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List of acronyms and abbreviations

AOX = Absorbable organic halogen compounds

BBR = Bolig og Bygnings-Registeret (Danish Building and Dwelling Register)

BNDE = Banque Nationale de données sur l'eau (French national database on water)

BOD = Biological oxygen demand (mass concentration of dissolved oxygen consumed under specific conditions by the biological oxidisation of organic and/or inorganic matter in water)

CBS = Centraal Bureau voor de Statistiek (Statistics Netherlands)

COD = Chemical oxygen demand (mass concentration of oxygen consumed under specific conditions by the chemical oxidisation with bichromate of organic and/or inorganic matter in water)

CSO = Central Statistics Office (Ireland)

EEA = European Environment Agency

EPA = Environmental Protection Agency

ESA = European System of Accounts

ESRI = The Economic and Social Research Institute (Ireland)

ETC/IW = European Topic Centre/Inland waters[1]

GEUS = Danmarks og Grønlands Geologiske Undersøgelse (Danish Geological Survey)

GVA = Gross Value Added

Ifen = Institut Français de l'Environnement (French Institute for the Environment)

IHERA = Instituto de Hidraúlica, Engenharia Rural e Ambiente (Portuguese Institute of Hydraulic and Rural Engineering and the Environment)

INE = Instituto Nacional de Estatística (Portugal)

INE = Intituto Nacional de Estadística (Spain)

INAG = Instituto da Água (Portuguese Water Institute)

IPC = Integrated Pollution Control (license system used in Ireland)

IWWTP = Industrial wastewater treatment plant

MWWTP = Municipal wastewater treatment plant

NAMEA = National Accounting Matrix including Environmental Accounts

OIEau = Office International de l'Eau (French international office for water)

ONS = Office for National Statistics (United Kingdom)

OSPAR = Oslo and Paris conventions for the protection of the marine environment of the North-East Atlantic

PARCOM = Paris Commission

RNB = Réseau National de Bassin (French National Network on catchment areas)

SERIEE = Système Européen de Rassemblement d'Information Économique sur l'Environnement (European System for the Collection of Economic Information on the Environment)

SNA = System of National Accounts

STP = Sewage treatment plant

STW = Sewage treatment work

TOC = Total Organic Carbon

UGR = Umweltökonomische Gesamtrechnungen (German integrated environmental and economic accounts)

VAV = Svenska vatten-och avloppverkföreningen (Swedish Water and Wastewater Association)

[1] This Topic Centre has recently merged with Marine Topic Centre to become ETC/WTR = European Topic Centre on water.

Preface

This publication summarises the numerical results and methodological findings of pilot water accounts in 15 European countries. Water accounts focus on physical flows of water in to and out of the economy: abstraction and use of water by industries and households, emissions to water by different actors; as well as the costs of water supply and wastewater treatment.

These pilot accounts generated results for many countries, showed the applicability of the Eurostat water accounts framework in practice and explored the accounting methods and data sources available. This publication will be a valuable source of inspiration for compilers of water accounts. Water policy-makers should also get an insight into what is and could in future be possible with such accounts.

This publication is one of the outputs of Eurostat's Environmental Accounting work. It contributes to various EU-wide and international activities in the context of national accounts and environmental accounting, including the implementation of the European System of Accounts (ESA 1995) and the new world-wide System of Integrated Environmental and Economic Accounting (SEEA). The publication was prepared by Mrs Christine Spanneut and Mr Gerard Gié of Planistat Europe and Mr Anton Steurer of Eurostat B1.

The pilot applications benefited from financial support provided by the European Commission's Directorate General for the Environment, in the context of the Communication from the Commission to the Council and the European Parliament on Directions for the EU on Environmental Indicators and Green National Accounting - The Integration of Environmental and Economic Information Systems (COM(94) 670).

The development of the water accounting framework was only possible due to the essential contributions made by the members of the Eurostat Water Accounts Task Force. Special thanks are therefore due to the members of the Water Accounts Task Force.

The Task Force met several times to develop the water accounts framework including a first set of pilot water accounts tables for testing in pilot applications, to discuss the results of the pilot studies and, in 2002, to agree on a revised standard set of water accounts tables (presented in Annex 2 of this publication).

The water accounts presently focus on the monetary and physical description of water-related economic activities and the direct impacts of the economy in terms of water abstraction and emissions to water. The development of a wider framework that also describes water in nature is a longer-term objective.

The main conclusions from the pilot applications are the following:

- The water accounting framework is adequate and useful for analysis and derivation of indicators.
- There are many usable data sources in countries, in particular economic data on water management and physical data describing the flows of water within the economy and between economy and environment, but systems to collect/centralise these data are not always in place.
- Setting up such systems will need to take account of various factors such as the organisation of water control (centralised/decentralised), of water management (public/private), the existence of taxation on water abstraction and/or water pollution, the dependency on other regions or other countries for water resources, and the nature and importance of the concerns about water.
- Data on the emission of pollutants to water by the economic activities are less complete and of lower quality. This situation should improve in future through the implementation of the European Water Framework Directive, of the Integrated Pollution Control registers, etc.
- The results show that it is possible to regionalise part of the water accounts.
- A major future extension is the development of water quality accounts for surface water bodies.

The work on water accounting is continuing at Eurostat together with the Water Accounts Task Force. Work is focusing on further methodological development and on collecting data more regularly from more Member States.

Brian Newson
Head of Unit B1
National accounts methodology,
statistics of own resources

Introduction

European concerns about water

Water is a vital resource for the economy and society. It is used to produce drinking water, food, energy and other products. It is used for transportation and amenity. It plays a key role in the preservation and protection of eco-systems. European water bodies are subject to three major threats:

- **quantitative depletion** of water resources of good quality (like groundwater);
- **qualitative degradation through pollution** of water resources as a result of direct discharges into water (through wastewater) or indirectly through pollution of the air or the soil (acid rain, fertiliser, etc.);
- **de-structuring of aquatic ecosystems** through conversion of surface waters, river regulation for transportation purposes, land recovery, production of electricity, etc.

European water resources are extremely diverse and variable in space and time in terms of water availability and water demand. These diverse conditions and needs should be taken into account in the planning and execution of measures to ensure protection and sustainable use of water. While problems of water availability are concentrated in some regions, water pollution is a major issue all over Europe.

The EU is therefore establishing a series of measures in order to address these problems: quality controls, setting of norms, information for the public, etc., and economic measures such as water pricing, abstraction and pollution taxes, etc.

