. There are two primary reasons for this.

First, water resources are very unevenly distributed in space and time. The highest runoff coefficient appears in the scarcely settled western parts of the country, from 20 to 80 l/sec/km^2. In contrast, the densely populated eastern and north-east parts of the country (over 100 inhabitants per km^2 with a considerable consumption of water per capita), are distinguished by a low runoff coefficient of below 3-5 l/sec/km^2 and a practically complete absence of surface runoff in some parts of Vojvodina.

Second, the seasonal unevenness of the water flow is reflected in the proportion of average flows in the rainy and dry years, which is often greater than 3:1. The flow of waters in a moderately dry year amounts to 60-70 $\times 10^9$ m^3 of water instead of the required 129×10^9 m^3 and wastewaters 50%. A large number of the catchment areas are subject to floods, and 70% and more per cent runs off in only 2-3 months. In dry periods, the flows of some smaller rivers reach the proportion of 1:1000.

The available volumes of surface waters and their distribution in space show that the population living in the hydrographic basin draining towards the Aegean Sea through the Vardar River disposes of 3220 m^3 per capita annually. The population living in the basin draining towards the Black Sea, through the rivers Danube, Tisa, etc., disposes of 3910 m^3 per capita per annum, while those living in the Adriatic Sea hydrographic basin dispose of 17 010 m^3 per capita annually. The water availability per capita can be seen in Annex 1b).

General statistics

Population

Total population in urban areas	47.0%
Total population in rural areas	53.0%

Drinking-water supply

Total piped supply for drinking purposes (captivated water, 1980)	1508 Ml/d[a]
Total population served by a piped public water supply (1985 estimate)	74.5%
Urban population served by a house connection (1985 estimate)	90.6%
Urban population without house connections but with reasonable access to public standposts	9.4%
Rural population served by house connections (public and private) (Census of 1981)	46.4%
Rural population without house connections but with reasonable access to public standposts (Census of 1981)	53.6%

Drinking water supply uses

Water supplied for domestic and commercial use	42.0%
Water supplied for industrial use	50.0%
Other uses	8.0%

Industrial water supply: direct abstractions

Total supplied from inland waters for industrial use (1984)	236×10^9 m^3
Used for industrial cooling water	1.67%
Usage as industrial process water	97.91%
Total coastal water used	NA[b]

Agricultural use (1985)

Irrigation channels	8 204 km
Drainage channels	56 248 km
Irrigated surface area	164 387 ha
Surface water	88 326 ha
Artificial rain	74 596 ha
Other	1 465 ha
Drainaged surface of land	2 136 000 ha

[a] 1 Ml/d = 1 million litres/day.
[b] NA = Not available

Wastewater disposal services (Census of 1981)

(a)	% of urban population served by a sewerage network	84.1%
(b)	% of urban population served by other adequate means	15.9%
(c)	% of urban population lacking adequate disposal means	0.0%
(d)	% of rural population served by a sewerage network	33.0%
(e)	% of rural population served by other adequate means	67.0%
(f)	% of rural population lacking adequate disposal means	0.0%

Sewage treatment (1984)

	Total purified waters	$1.2 \times 10^9 m^3$
(g)	% of sewerage systems receiving primary treatment only (mechanically)	53.5%
(h)	% of sewerage systems receiving secondary treatment (chemically)	11.0%
(i)	% of sewerage systems receiving tertiary treatment (biologically)	8.5%
(j)	% type of treatment unknown	27.0%

Discharge of treated sewage

(k)	% discharged into the sea	NA
(l)	% discharged into surface water bodies	NA
(m)	% discharged onto farmland	NA

Discharge of untreated sewage

(n)	% discharged into the sea	NA
(o)	% discharged into surface water bodies	NA
(p)	% discharged onto farmland	NA

Sludge disposal

(q)	% of sludge disposed into the sea	0.0%
(r)	% of sludge disposed into surface water bodies	0.0%
(s)	% of sludge disposed onto farmland	41.0%
(t)	% of sludge disposed as landfill	54.0%
(u)	% of sludge incinerated	5.0%

Useful addresses

Governmental

Federal Secretariat for Labour, Health, Veteran Affairs and Social Policy
SIV II
Bulevar Avnoj-a 104
YU-11070 Belgrade

Tel: 60 25 22

Federal Institute of Public Health
Slobodana Penezica-Krcuna 35
YU-11000 Belgrade

Tel: 64 40 66; 64 43 50; 64 63 76

Water industry

Association of Self-Management Communities
of Interest for Water Management of Yugoslavia

General Water Management Association of Yugoslavia

Water research

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Annex 1a

According to information provided by the Federal Hydrometeorological Institute and based on a 30-year average, the situation in various regions of the SFRY was as follows:

		Rainfall in mm
(a)	North-west (Slovenia, western Croatia)	1000-4000
(b)	Medjumurje (north-west, north-east of Zagreb)	700-1500
(c)	The Littoral mountains (along the Adriatic Sea)	1250-3000
(d)	Islands in the Adriatic Sea	600-1500
(e)	South Adriatic (mountains)	1250-5000
(f)	North-east (the Danube region)	400-1000
(g)	Eastern parts of the SFRY - Timocka krajina	600-1250
(h)	Central mountainous regions of the SFRY (parts of Bosnia, Serbia, Kosovo)	900-1500
(i)	South-east (Macedonia)	365- 883

Annex 1b

Water availability per capita in the different regions of the SFRY

Region	m^3/capita/annum
Slovenia	10 140
Bosnia and Herzegovina	8 110
Croatia	6 360
Macedonia	3 550
Serbia (not including the provinces)	2 250
Kosovo	2 120
Vojvodina	1 000

The average for the SFRY is 5700-6100 m^3/capita/annum