

# THE DANISH MODEL FOR SUSTAINABLE WATER SOLUTIONS



*Transferring know-how and  
expertise from Denmark to international  
water management projects*

## PREFACE

---

Denmark has long been actively working to address environmental pollution and improve conditions for man and nature. Much experience has consequently been gained and good solutions to the problems have been devised. More recently, Denmark has endeavoured to apply this experience to projects abroad, primarily in Eastern and Central Europe, as well as in the developing countries.

This publication describes the background for Danish solutions within the water sector, most of which are founded on extensive cooperation between authorities,

research institutes, private companies and public enterprises. Danish competence is highlighted – in particular regarding public responsibilities and the operation of water supply and wastewater treatment plants. Carefully adapted to local needs, Danish know-how and expertise could make a valuable contribution to water sector projects abroad. Export of Danish know-how and expertise pertaining to sustainable water solutions takes place through cooperation between private enterprises and public institutions in Denmark and represent solid professional knowledge.



## INDEX

---

● Transfer of know-how and expertise .....	page 4
● From research to environmental management .....	page 6
● Holistic management .....	page 8
● Effective environmental administration – to ensure a sound aquatic environment .....	page 10
● Sustainable water supply and wastewater treatment .....	page 12
● Reliable and safe water supply .....	page 14
● The consumer in focus .....	page 16
● Reliable sewerage systems .....	page 18
● Efficient wastewater treatment .....	page 20
● Areas of special competence in the Danish public sector – selected examples .....	page 22

## TRANSFER OF KNOW-HOW AND EXPERTISE

Denmark is a world leader as regards aquatic environment issues and is renowned for exemplary cooperation between the public and private sectors. Exports of environmental technology and environmental administrative knowledge are therefore expanding rapidly. In this respect private-sector consultancy firms play a major role.

### Danish drinking water policy is based on ground-water protection:

- Prevention and source-oriented efforts
- Higher priority is accorded to contamination prevention than to subsequent purification
- Designation of particularly valuable water abstraction areas (as regards resource size, quality, protection requirements, etc.)

### Danish wastewater policy aims to:

- Minimize discharges of hazardous substances
- Allow discharges of other substances provided the aquatic environment is not harmed
- Protect the environment by imposing limits on discharges of organic matter, nitrogen and phosphorus from major wastewater treatment plants that are tailored to the pollution sensitivity of the recipient waters

### Transfer of know-how

The Danish Environmental Protection Agency (Danish EPA) – often in collaboration with Danish companies and authorities – advises and assists other countries on a series of environmental issues.

In recent years, a number of Danish counties and public water utilities have been involved in the transfer of know-how to Eastern Europe, as well as to the developing countries. Denmark is thus able to provide public expertise on an international level.

In this context, Danish consultancy firms play a major role, mainly operating alone in the water sector, but also in close cooperation with various public stakeholders.

The international water sector projects in which Denmark participates are staffed by personnel with practical experience in jobs similar to those of the client – typically key personnel in technical, financial and managerial positions.



Examples of services and assistance offered by consultancy firms or public and private entities in cooperation are shown in the text box below.

### Danish assistance:

- Preparing draft legislation, regulations, directives, guidelines, etc.
- Administering and enforcing legislation, supervision, emission standards, etc.
- Formulating action plans
- Monitoring the state of the environment, collecting knowledge and information on environmental conditions
- Deploying economic instruments
- Training
- Institutional development at national and regional levels
- Organization, preparation and implementation of environmental administration and supervision of groundwater, drinking water, wastewater and surface waters (watercourses, lakes and coastal waters)
- Development of water and wastewater utility management and operation covering technical, administrative and organizational aspects as well as customer relations

This assistance is based on the Danish tradition of:

- Holistic management
- Optimization of operation and maintenance
- Consumer-oriented services



## FROM RESEARCH TO ENVIRONMENTAL MANAGEMENT

Denmark has a long tradition for close cooperation between the research institutes and agencies responsible for administering our water resources. This ensures the continued development of water resource management founded on scientific knowledge and research. In addition, Danish research institutes work closely with private consultancy firms and water/wastewater utilities concerning the environmental effects of water resource development on the hydrological cycle, thereby ensuring that management is based upon the latest research findings and up-to-date scientific knowledge.