Water was one of the seven major themes selected in the fifth environment action programme[2] of the European Commission. "*Ensuring the sustainable use and high quality of our water resources*" is also one of the objectives in the sixth environment action programme[3].

In particular, the European Union adopted a Water Framework Directive[4] (WFD) which expands water protection to all water bodies and aims at achieving good status for those waters. The WFD encourages the Member States to use pricing for water-related services as an effective tool for promoting water conservation. It recommends environmental costs of water to be reflected in the price of water. Implementation of the WFD will lead to further improvements in the quality of surface water and groundwater bodies in Europe.

Recognising that water management and water quality must respond to local conditions and needs, the WFD emphasises the need for actors at different levels to take up their responsibilities. The measures needed to improve the efficiency of water use and to encourage, for example, changes in agricultural practices should be implemented at different levels of decision: local, national or supranational, depending first on the area concerned by the problem (from a Southern region which lacks water resources in summer to the drainage basin of the Rhine, which involves nine European countries) and secondly on the sharing of competence across administrative divisions.

Water is an indispensable element to life. The majority of human activities depend on the existence of water resources, and for some of them, on water of good ecological quality. The interplay between the economy and the environment is particularly strong in the water domain. Economic activities can radically change the natural state of water as well as its distribution. If water is lacking or is so degraded that usable water becomes too costly, the structure of economic activities may have to be modified and even lead to the geographical displacement of people. This extreme dependence on water makes it a difficult element to deal with. Arbitration between various political objectives is necessary; the environmental water policy is not independent of economic and social policies.

The fifth environmental action programme particularly stressed the need to implement the polluter-pays principle. This objective requires studying the water use and the pollution flows; the costs to be taken into account (costs of purification for obtaining drinking water, wastewater treatment costs, environment restoration costs, etc.) and the pricing methods that could be adopted for water use (installation of meters,

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2 OJ C 138 of 17 May 1993

3 Decision 1600/2002/EC of 22 July 2002 published in OJ L 241 of 10 September 2002

4 Directive 2000/60/EC of 23 October 2000

multiple prices, etc.). The recent Communication from the Commission 'Pricing policies for enhancing the sustainability of water resources'[5] addresses such issues.

The sixth environment action programme stresses that the integration of the environment into the economic and social policies that influence the pressures on the environment should be improved. It also stresses the importance of measuring progress through indicators and benchmarking.

The contribution of water satellite accounts

The integration of economic and environment data within a single framework makes it possible to show the interplay between the economy and the environment and helps in identifying appropriate measures. This integration can be carried out through a satellite account to the National Accounts that is dedicated to water. Such a satellite system can:

1) show the present management of water, i.e.:
   - identify all actual costs for the abstraction, treatment and distribution of water including water abstracted by enterprises and households for their own use; for collection and treatment of wastewater; for the regulation of water flows in rivers; for in situ de-pollution of surface waters, etc.,
   - examine the corresponding financing system, notably the breakdown between individual and collective expenses,
2) with a view to applying the polluter-pays principle, produce information in physical units on the pressures exerted on water by the different economic activities (quantities abstracted and used, emissions to water),
3) describe the state of the water bodies reached with this management.

National accounts and forecasting models based on national accounts can bring valuable support to these kinds of studies. Although some water problems are very local, general economic responses are often necessary. Simulation models fed with data from the national accounts can inform the definition of policy instruments as well as mediation between different policy objectives. Such models allow studying the positive and negative impacts of planned policy measures including the environmental effects of these measures, and the effects on prices of goods and services and on competitiveness, growth, employment, etc.

The national accounts framework as set out in the European System of Accounts (ESA 1995)[6], describing the economic sphere, can be used as the starting point. This system can be expanded as follows:

- the level of disaggregation should be adjusted to clarify all questions relating to water management,
- a more complete description of water as a natural resource should be added. Water does not have an economic origin; in its natural form, it is rarely traded on the market and, therefore, it only appears sporadically in the ESA as a natural resource,
- extend the system to include physical data on the flows and stocks of water and on emissions to water to allow studying the pressures and consequences of economic activities on the water environment.

Some of these data in physical units are already being collected and the water satellite accounts can be based on these existing sources, notably data collected in the framework of the joint OECD/Eurostat questionnaire on inland waters. Environment statistics on water are not always compatible with the ESA. In order to provide data integrated under a single framework of economic accounting on the environment, the primary data need to be treated and re-arranged so as to make economic and environmental data consistent with one another.

The availability of adequate data sources is a precondition for compiling such integrated accounts. Most of the data are available in countries but not necessarily in the required format. This is why Eurostat, supported by the Directorate General for the Environment, has organised a series of pilot studies in order to determine which data sets are feasible and at which cost.

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5 COM(2000) 477 final

6 Council Regulation 2223/96 on the European system for national and regional accounts in the Community

Work carried out under the aegis of Eurostat

In response to requests by European Commission users of statistics, Eurostat developed the water accounts in three steps: 1) develop a framework with harmonised definitions and concepts, 2) organise practical testing of this framework, and 3) analyse the results of the test phase before proposing the implementation of a harmonised European system of water accounts.

A Task Force with interested Member States was established to carry out step 1. It met three times in 1996 and 1997. Its first meeting essentially intended to take stock of ongoing work, to decide upon the future directions and to discuss the usefulness of producing *national* and *yearly* accounts while some concerns are local and periodic.

During the second meeting, the participants decided to fix two objectives for the water satellite accounts:

- Objective 1: to rapidly develop a monetary and physical description of the water economy and to extend it to direct interactions between economy and water in nature. A NAMEA-type framework was adopted for this description. (NAMEA stands for National Accounting Matrix including Environmental Accounts.)
- Objective 2: to continue reflecting on the development of a more general framework including a description of water in nature and of indirect impacts of economic activities. The French model of description of water in nature was adopted as a basis for reflection.

At the third meeting, a set of 13 pilot water accounts tables developed on the basis of a priority order and of assumed data availability was adopted to fulfil objective 1. The tables were organised into three groups:

- Monetary tables corresponding to the ESA, but with the extra detail necessary to understand the economic transactions linked to water supply and use (output, costs, specific taxes, etc.)
- Physical description of the water flows within the economy (supply and use of water, wastewater collected) and between economy and the environment (abstraction of water from the environment and returns of wastewater to it).
- Description of the flows of pollutants associated with these water flows in order to capture the direct emissions of pollutants by economic activities.

In the pilot water accounts tables (see Annex 1), the breakdown of water bodies by categories (lakes, rivers, aquifers, etc.) and by quality classes (only introduced for the abstraction of water for drinking purposes) was viewed as provisional. The tables were also viewed as flexible as regards the level of detail suggested.