Integrated Water Resource Management (IWRM) is an interdisciplinary process whereby traditional disciplines such as hydrology, river hydraulics, hydrogeology, water chemistry and dynamic modelling of both surface water and groundwater flow are combined with legislative, institutional and socio-economic aspects. IWRM also takes into consideration the interests and conflicts of various stakeholders.

### Danish assistance:

- Capacity building at research institutes and universities
- High scientific level training of staff and teachers
- Research-based consultancy for national and regional authorities
- Data collection, processing and archiving at the national level
- Integrated environmental information systems based on GIS
- Environmental indicator systems
- Water abstraction and resource evaluation
- Catchment-level integrated hydrological modelling
- Integrated water resource management and planning
- Geological mapping and modelling
- Environmental impact assessment
- Environmental economics
- Rehabilitation of water resources
- Air pollution monitoring, data management and forecasting
- Air quality assessment
- Soil ecology and pollution
- Plant, animal and forest ecology
- Wildlife management
- Risk assessment of xenobiotics and genetically modified organisms
- Analytical and environmental chemistry
- State-of-the-art laboratory facilities for chemical and microbiological analyses



## HOLISTIC MANAGEMENT

Over the past decade, considerable investments have been made to increase the efficiency of the water utilities, sewerage systems and wastewater treatment plants. The establishment of effective and reliable organizational structures to operate and maintain the plants and conduit systems has endowed Denmark with a good international reputation as regards environmental standards and improvements.



### Danish assistance:

#### The role as environmental authority:

- Legislation
- Institutional development and administrative assistance
- Wastewater permits
- Water abstraction management
- Industrial supervision
- Law enforcement
- Sector-specific campaigns

#### The role as client:

- Wastewater permits
- Identification of terms of reference (TOR)
- Tendering procedures (TOR, evaluation of tenders, etc.)
- Procurement management
- Project planning and management

#### Water utility management:

- Service agreements
- Ownership
- Management information systems
- Financial management
- Tariff policy/billing and collection
- Operation and maintenance
- Environmental management
- Benchmarking

### Environmental authorities

The Danish Environmental Protection Agency is responsible for drawing up and implementing environmental legislation, regulations and action plans at the national level. In addition the agency is responsible for keeping Parliament well informed about the state of the Danish environment.

The Counties are responsible for the water resource size and quality.

Construction, operation and maintenance of water and wastewater facilities are the responsibility of the Municipalities, and are 100% financed by the consumers.

### The client: Supervising private contractor performance

The Danish water utilities frequently invite tenders for construction and renovation projects. In order to ensure project success, the water utilities need to have a high professional standard and extensive knowledge of contract preparation, project management and project follow-up.

The Municipalities are responsible for planning and operation of the local water utilities, wastewater treatment plants and sewerage systems. Moreover, they stipulate the regulations governing connection to the sewerage system and wastewater disposal charges.

### Water utility management

The overall objective of the Danish water utilities is the provision of a fully reliable, environmentally sound water supply at competitive prices.

New forms of water utility organization and ownership have developed in recent years, and the know-how and experience gained are now available to clients abroad.

### The implementation of projects

In Denmark the roles of the private and public sectors are very well defined. Building and construction projects within the water sector are implemented by Danish private sector consultancy firms and construction companies.

## EFFECTIVE ENVIRONMENTAL ADMINISTRATION – TO ENSURE A SOUND AQUATIC ENVIRONMENT

In order to meet national environmental policy and international commitments, Denmark manages environmental issues at three levels: National, regional and local.

### Danish assistance:

- Establishment of efficient environmental administration
- River basin and water resource management
- Supervision and monitoring
  - quality
  - resource
- Setting water quality objectives
- Action plans
  - point-source outlet criteria
  - diffuse pollution sources
- Watercourse restoration and maintenance
- Environmental contingency plans
- Environmental risk assessment
- Environmental impact assessment
- Remedial measures (groundwater)
- Public participation
- Cleaner technology
- Mapping (GIS)
- Training and twinning

To this end Denmark has developed an efficient environmental administration to implement the political decisions made, to prioritize efforts to deal with the consequences of past environmental problems, and to consult the relevant authorities when faced with major accidents threatening the environment.

Solving these tasks necessitates that the administration possesses a high level of professional competence founded on knowledge of the latest research findings. Moreover, the administration must be able to procure and process information on the state of the environment and monitor developmental trends in environmental quality. Finally, the administration must possess good communication skills.