Introducing time and space issues into the accounts was discussed, as well as different ‘economically available water’ concepts and water quality measurement, but not adopted.

The next step was the practical testing of the 13 pilot water accounts tables. 14 Member States plus Norway carried out pilot exercises on the basis of existing statistics.

The Task Force met again in 1999 to review the first results of the pilot exercises. The general conclusion was that the NAMEA-type approach was successful in combining different data sources in order to produce data sets that are useful for analysis and for deriving indicators. As more results of tests became available, a workshop was organised in Luxembourg in June 2001 during which the participants in the pilot exercises shared their experience. In April 2002, the Task Force met again to draw the conclusions from the pilot exercises and to revise and finalise the set of water accounts tables (presented in Annex 2).

Outline of the publication

It has not been easy to organise the presentation of the results because of the diversity of the pilot applications: some countries tried to fill in the whole set of 13 tables, others concentrated on a certain kind of information, e.g. on the identification of the quantities of water involved in each economic activity, others focused on the quality of the data, compared different sources, etc.

The selection of the results themselves was not easy either: more than 800 pages of reports had to be condensed. The focus has been on sources and methods, since the national results, in terms of indicators useful for European water policy, will only be entirely relevant when they are comparable and consolidated. Some of the numerical results, however, are reproduced for illustration.

The outline finally retained is as follows:

Chapter 1 explains the context in which these pilot studies have been carried out: the concerns about water in Europe, the links with economic activities, the objectives that satellite accounts on water should achieve in order to supply information in support of decision-making. The present state of available economic and environmental information is analysed. Chapter 1 concludes by summarising what each country, within this general framework, has tested as its contribution to the water accounts pilot exercise.

Chapters 2 and 3 form the core of the document, presenting the diverse experiences. Both chapters are organised by 'themes', which more or less correspond to the groups of the tables that were tested.

The first theme examines the **'water economy'** and describes, in monetary terms, the economic activities related to water. The second concerns the **'volumes of water and wastewater flows'**. The third theme reviews the **'flows of pollutants'** associated to these water flows. Water flows in nature, however, are not studied.

For each of these three themes, **Chapter 2** reviews, for each country participating to a theme, the objectives of its pilot exercise, the data sources used and the methods applied to achieve its goal. Countries are grouped according to the similarities in their approach: for instance, the use of certain data sources such as administrative data, specific surveys, etc.

Chapter 3 analyses how successful the pilot exercises have been, reporting some of the results, showing their limits, raising questions of data reliability and international comparability. Ways of disseminating results initiated by countries are also presented: synthetic indicators, graphic analyses, etc.

Chapter 4 summarises issues not specifically covered by the set of tables tested or which appeared as a new issue for development as a result of the pilot exercises: time and space dimensions, water quality and quantity accounts, water availability.

Chapter 5 summarises the lessons learnt from the whole exercise: workability of the set of water accounts tables tested, changes necessary, topics on which a supplementary investigation is needed, etc.

The **Annexes** include the initial set of pilot water accounts tables that was tested in the pilot exercises (Annex 1) and the revised standard set of water accounts tables with explanatory notes (Annex 2).

1 The Water Accounts framework

1.1 Concepts

1.1.1 Specific characteristics of water

At first sight, water could be perceived as a resource like other natural resources such as mineral deposits or forests. But because of its elusive nature, in accounting, water cannot be dealt with in the same way as other resources: water travels by itself, beyond human control. Monitoring of quality, time and location is more crucial than is the case with other resources. Water accounts encounter some of the most fundamental problems of environmental accounting.

- Water (like forest) is both an ecosystem and a natural resource and is used by man in both its aspects. As an ecosystem, it is used as a biotope for fish, algae, etc., as a structure for transportation (maritime and river navigation), for recreation (swimming, water sports, fishing, etc.) and as a dump for liquid waste. As a raw material water is used in practically all agricultural, industrial and service activities and by households (drinking, washing, etc.). It is also an energetic resource (hydroelectricity generation) and used for cooling.
- Water (like air) is a mobile element with a cyclical course. The water cycle raises the problem of an economic definition of water as a resource: should all forms in which it exists in nature, including vapour and ice, be included in the resource description? In practice, man only withdraws water from its natural environment in liquid forms, naturally or artificially structured: watercourses, underground reserves (aquifers) or surface waters (lakes, basins). It is the state of these structured forms which is the subject of environmental concern, but these structures are themselves fed by unstructured forms such as rain and snow which are also important for the economy (agriculture). The availability of water resources depends on the rate of renewal of their structured forms. The description of water resources at a given point in time (statistics in terms of stocks) provides little information. The rate of renewal of resources can itself constitute an environmental problem: excess flows against which preventive measures must be taken (rising waters, floods, tidal waves, etc.), or shortages that have to be remedied (seasonal, temporary or definitive drought).
- Water exchanges matter and energy with the air, the soil and the subsoil. The same water circulates from a river's source to its mouth and takes on or discharges pollutants along its way. Water can take in toxic elements when passing through the air (rain), the ground (drainage), or the subsoil (infiltration). Inversely, it can deposit these same toxic elements (sedimentation, natural filtration). Water quality is influenced by emissions to water as well as by natural factors.
- Several successive economic uses are possible: polluted water, unfit for drinking, may still be used for irrigation or as an energy source, according to its state and location. Several successive uses within a single enterprise are also possible: recycling, use within a closed circuit cooling system, etc. This last characteristic of water is due to the fact that only a minor portion of the water actually disappears in the production or consumption processes. It is particularly significant for water accounts that ‘use’ does not mean definitive physical disappearance of water. The major portion remains available for use further along, although its quality may undergo change.
- Contrary to other natural resources, water is inexhaustible on a planetary scale. Its geographic distribution as well as its breakdown into different forms (vapour, rain, fresh water, salt water, ice, snow, etc.) may evolve. These forms are distributed unequally, oceans constituting 96% of the planet's water.

1.1.2 The economics of water

Contrary to other natural resources such as forest or mineral deposits, water in its natural environment is rarely considered to be an economic asset. Natural water as such is rarely owned, but rather the right to use it or the services it provides. In most countries ownership rights on water resources are not enforced, neither by individual units nor by government. When the water leaves the owned property the ownership rights cease. In some countries the water supply system is privatised but this does not necessarily mean that ownership rights to water resources are assigned to the corresponding economic units.

A part of the water resources is under the effective control of economic units: regulation of water bodies, storage of water in reservoirs are examples of this control. However most of the water is rather uncontrollable: it comes and goes as it pleases (precipitation, evapotranspiration) and floods and droughts

show that total control by economic units is not effective. This can partly be redressed by change of land use and additional regulation of water bodies (drainage, extending the capacity of reservoirs, deliberate influence on evapotranspiration from agricultural land). In effect, it is possible, to a certain degree, to 'control' water. These activities of regulating 'natural' water flows should be included in the economic part of water satellite accounts.

In fact, with the exception of mineral water resources (springs, wells), a natural water resource is rarely an asset that can be exchanged on the market. Prior to abstraction and 'processing', water in nature rarely has an explicit market price, and it has been considered that natural water can be used without limit or discernment. The results may be:

- an over-exploitation of the aquifers in certain regions,
- an excessive discharge of pollutants into surface waters,
- a creation of unstable artificial ecosystems (deviated watercourses, dried-out marshes, etc.)

The monetary consequences of this water management could be partly obtained from the national accounts (directly or indirectly), if the following costs were isolated:

- increased purification for the purpose of obtaining drinking water and increased de-pollution work on fishing rivers and lakes, on frequented beaches, etc.,
- new construction for water transportation (or, on the contrary, for draining it),
- repairs for damage caused by 'natural' disasters (floods).

On the other hand, as for the environment in general, the accounts will not directly reveal the symptoms of unsustainable development such as:

- displacement of population or economic activities due to desertification of a certain region (except in regional accounts),
- deterioration of water quality when purification efforts do not suffice to restore or maintain its original quality,
- inability of the land to fulfil its future economic role because of present day over-exploitation of water resources.

National accounts, if they are to answer the sustainability issue must be expanded to include physical measurement of the pressures on, and the state of, water and try to link this measurement with the pressure exerted on water resources by economic activities.

If it is then apparent that decisions are indispensable for the preservation and repair of the environment, the accounts could be used to test the political measures to be taken, prepare forecasts and observe the results. For that, it suffices that the interplay between economic activities and the pressures exerted by these activities on the environment be known, the underlying hypothesis being that the state of the environment is the result of the pressures exerted upon it.

Due to insufficient knowledge about all the factors that influence the quality of water in nature, the water accounts will probably have to be limited to measuring the pressures constituted by the withdrawals and the direct discharges of pollutants by economic agents and omit the effects of exchanges between water, air, soil and subsoil and the self-cleaning achieved by nature. These latter effects could be taken into consideration with physical models.

For the national accounts to fulfil the role described above, they must be disaggregated, reformatted and supplemented by new data (in particular physical ones). Such a process constitutes the drawing of a satellite account. To begin with, the following paragraphs examine how water is recorded in the conventional national accounts, starting with an important feature of water from an accounting point of view: the dual nature of water. Water is at the same time an asset, i.e. a structured form, and a natural resource, i.e. a raw material.

1.1.3 Water resources as an asset

In this case, the interest is in the structured forms of water resources (water bodies): rivers, lakes, marshes, aquifers, glaciers, reservoirs, etc. The relevant aspect is the structure through which the water flows or that it fills. Such water resources have a water storage (lakes, underground aquifers) and/or a water delivering capacity (springs, rivers). With the exception of groundwater aquifers they also have the character of eco-systems.

In most countries ownership rights on water resources are not enforced, either by individual units, or by communities. In general these natural structured forms of water resources (rivers, lakes, etc.) cannot be sold separately from the land that supports them, although the right to use them or the services they provide may in some instances be recognised as a separate (intangible) asset. Of course the existence of water can influence the value of land, positively or negatively: its presence or its proximity can raise the value of land when it allows irrigation or offers specific services including landscape quality or, on the contrary, lower it as in the case of marshland. However the market does generally not make this 'economic value' directly visible since it is 'embodied' in the value of the land.

Thus, in practice, the natural structured forms of water resources are not separately recorded in the monetary balance sheets of the national accounts except for "aquifers and other groundwater resources to the extent that their scarcity leads to the enforcement of ownership and/or use rights, market valuation and some measure of economic control" (ESA 1995 definition of Water resources (AN.214), ESA Annex 7.1,). This is in particular the case of mineral water resources (springs or wells) that can be exchanged on the market.

Besides these natural structured forms of water resources, which are "non-produced", numerous forms of produced structured forms of water resources exist: reservoirs, artificial lakes, channels for navigation, etc. As these structures are man-made they receive a value in national accounts balance sheets. A specific case corresponds to the structures for controlling the flows of water: e.g. dams and dykes for flood control, terracing to slow the water runoff and erosion etc. According to national accounts conventions, these structures, qualified as "improvement to land' are included in the value of land.

Therefore, whereas the system of national accounts provides the accounting framework for recording assets and changes in assets, these will only be explicitly recorded for man-made structured forms of water, and possibly land. The changes in quality of water resources as an asset will only be recorded as a change in the value of land: the drying up of a spring or a river, the degradation of a water body in its capacity as eco-system (fishing, bathing, etc.) will be reflected in the value of land. Whereas environmental accounts are interested in the (changes in) quality and quantity of water it will be difficult to link these accounts with the balance sheets of national accounts.

In the European System of Accounts (ESA), the economic territory of a country includes 'the territorial waters[7] and the continental shelf located in international waters, on which the country disposes of exclusive rights'. Thus, the open seas that are outside these limits are excluded from the economic territory. Environmental concerns involving oceans (reduction of fish catch or of the variety of flora and fauna, discharges into the sea, etc.) are difficult to record in a 'national' accounting framework except for economic exploitation (fishing, tourism) or discharges in coastal areas. Water accounts will in practice often deal solely with inland waters. Moreover, whereas an ecological definition of inland water would include the water of watercourses, of lakes, ponds, glaciers, and of aquifers to which would be added the water contained in the soil and vegetation cover as well as that contained in the atmosphere, only water from watercourses and surface or underground reserves has an economic use.

Asset classification

The assets considered in the ESA are economic assets[8], i.e. they must be owned (individually or collectively) and being capable of providing an economic benefit. Ocean water is generally not owned and therefore does not constitute an economic asset. Only aquifers and other groundwater reserves, to which such qualifications may be assigned, constitute a non-produced, non-financial asset (Asset AN 214: water resources).

Surface water is not distinguished from the land on which it is located (AN 211 and its subdivisions).

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7 The sea within 12 nautical miles from the low water mark or other point on the coastline.