In Denmark, the responsibility for ensuring an adequate water resource of good quality lies with the Counties. The areas where the most important aquifers are located, and which must be effectively protected against contamination – so-called particularly valuable water abstraction areas – are designated in each County's Regional Plan. This also stipulates quality objectives for the biological and chemical quality of the surface waters. These must be adhered to and form the basis of municipal and industrial wastewater treatment requirements.

The Counties are responsible for supervising particularly polluting enterprises and providing advice on the implementation of cleaner technology and environmental management. The Counties are also responsible for identifying contaminated sites (landfills, disused industrial sites, etc.) and prioritizing their remediation.



## SUSTAINABLE WATER SUPPLY AND WASTEWATER TREATMENT

Danish cities are known for their safe and reliable water and wastewater services of a high environmental standard.

Optimization has enabled Danish water utilities to become cost-competitive, while achieving the goal of providing water and wastewater services to consumers at the lowest cost without compromising quality, thereby enabling them to retain control of operations. Danish experience in this area is now available to water sector projects abroad.

### Training and twinning

Danish companies organize training courses on the planning, operation, restoration and maintenance of water and wastewater services. The courses are divided into categories (practical, technical and technical/administrative), but are tailor-made according to the individual requirements of the client.

The instructors come from Danish water and wastewater utilities and are specialists in all the practical and administrative tasks necessary for the efficient management of such utilities. Their long working experience has provided them with a comprehensive understanding of the whole spectrum of water supply and wastewater disposal issues.

The available expertise encompasses all levels ranging from management to specialists to technicians.

Danish authorities have been working with practical twinning arrangements for many years.

### Danish assistance:

- Operational services/optimization
- Institutional development
- Training and twinning



## RELIABLE AND SAFE WATER SUPPLY

### Supply and quality requirements

The Danish water supply is known for its unusually high drinking water quality and supply reliability. Despite the highly decentralized structure, detailed legislation and thorough planning ensure all citizens a constant supply of high-quality water. The water supply is based on cooperation between municipal and private water utilities and private companies.

All Danish drinking water is routinely controlled by the waterworks and authorities in accordance with WHO and EU quality standards so as to ensure that it is free of undesirable substances and microorganisms, e.g. pesticides and coliform bacteria.

### Pollution

The greatest threat to the quality of the drinking water from the main water utilities is increasing contamination of the groundwater from intensive agricultural production (nitrate and pesticides) and chemical waste depositories.

Until now, water utilities have been able to meet these contamination threats by relocating abstraction wells and reorganizing the abstraction of groundwater. In the future, though, priority will be accorded to preventative efforts, so as to ensure that the Danish water supply can continue to be based on pure, uncontaminated groundwater.

### Danish assistance:

- Planning of supply structure
- Groundwater abstraction plans – consumer participation
- Monitoring of intake/raw water management
- Operation and maintenance of the technical installations using SCADA
- Resource and energy optimization
- Network models (operation)
- Network registration using GIS, etc.
- Leakage detection
- Network renovation (No-Dig, etc.)
- Customer relations
- Water meters, tariff systems
- Quality control, health and customer security
- Operation and maintenance manuals
- Tariff policy
- Financial management
- Organizational structure
- Management information systems (MIS)
- Environmental management systems
- Environmental contingency plans
- Training and twinning
- Institutional development



## THE CONSUMER IN FOCUS

The primary obligation of the water utilities towards consumers is to ensure a continuous and adequate supply of pure drinking water of good quality and taste. In this regard, ongoing communication with the consumers plays an important role.

Since 1987, domestic water consumption has decreased by 22% to 136 litres per person per day (1998), largely due to intensive water saving and information campaigns, leakage reduction efforts and other campaigns that the Danish water utilities have been organizing for many years. These consumer-oriented campaigns have raised consumer awareness of the fact that water is a scarce resource of vital importance for future generations.

### Sustainability

In Denmark, all costs pertaining to construction, operation and maintenance of water utilities are recuperated through tariffs. It is therefore vital that consumers are well informed and are motivated to pay for the water services.

Water sector sustainability is best ensured by the end user covering the costs of water supply and wastewater disposal. For this reason Danish assistance is mainly directed at water projects founded on the concept that consumers have to cover the full cost of operating and maintaining the water and wastewater utilities.

### Danish assistance:

- Water saving campaigns
- Metering
- Customer service strategies
- Information policy and strategy
- Training and twinning



## RELIABLE SEWERAGE SYSTEMS

The total length of the Danish sewer network is approx. 50,000 km. The older systems in the central part of the towns are typically combined systems (stormwater and wastewater), while separate systems predominate in the newer urban areas.

The Danish sewerage system removes wastewater and stormwater in a manner that safeguards public health, protects the environment from exposure to hazardous substances and ensures the sustainability of organic matter recycling.

### Renovation and maintenance

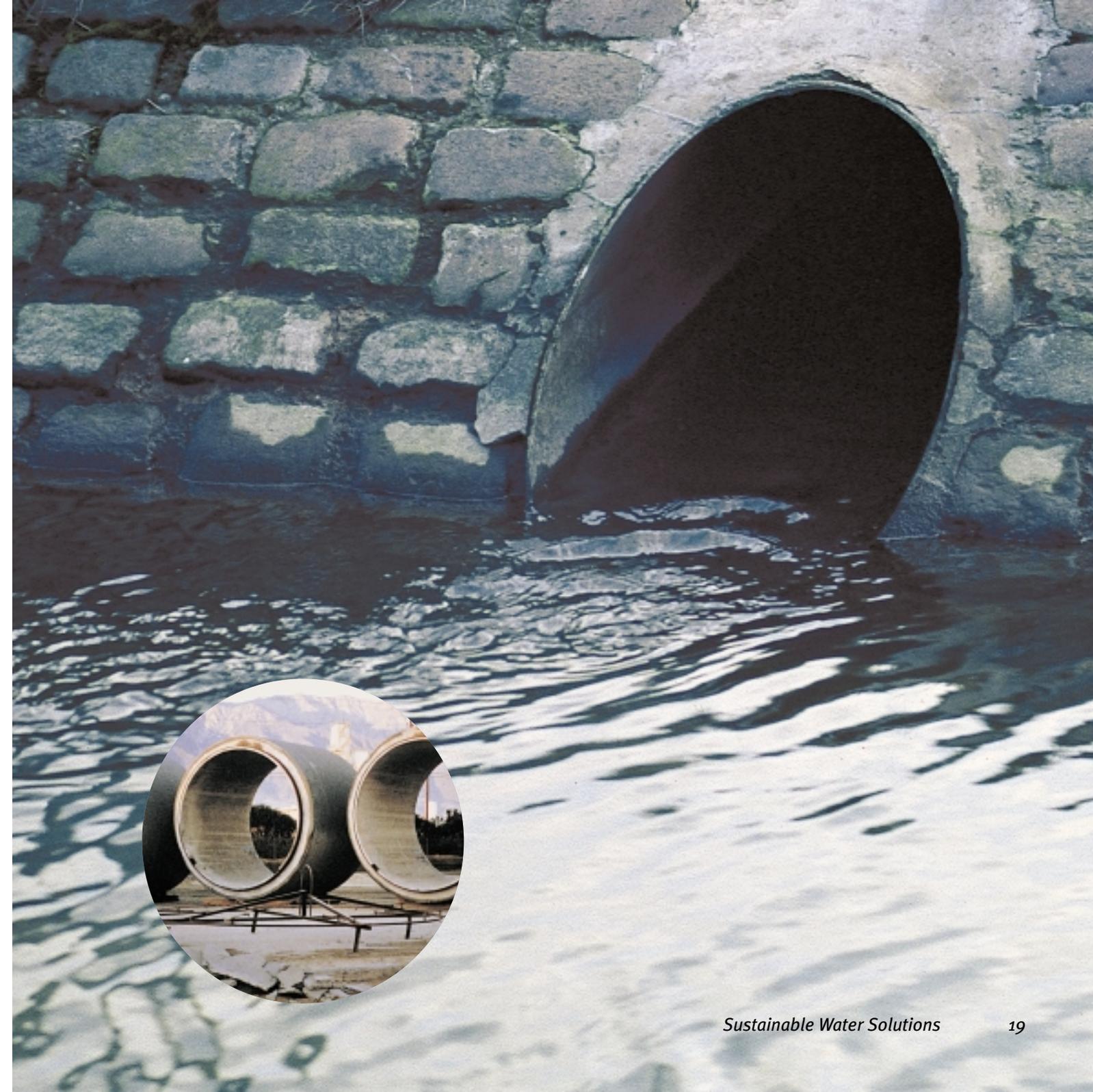
In order to prevent sewer collapse and excessive infiltration/leakage to and from the ageing systems, renovation programmes are being implemented in many municipalities. Sewer renovation will necessitate investments estimated at USD 5 billion over the next 30 years. In order to optimize these major investments, renovation plans have been or are being prepared by the Municipalities on the basis of extensive sewer inspection campaigns encompassing flow and infiltration measurements, TV inspection and computer modelling of the sewer hydraulics.