8 In the asset classification of the System of Integrated Environmental and Economic Accounting (SEEA 2000), water – accounted for in physical terms – is classified separately and measured in m^3, in addition to being accounted for as water-covered land (measured in km^2). It is further subdivided into:

EA.13 Water resources
- EA.131 Surface waters
  - EA.1311 Reservoirs
  - EA.1312 Lakes
  - EA.1313 Rivers
- EA.132 Groundwater

1.1.4 Water as a raw material and a product

As a raw material water has no explicit price prior to abstraction and 'processing' although in an increasing number of countries taxes on the abstraction of water are put in place, which influence the market price of distributed water. The price of water on the market is the price of a product: 'distributed water'. National accounts record the value of distributed water, and the costs involved in providing the water – abstraction, purification and distribution. Government units (local, regional or national) often provide these services. Subsidies may be involved e.g. due to the social acknowledgement of the right to water access for all people or political objectives as concerns agriculture.

On the other side, many economic agents withdraw water directly from the natural environment (electric power plants, farmers, etc.) and face very variable costs. In addition to differences concerning costs, these direct users may also, in certain cases, penalise other users since the water will require re-treatment further along the chain. This abstraction for own use is only recorded in national accounts when for own final use (final consumption)[9]. Direct abstraction and purification for productive uses is considered as an ancillary activity whose output and costs are not isolated.

Water in ESA classifications

Classifications of activities (NACE) and products (CPA)
The set of water accounts tables that was tested in the pilot applications used the standard statistical classifications in force in the EU. The *statistical classification of economic activities in the European Community* (NACE Rev. 1) at its subsections level and the *statistical classification of products by activity in the European Economic Community* (CPA 1996) were used with some extra detail as regards activities related to water. In the tables, an asterisk marks codes that did not exactly match NACE and CPA definitions. Important categories of NACE and the corresponding categories of CPA are summarised below.

It should be noted that NACE Rev. 1 and CPA 1996 will be replaced by the new NACE Rev. 1.1 and CPA 2002[10] from 1 January 2003. In case of differences between the new and earlier classifications, references to both versions are made.

NACE class 41.00 - Collection, purification and distribution of water. The products corresponding to this activity are CPA 41.00.1 - Distributed water[11] - with a further subdivision into drinking water (CPA 41.00.11) and non-drinking water (CPA 41.00.12) – and CPA 41.00.20 - Distribution services of water, including notably reading and maintenance of meters. NACE 41 includes desalting of seawater to produce water as the principal product of interest. NACE 41 excludes the operation of irrigation systems for agricultural purposes (classified in NACE 01.41 - Agricultural service activities; landscape gardening) and the treatment of wastewater solely in order to prevent pollution (classified in NACE 90 – Sewage and refuse collection).

NACE class 90.00 - Sewage and refuse disposal services, sanitation and similar services. The products 'Sewage removal and treatment services' (CPA 90.00.11) and 'Treatment services of cesspools and septic tanks' (CPA 90.00.12) are classified under NACE 90. Class 90.00 of the NACE Rev. 1 includes also activities that produce e.g. refuse disposal services. The new NACE Rev. 1.1 provides more detail (see also Annex 2). New *class 90.01 - Collection and treatment of sewage* includes:

- collecting and transporting of human wastewater from one or several users, as well as rain water by means of sewerage networks, collectors, tanks and other means of transport (sewage vehicles etc.) and their treatment and disposal
- treatment of wastewater by means of physical, chemical and biological processes like dilution, screening, filtering, sedimentation, etc.
- maintenance and cleaning of sewers and drains
- emptying and cleaning of cesspools and septic tanks, sinks and pits from sewage, servicing of chemical toilets
- treatment of wastewater from swimming pools and from industry

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[9] The ESA does not include water in the list of products for which own account output for own final use should be measured.

[10] Commission Regulation (EC) 29/2002 of 19 December 2001 amending Council Regulation 3037/90 on the statistical classification of economic activities in the European Community and Commission Regulation (EC) 204/2002 of 19 December 2001 amending Council Regulation 3696/93 on the statistical classification of products by activity (CPA) in the European Economic Community.

[11] In the official English CPA terminology, the product of this activity is called 'natural water' The wording 'distributed water', like in the French version of the CPA, is used here in order to avoid a possible confusion with water in nature.

NACE class 01.41* - operation of irrigation systems. The operation of irrigation systems is part of NACE class 01.41 – Agricultural service activities; landscape gardening and the corresponding product is part of CPA 01.41.11 - Services incidental to agricultural production. These irrigation systems are supposed to be a specific provision of water to farmers, especially through a network of open air canals the feeding and allocation of which is managed.

NACE class 75.12* - public administration for water. Water-related public administration is part of NACE class 75.12 - Regulation of the activities of agencies that provide health care, education, cultural services and other social services, excluding social security. The corresponding product is part of CPA 75.12.13 - Administrative housing and community amenity services. This product supplied by government includes: "services provided by offices, bureaux, departments and programme units engaged in developing and administering regulations concerning *water supply*; public administrative services related to (…) *sewage system operation."*

Mineral waters come under CPA 15.98.11 and are not included in the list of water-related economic products followed through the water accounts. However, the corresponding abstraction of water will be considered as an ancillary activity by beverage producers. **Distilled water** is part of CPA 24.13.42 (Other inorganic compounds n.e.c.) and is not included either.

Most other activities also use water in various forms; some are dependent on the existence of water-covered surfaces: hydroelectricity, fishing and fish farming, water transportation, recreational services or beach installations.

Much construction work is also linked to the storage, transportation, distribution and control of water. The products of these activities are classified in the following CPA categories:

45.21.32: general construction work for other long-distance pipelines, including water
45.21.41: general construction work for local water and sewage pipelines, including ancillary works
45.24.12: general construction work of dams, canals, irrigation channels and aqueducts
45.24.13: general construction work of locks, floodgates and other hydro-mechanical structures
45.25.22: water well drilling
45.33.20: water plumbing and drain laying work.

Classification of the functions of government
The Classification of the functions of government (COFOG) is used in the national accounts to classify government expenditure. The version of COFOG that was in use when the set of tables was developed, had separate headings for 'water supply affairs and services' (group 07.2) and 'sanitary affairs and services including pollution abatement and control' (group 07.3 – wastewater management was included in this group along with other expenditure). The new version of COFOG is more useful for water accounting as it separately identifies wastewater management (group 05.2) – for detail see Annex 2.

Accounts relating to water within the standard national accounts

For water supply (NACE 41) and wastewater management (part of NACE 90) activities, *production accounts* and *generation of income accounts* should be available. However, these accounts are often established only at the NACE 2-digit level. Wastewater management is not isolated at this level.