### Structured management

To minimize the impact of storm-induced overflows on the aquatic environment, holding basins and enclosed overflows have been established in large numbers in recent years and still more are planned. Operation of holding basins, overflows, pumping stations and networks is controlled using supervisory control and data acquisition (SCADA) systems, thus ensuring a high level of sewerage system safety.

### Danish assistance:

- Sewerage planning
- Identification of catchment areas/water abstraction wells
- Network monitoring
- Control, regulation and monitoring using SCADA
- System and energy optimization
- Network registration using GIS
- Renovation (TV inspection, No-Dig, etc.)
- Stormwater overflow (holding basins)
- Working environment
- Operation and maintenance (manuals, etc.)
- Tariffs and tariff plans
- Organizational structure (MIS)
- Local stormwater management
- Tariff policy
- Environmental contingency plans
- Training and twinning



## EFFICIENT WASTEWATER TREATMENT

In Denmark there is a long tradition for treating wastewater before it is discharged to watercourses, lakes or the sea. The 1,500 or so Danish wastewater treatment plants (WWTPs), most of which are publicly owned, have been considerably upgraded over the past two decades. All wastewater in Denmark undergoes some form of treatment before discharge to the recipient waterbody. Moreover, the pollution sensitivity of the waterbody is taken into careful consideration when determining the required treatment level.

### Safe and efficient treatment

The efficiency of the individual WWTPs is subject to routine control, both in-house and by the authorities. In cases of non-compliance with the discharge criteria the supervisory authority takes action. Operation of the WWTPs is continuously monitored, and well-qualified staff ensure correct application of the advanced treatment technologies employed.

At present, 130 WWTPs larger than 15,000 PE and 30 plants larger than 100,000 PE treat more than 90% of all Danish domestic wastewater.

### Up-to-date treatment technologies

Nitrogen is removed using biological methods while phosphorus is removed using biological and/or chemical methods. Most WWTPs are equipped with automatic 24-hour SCADA systems to optimize the processes and reduce energy and other operating costs.

### Danish assistance:

- Wastewater planning
- National monitoring programmes
- Monitoring (inlet and outlet)
- Recipient discharge criteria
- Industrial sewerage requirements
- Operation and maintenance of technical installations using SCADA
- Process control and process optimization
- WWTP start-up
- Resource and energy optimization
- Sludge treatment and management
- Customer relations
- Tariff policy
- Working environment
- Laboratories (in-house control)
- Operation and maintenance manuals
- External environment (neighbour relations)
- Financial management
- Organizational structure
- Management information systems (MIS)
- Environmental management systems
- Environmental contingency plans
- Training and twinning

Data from all WWTPs concerning treatment type and efficiency, outlet concentrations, etc. are collected and analysed by the Danish Environmental Protection Agency.



## AREAS OF SPECIAL COMPETENCE IN THE DANISH PUBLIC SECTOR – SELECTED EXAMPLES

---

No matter which areas of the water sector you wish to develop – water utilities, sewerage systems or wastewater treatment plants – Danish consultancy companies and manufacturers can provide just the solution you need.

In each of these areas the public sector has a very special and important role to play. The following sections provide examples demonstrating the interaction between the private and the public sectors in Denmark.



## RIVER BASIN MANAGEMENT

### Objective:

To provide an adequate supply of pure drinking water and to safeguard the ecological quality of the entire aquatic environment through modern management methods.

### Background:

Pure water is in short supply. A growing understanding exists that water must be protected against contamination and pollution as well as against overexploitation that might upset the water balance in the area.

River basin management (RBM) takes these issues into consideration by focusing on the water cycle and the relationships between the groundwater, the fresh surface water in watercourses and lakes, and the salt water in fjords and marine waters. RBM takes a holistic approach to administering the water resource, focusing on the fact that water is not only a precious commodity, but also a vehicle for pollution.