Similarly, for products relating to these activities, we must go down to the CPA 5-digit level to isolate water-related services and construct *Supply-Use* or *Input-Output* tables. Such details are generally available for the product 'distributed water' only. The supply-use tables provide information on the supply and use of distributed water by industries and households.

Acquisitions less sales of non-produced, non-financial assets of water resources, when they exist, would be recorded in the *capital account*. In the *Other changes in assets account,* the discovery and depletion of water sources would be recorded. However, for water resources such accounts are generally not available.

Geographical breakdown

From a hydrological point of view, the economic territory of the national accounts is made up of a set of drainage basins (or portions of basins). A purely national perspective could be inadequate for the study of water problems: problems concerning water availability are often local whereas problems of water pollution go beyond national borders: the Danube drains surface waters from 16 countries, the Rhine from 9. Pollution problems often increase at the bottom of the basins, whereas problems concerning the regularity of water

resources can be found all along its course. Water withdrawn in one basin cannot easily be used to compensate for water shortage in another basin due to high transport costs and ecological repercussions.

To analyse water problems in terms of quantity and quality, it would be necessary to have regional data. However, the European regions, based on administrative divisions, do not necessarily correspond to the water basins. A table relating water basins and the European regions is under construction. It requires descending to NUTS 5 level (NUTS is the European Nomenclature of Territorial Statistical Units). Comprehensive integration with economic accounts, desirable for the good management both of water and other resources, is difficult at this level due to limited data availability.

The integrated management of water resources may be complicated. Administrative boundaries may not match the boundaries of water basins. Divisions are not only geographical but also regard subjects: distinctions between withdrawal, pollution and treatment problems, on the one hand, and co-ordination with other policies (e.g. agriculture, industry, transport) on the other. Fortunately, these divisions by subject are gradually disappearing and are being replaced by integrated water management administrative structures: basin authorities in Spain, water authorities in the United Kingdom, basin agencies in France, etc.

These new structures are certainly better adapted, but they are still far from allowing for the full integration of water policy which demands co-ordination across ministries and regions, or international co-operation. When a catchment basin includes two or more countries, the treatment of environmental problems requires the participation of all countries concerned. The treatment of these questions at the supranational level, such as at the EU level, then makes sense.

Certain instruments of water management – legislative, economic or other – will be defined at the national level or have consequences for the national economy as a whole: pollution standards, rates for water services, taxation, etc. Political decisions such as the sharing of costs between different national agents (including between different basins), or the choice between potentially antagonistic policies (for example, between increasing agricultural performance or preserving the quality of groundwater) must necessarily be taken at several geographical levels, including the national level. Obviously, it is this level of decision that can benefit most from the light shed by the national accounts.

1.1.5 Conclusions as concerns water in the national accounts

Activities classified in NACE 41 and 90 are described in the conventional national accounts. However, national accounts as published will rarely provide sufficient detail for the study of water management. Such detail must be found at the level of basic data (surveys of enterprises and government units, administrative sources, etc.). More important, only water-related activities exercised as principal or secondary activities are classified in NACE 41 and 90. As concerns water, ‘ancillary’ activities (within the enterprise) are definitely not negligible. For example, water abstraction on own account constitutes the major part of water uses in quantity terms. The decisions required for good water management, such as standards or incentive measures must rest on data covering the *totality* of water-related activities and contain a *sufficient level of detail*.

It is useful, therefore, to obtain the following supplementary data:

1) to collect in detail all costs (in *monetary* terms) pertaining to present day water management, including costs borne by producers for ancillary activities and, simultaneously, to explain the financing of these expenditures, notably the financing by water users and by government.

2) to indicate the responsibilities of each economic agent for these costs by establishing the (physical) links between activities and their consequences for water (and in particular abstraction of water and discharge of pollutants).

3) to examine the adequacy of the present situation in the light of the general goal of sustainable development. Physical measurements of the environmental state of the country's continental waters would have to be carried out and compared with the state defined as sustainable.

The first two developments suggested will be discussed in the second part of this chapter. The third development is more long-term and will be briefly discussed in chapter 4.

1.1.6 Water in environment statistics

The OECD/Eurostat Joint Questionnaire on Inland Waters

Satellite accounts complement the economic statistics with statistics in physical terms. It is useful at this point to present the physical water statistics that Eurostat collects in the framework of the statistics of the environment.

The work carried out at Eurostat is developed in close co-operation with the OECD as well as with the United Nations Economic Commission for Europe (UN-ECE). Information is collected through a biennial questionnaire (the OECD/Eurostat joint questionnaire). The definitions of a number of key variables are presented below. These were the definitions in use at the time when the water accounts tables were set up and tested (see tables in Annex 1). Some of these definitions have been clarified for the 2002 Joint Questionnaire. The new definitions are shown in Annex 2.

Categories of water resources
(Fresh) Surface water: 'Water which flows over, or rests on the surface of a land mass, natural watercourses such as rivers, streams, brooks, lakes, etc., as well as artificial watercourses such as irrigation, industrial and navigation canals, drainage systems and artificial reservoirs.'

(Fresh) Groundwater: 'Fresh water which is being held in, and can usually be recovered from, or via an underground formation. All permanent and temporary deposits of water, both artificially charged and naturally, in the subsoil, of sufficient quantity for at least seasonal use. Includes phreatic water-bearing strata, as well as deep strata under pressure or not, contained in porous or fracture soils. Includes also springs, both concentrated and diffused, which may be sub aqueous.'

Other water: 'Includes atmospheric precipitation, sea water, permanent bodies of stagnant water both natural and artificial, mine water, drainage water (reclamations) and transitional water, such as brackish swamps, lagoons and estuarine areas.'

Flows of water between economy and environment
Abstraction (or withdrawal): "Water removed from any source, either permanently or temporarily. Mine water and drainage water are included. (Water abstractions from groundwater resources in any given time period are defined as the difference between the total amount of water withdrawn from aquifers and the total amount charged artificially or injected into aquifers. The amounts of water artificially charged or injected are attributed to abstractions from that water resource from which they were originally withdrawn.)"

Discharge: "The amount of water (in m^3) or substance (in kg BOD/d or comparable) added/leached to a water body from a point or a non point source."

Return: "Water abstracted from any fresh water source and discharged without use into fresh surface waters or groundwater. Occurs primarily during mining or construction activities. When abstracted fresh water is discharged without any use into 'other water', it is not considered to be returned water."