Recreational and hygiene considerations must be coordinated in order to ensure good water quality in watercourses and lakes and pure, good-quality groundwater for exploitation as a drinking water resource. RBM facilitates this coordination.

The drinking water supply in Denmark is traditionally based on the groundwater. As intensive farming dominates the Danish landscape, the quality of our groundwater and hence of the drinking water has been under increasing pressure for many years. The

consequences of intensive farming have also become obvious in the Danish aquatic environment, parts of which suffer from eutrophication. Danes therefore have a long tradition for coherent administration of the groundwater and surface waters.

In its recently ratified *Water Framework Directive* the EU requires Member States to ensure good water resource ecological quality through the implementation of RBM. Formulation of the Directive was influenced by Danish experience with many years of aquatic environment administration.

### Danish assistance:

- Preparation of RBM strategies and plans
- Implementation of RBM



## ENVIRONMENTAL ADMINISTRATION OF INDUSTRIAL WASTEWATER

### Objective:

Environmental administration of industrial wastewater aims to enhance resource awareness and recycling, to protect sewerage systems, the treatment plants, the personnel operating them and the recipient waters and to ensure compliance with discharge permits. This is primarily achieved through efforts to reduce discharges of heavy metals and other hazardous substances into the sewerage system at the source.

### Background:

Hazardous substances pose a growing problem in the aquatic environment. Industry is a potential source of pollution with heavy metals and xenobiotic substances.

In Denmark, attention regarding pollution of the aquatic environment has shifted in recent years from nutrients and organic matter to hazardous substances. Source-tracing studies reveal that the latter primarily derive from industrial sources.

Under Danish legislation the conditions stipulated in enterprises' discharge permits may be tightened or amended if considered inadequate or inexpedient. Source tracing and regulation thus enable discharges of hazardous substances to the aquatic environment to be reduced to acceptable levels. Infiltration into the sewerage system and sewage sludge are other potential sources of pollution.



### Danish assistance:

- Preparation of discharge permits, including choice of water analysis methods and parameters
- Control, including wastewater sampling
- Enforcement of current legislation
- Sewerage system monitoring
- Source tracing
- Monitoring of the wastewater load from industries, including collection of charges, levies and taxes



## WATER SAVING CAMPAIGNS AND MEASURES

### Objective:

Water saving campaigns and measures are useful means of ensuring sustainable exploitation of the water resource, of increasing the supply capacity in cases where the size and quality of the resource are inadequate, of safeguarding wetlands and of optimizing water utility investments.

### Background:

Since the 1980s, Danish water utilities have carried out numerous water saving campaigns and implemented various other initiatives to reduce water consumption. The result is clear: Water consumption has decreased by more than 20% in Denmark over the past 10 years.

The impetus for these initiatives was the increasing contamination of the groundwater resource and the fact that excessive abstraction in some areas was lowering the water table to the detriment of surface water bodies and wetlands. Efforts were thus needed to protect the water resource and limit consumption. The Danish water sector consequently has considerable and comprehensive experience with water saving campaigns and measures.

A reduction of the water consumption will often represent a more attractive alternative for water utilities than investments in expansion of existing abstraction, production and distribution facilities.

### Danish assistance:

- Information on experience with water saving campaigns and measures
- Evaluation of the water saving potential
- Evaluation of the water saving potential among different consumer categories
- Suggestions for strategies for water saving campaigns and measures
- Suggestions for organization of water saving campaigns and measures
- Preparation of action plans for water saving campaigns and measures



## WATER LOSS MINIMIZATION

### Objective:

To ensure sustainable water abstraction and supply through minimizing water losses at waterworks and from mains networks and through efforts directed at consumers (information campaigns, advisory services, control activities and tariff policies).

### Background:

Minimizing water losses often presents a more attractive alternative for water utilities than investments in expansion of abstraction, production and distribution facilities. In cases where the size and quality of the water resource are inadequate, a reduction in water loss might represent a cost-effective way of increasing supply capacity. Minimizing water losses reduces the need for water abstraction and thus paves the way for sustainable development and safeguards wetlands. The economic advantage to consumers of minimizing domestic water losses are an efficient incentive to have leaky installations repaired, to recirculate water for cooling purposes, for installing water-saving equipment, to optimize the operation of existing installations and to economize on water.

In Denmark, the wastage of water has long been prohibited. In order to reduce wastage, Danish water utilities have improved operational conditions and standards for installations and equipment. The pace of development has increased since the 1980s due to increasing water costs and resource problems. The Danish water sector thus possesses considerable and comprehensive experience in minimizing water wastage and loss by water utilities as well as by consumers.

### Danish assistance:

- Information about experiences with water loss minimization
- Assessment of the possibilities for minimizing water losses at the utility level, including the waterworks and distribution network
- Assessment of the possibilities for minimizing water losses at the consumer level by monitoring of consumption
- Experience with the effects of tariffs and water meters on water consumption
- Suggestions for strategies and organization of water loss minimization efforts
- Education and training in water loss minimization methods



## SUPPLY POLICY/ TARIFF SYSTEMS

### Objective:

The development of a single unified supply policy based on the size and quality of the water resource and the supply security needs of all consumers (amount of water, pressure, quality, etc.). The policy is to be defined in terms of clearly understandable regulations governing the water utilities. A further objective is transparent and operational tariff systems that ensure equitable sharing of the financial burdens between the various consumer groups.

### Background:

Water utilities need to enforce a supply policy defined by the needs of their consumers, the size of their water resource and the capacity of the waterworks while concomitantly complying with local legislation.

The regulations must encompass all conditions pertaining to the supply of water to the consumer, describing in detail consumer rights as well as the obligations of both the utility and the consumer, e.g.:

- Water pressure and supply conditions
- Monitoring of water consumption
- Construction and operation charges
- Consumer obligations
- Common regulations

The Danish water supply is mainly provided by a large number of public and private water utilities, i.e. a decentralized structure of water suppliers with a *de facto* monopoly in the districts they service.

Their economies are based on a self-containment principle, introduced to protect the consumers against any misuse of the monopoly position. The principle does not *per se* encompass cost effectiveness, but the small size of the utilities enables the consumers and the control authorities to ensure that the utilities operate efficiently.

### Danish assistance:

- Preparation of a supply policy
- Preparation of regulations
- Preparation of tariff systems



## CONSUMER SERVICE

### Objective:

To improve communication with consumers/customers, to provide better information concerning the function and operation of the municipal water and wastewater utilities, and to keep the services provided by the water sector in line with consumer needs.

### Background:

In the 1990s, attention started to focus on the level of service provided to consumers by municipal institutions. The continued development of the service society with its emphasis on IT and marked growth in rapid access to comprehensive information and communication raised demands for efficient service by the public sector as well as insight into its work and services.

The public/consumers have become customers demanding increasingly more from the public services that they pay through taxes. With the water sector, Danish water and wastewater utilities have therefore long been endeavouring to improve the services they provide to their customers.

### Danish assistance:

- Information on experience with consumer service
- Information on available service tools, e.g. more efficient telephone service, rapid-service counters, information material adapted to specific consumer groups, homepages, electronic customer service, remote control of meters, CTI (computer telephony integration)
- Assessment of the service tools most suited for specific customer groups
- Assessment of realistic goals for improving consumer services



## OPERATION AND MAINTENANCE MANUALS

### Objective:

To ensure optimal operational economy and quality through efficient operation and maintenance.

### Background:

In Denmark there is a long tradition for maintaining and optimizing the operation of "old" waterworks. Many well-functioning waterworks have thus been in operation for more than 100 years. Like any new waterworks, these are closely monitored as regards operational economy and quality. Increasing manpower reductions and associated automation contribute to Denmark's extensive experience with optimal operation and maintenance procedures.

Sound operation and maintenance of the waterworks are vital to ensure operational economy and quality. Even a new and well-planned waterplant requires constant monitoring, optimization and maintenance right from the moment it enters into service. Although the scope and methods may differ considerably, a long series of minimal demands generally have to be met.

In line with the development of technology enabling waterworks to operate virtually unmanned, demands are steadily increasing for supply efficiency, quality, control, documentation, cleaner technology and optimized operation. Consumers demand, and rightly so, a continuous supply of the purest and best possible products. Routine control by the engineer and his "nose" for what is right are being replaced by sensors, monitors and "intelligent" SRO systems.

Moreover, operational control has shifted from the plant as such to the desktop computer in an office somewhere. The demands for computer-based tools are constantly changing and programs often become obsolete soon after being introduced.