Water statistics at European level

Eurostat disseminates the information collected through the Joint Questionnaire.[12] The following results are presented:

- Intensity of water use in Europe, i.e. the ratio defined by abstractions divided by fresh water resources.
- Abstractions by sources (surface or groundwater)
- Abstractions by (main) sector
- Percentage of population connected to sewerage systems
- Efficiency of treatment plants
- Wastewater generated by sector
- Sewage sludge production and disposal
- Investment for the internal treatment of wastewater by industry.

[12] Notably in Eurostat's series *Statistics in focus, Theme 8, Environment and energy.* The three 2001 issues dealt respectively with 'Water resources, abstraction and use in European countries' (6/2001), 'Water management in the regions of the European Union' (13/2001) and 'Wastewater in European countries' (14/2001)

However, the coverage is not yet what it should be: the completeness is acceptable for data on water resources and abstractions, but less satisfactory for water consumption by sector, and for the generation and discharge of wastewater. A recent balance drawn up by Eurostat also stresses that the comparability of statistics collected needs to be improved further.

Intermediate conclusion on environmental statistics

The environmental statistics concepts are a key basis for water accounts and will be referred to in the rest of this document.

Not all environmental statistics will be used in the water accounts. As will be seen in the next section, the description of the state of the water resources is not covered by the present water accounts framework. Therefore, purely hydrological concepts are not introduced. Furthermore, in the organisation of the European Union institutions, the evaluation of the state of environment is a task delegated to the European Environment Agency (EEA).

The environmental statistics on water are less developed and harmonised than economic statistics. These difficulties will be reflected in setting up water accounts that integrate economic and environmental data.

1.2 Systems for water accounting

1.2.1 Eurostat's proposal

Water accounting is a system allowing to present data concerning water in a way that is consistent with economic statistics as well as with the concepts of hydrology. The comprehensiveness of the water accounts should be determined by the intended usage of such a system for policy making and by the cost and feasibility of implementing the system based on available data sources.

During the preparation of the water accounts framework two different approaches emerged. The first emphasised water in the economic sphere including descriptions of human uses of different water qualities, of emission to water by economic actors, of de-pollution by wastewater treatment, of costs generated by this treatment, of impacts on water quality when measurable. The second approach was a more general description of water within the environment, including a description of the state of the water system and of the hydrological cycle. This second approach would allow studying also indirect impacts of economic activities on water and the management of local or periodic scarcity of water, as well as natural flows of water and related substances (pollutants).

The second approach was felt to be out of reach at an EU-wide scale at present and the Eurostat Water Accounts Task Force recommended to concentrate on the work necessary to implement the first approach. Research work on a comprehensive set of accounts that includes a description of the state of the water system including stocks and flows is to be continued within the Water Accounts Task Force.

1.2.1.1 Developments needed within the ESA framework

The previous section has shown that in order to provide a useful guide for decision-making on water issues the national accounts need to be complemented, notably by:

1. a description of all transactions related to water management, including transactions that refer to ancillary activities,
2. a description of the way expenditure related to water and water-related services are financed by the various categories of water users,
3. the identification of the production and consumption activities responsible for the pressures on water bodies (abstraction of water or discharges of pollutants),
4. a description of the state of water bodies, including the sustainability of their present management.

The two first points can be managed entirely within the ESA framework.

1 – Disaggregating and reformatting national accounts

This involves identifying all water-related activities and transactions, and drawing the accounts for these activities including transactions for ancillary activities as well as supply-use tables for the respective products.

a) Disaggregating production accounts and product transactions

The first stage would be to isolate and regroup the accounts of water-related economic activities and to describe in detail the supply and use of water-related products. Three aspects of the water management are concerned.

The collection, purification and distribution of water

Supply of the product 'distributed water' through domestic production (imports are usually very small) must be examined in detail, as well as its uses by economic activities, including households' consumption. Production accounts and generation of income accounts for NACE 41 and supply-use tables should be established and complemented by physical accounts of distributed water by categories of users.

Treatment of wastewater

Treatment of wastewater should be separated from the rest of division 90 of the NACE (Sewage and refuse disposal services, sanitation and similar services). Various other activities for water pollution control and the restoration of aquatic media such as dredging (part of NACE 45.24 and CPA 45.24.14) should, if they can be isolated, also be integrated. The same studies as for NACE 41 would then be carried out.

Prevention of pollution

Prevention of pollution covers the activities for the monitoring of water quality, pollution control, research for less polluting technologies, administration and management of water in general.

These activities are often undertaken by government bodies, and classified in NACE class 75.12. Environmental NPISH (non-profit institutions serving households) can also be active in these areas.

At this step, only data related to activities practised as main activities (potentially also secondary) can be collected. The data required on products of activity 41 are usually available directly from the accounts in an aggregated form (all of NACE 41). Data concerning wastewater treatment (NACE 90) may not be directly available in the national accounts publications at the desired level of detail. However, the basic data used for the construction of the accounts (surveys for specialised firms and accounts for local government specialised units) generally make it possible to construct accounts for wastewater treatment. For the 'prevention' item, on the other hand, the existing accounts can hardly be used. Insofar as it is possible, they will have to be recomposed using specific data.

b) Accounts for ancillary activities

In order to establish direct links between water use and the related expenditure, it is necessary to record not only the expenditure for the use of distributed water and for wastewater treatment services but also the expenditure or costs related to ancillary activities.

Many economic agents abstract water directly for own use: farmers practising irrigation, electric power plants using water for cooling, industrial establishments that abstract their own water etc. The same applies to wastewater treatment: enterprises and households may operate their own wastewater treatment facilities (industrial wastewater treatment plants, septic tanks, etc.).

These direct users will have costs for operating their equipment for abstracting and using water. These users may also purchase land in proximity to water or undertake construction works in order to use the water.

All these own account activities entail costs: either costs for capital formation or the acquisition of land in proximity to water or current costs directly tied to water usage (electricity or fuels for pumps, chemicals for the purification of water or treatment of wastewater, compensation of employees, water abstraction or pollution taxes, etc. All these costs for water use should therefore be accounted for: abstraction and purification costs, treatment and pollution control costs, capital and current costs.

For wastewater treatment and water pollution prevention, the environmental protection expenditure account (EPEA) of the European System for the Collection of Economic Data on the Environment (SERIEE)[13] has already set a framework for the collection and reporting of such information. This framework should soon be extended to the management of the water as a natural resource (quantity aspects).

2 - Financing of the expenditure

The second objective of detailed water accounts is to determine the present financing mechanisms for expenditure linked to water management. Although limited to monetary transactions, and thus excluding the 'non-market' costs (residual degradation of water bodies), this second objective is directly related to the application of the polluter pays principle. Questions are: How are these activities presently financed? By which agents (water users, local governments, central government)? By means of which instruments (sales of services, environmental taxes e.g. on discharges of wastewater, government budget, etc.)?