The prerequisite for optimal operation nevertheless remains comprehensive and efficient registration of the technical facilities and their conditions of operation. In principle, this information could be recorded on paper filed in a binder. However, even the smallest waterworks are best advised to supplement paper registration with electronic registration.

It is important to remember, though, that even the best SRO system only functions if the specifications are unambiguously defined. It is thus important to produce clearly understandable reports containing all key information. For example, energy use per cubic metre of water produced should be measured and controlled at as many steps as possible throughout the entire process.

### Danish assistance:

- Preparation of operation and maintenance manuals
- Implementation of optimal operation and maintenance procedures
- Evaluation of operational plants



## FURTHER INFORMATION ABOUT KNOWLEDGE AVAILABLE FOR USE ABROAD CAN BE OBTAINED ON THE FOLLOWING WEBSITES:

### www-Links

Danish Association of Sewage Works .....	www.danasdk.dk
Danish Environmental Protection Agency .....	www.mst.dk
Danish Water Services Ltd. ....	www.danwater.dk
Danish Water Supply Association .....	www.dvf.dk
Environment and Resources DTU .....	www.er.dtu.dk
Geological Survey of Denmark and Greenland .....	www.geus.dk
Green City Denmark .....	www.greencity.dk
International Water Association .....	www.iwahq.org.uk
Ministry of Environment and Energy .....	www.mem.dk
Ministry of Foreign Affairs .....	www.um.dk
– Danida .....	www.um.dk/danida
National Environmental Research Institute .....	www.dmu.dk
The Association of County Councils in Denmark .....	www.arf.dk
The Confederation of Danish Industries .....	www.di.dk
The Danish Council of Consulting Architects and Engineers .....	www.par-fri.dk
The Joint Organization of Private Water Works in Denmark .....	www.fvd.dk
The National Association of Local Authorities in Denmark .....	www.kl.dk
Water Resources, Denmark .....	www.groundwater.dk

## DATA SHEET

### Publisher:

Ministry of Environment and Energy,  
Danish Environmental Protection Agency,  
Strandgade 29, DK-1401 Copenhagen K  
Telephone int (+ 45) 32660100  
Telefax int (+ 45) 32660479  
Internet <http://www.mst.dk>

**Year of publication:** 1st issue 2001

### Title:

The Danish Model for Sustainable Water Solutions

### Subtitle:

Transferring know-how and expertise from Denmark  
to international water projects

### Performing organizations:

Danish Environmental Protection Agency, with support from the Danish Agency for Trade and Industry, Dahlerups Pakhus, 17 Langelinie Allé, DK-2100 Copenhagen Ø, Telephone int. (+45) 35 46 60 00, Telefax int. (+45) 35 46 60 01

### Abstract:

Description of the Danish spheres of excellence within the water sector

### Terms:

environmental export; public and private partnership; capacity building drinking water; waste water

**Supplementary notes:** Is part of the same series as: "The Danish Model for Sustainable Waste Solutions" (Danish Environmental Protection Agency, 2001) and "Guidelines for Public-Private Co-operation on Project Export" (Danish Environmental Protection Agency, 2001)

**Edition closed (month/year):** oktober 2001

**Number of pages:** 40

**Number of copies:** 5000

**ISBN:** 87-7944-858-5

**Printed by:** Phønix-Trykkeriet A/S

ISO 14001 certified og EMAS-registered  
This publication bears the Nordic Swan Ecolabel  
100% recycled paper – Cyclus

**Layout:** Julie Thesander Wedderkopp

**Photos:** Bent Lauge Madsen, Rambøll, BAM (Gunnar Smoliansky, Lars Bahl, Klaus Holsting)

### Available from:

Miljøbutikken, Books and Information,  
1-3, Læderstræde, 1201 København K  
Phone (+45) 33954000 Fax +45 33927690  
[butik@mem.dk](mailto:butik@mem.dk)

Reproduction is authorized provided the source is acknowledged



Published by the Danish  
Environmental Protection Agency,  
with support from the Danish  
Agency for Trade and Industry  
Scheme on Development of  
Public/Private Cooperation

Available free of charge from:  
Information and Books  
1-3, Læderstræde  
DK-1201 Copenhagen K  
Tlf: (+45) 33 95 40 00  
butik@mem.dk  
www.mem.dk/butik



**Danish Environmental Protection Agency**

Danish Ministry of Environment and Energy