The purchase of water-related services by households and enterprises is directly visible in the supply-use tables of these products. The identification of expenditure for direct withdrawal should also be possible, as a result of step 1. The total of this expenditure represents the direct contribution of households and enterprises in the national expenditure for water. However, purchases of water-related services (and thus sales by producers) do not generally cover the total amount of costs borne by the producers. For example:

- The treatment of wastewater is sometimes a non-market output by local authorities. In the ESA, on the use side, this appears as government actual collective consumption and is valued by the costs. Nonetheless, it is possible that government units involved in the production of these services do not bear

[13] See Eurostat 1994 *SERIEE 1994 Version* and Eurostat 2002 *SERIEE Environmental Protection Expenditure Accounts – Compilation Guide*, Office for Official Publications of the European Communities, Luxembourg.

all the costs associated with this production: they may e.g. levy taxes for the treatment of wastewater, which are allocated solely for that purpose. These taxes are often included in water distribution bills.

- Units responsible for the production of water services may benefit from subsidies and capital transfers. Those financing mechanisms must be analysed in detail in order to obtain an accurate description of all flows financing the expenditure for water activities. Subsidies may be justified from a social or economic standpoint, by the will to avoid that, for example, low-income households or activities exposed to international competition or regions where water is scarce, be overly penalised. Other transactions, such as direct transfers to users or taxes on products should also be examined and a detailed breakdown of the financing circuit may appear necessary. In the end, results might be summarised in a SERIEE table on the financing of national expenditure for wastewater management.

1.2.1.2 Complements needed outside the ESA framework

After this disaggregation and reformatting of national accounts data, next steps of work respond to the two last objectives of the satellite accounts on water:

- the identification of the production or consumption activities responsible for pressures on water bodies (abstraction of water or discharges of pollutants),
- the determining of the state of water bodies, including the sustainability of their present management.

These steps mainly consist in complementing the national accounts data, notably with physical information on quantities of water abstracted or used and emissions to water. These physical flows within the economy and between the economy and the environment can be included in a NAMEA-type framework, along with the corresponding economic transactions. NAMEA stands for National Accounts Matrix including Environment Accounts.

A NAMEA-type framework for water

A NAMEA framework extends the matrix presentation of national accounts (NAM) with supplementary rows and columns where flows of substances (water and pollutants) are recorded in physical units and presented in parallel with economic transactions. The NAM presentation equally allows for the representation of flows of water within the economic system (e.g. supply-use tables of distributed water in physical units).

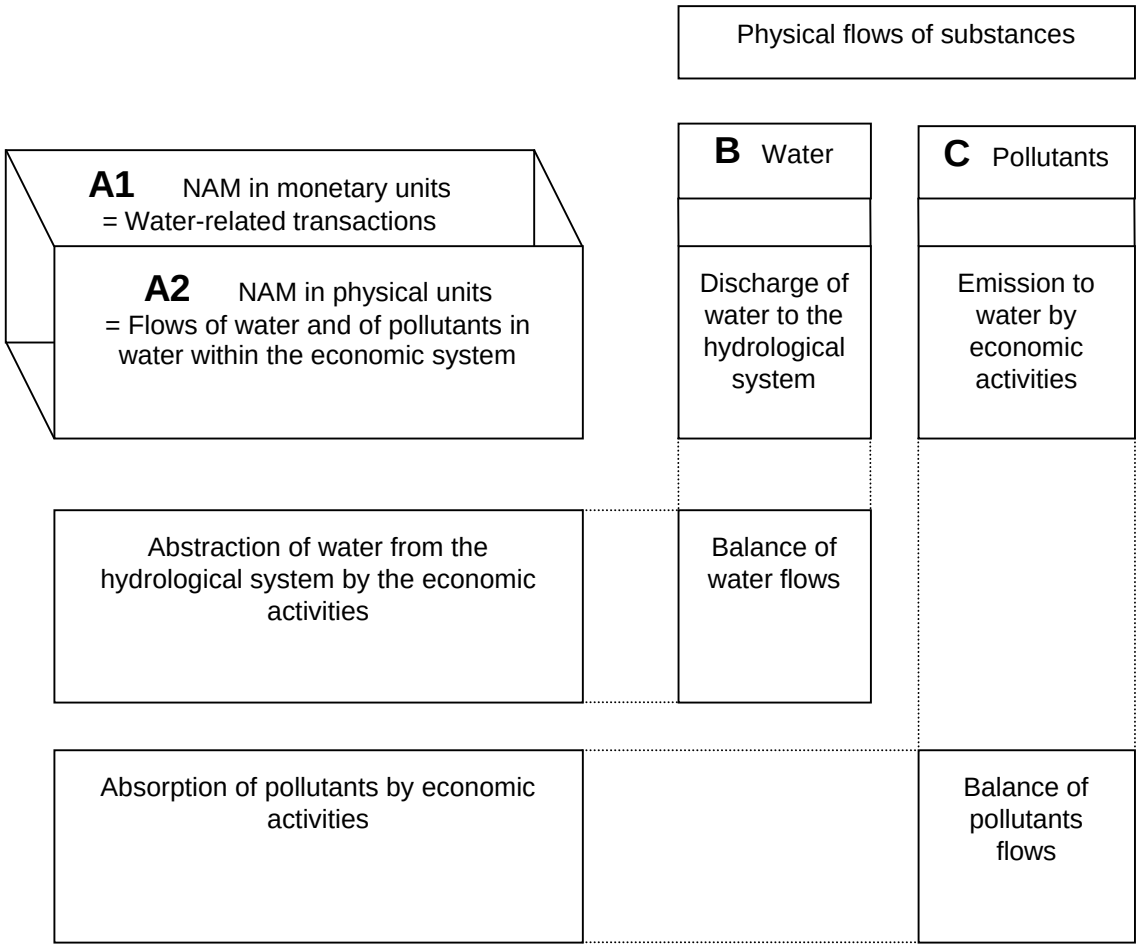
The main pressures placed on the water system by economic activities, i.e. abstraction and emissions of pollutants to water, and some of the responses (wastewater treatment) can easily be described in a NAMEA framework: the matrix presentation of flows of water, including wastewater, and of pollutants in physical units is organised by economic activities in the same way as the monetary transactions connected to water. This information enables the macro-level analysis of different policy initiatives.

Applied to water, a NAMEA framework could be schematised as is done on the following pages. First, in a NAM detail on water-related transactions is added by using an adequate breakdown of the transactions, for instance by isolating products CPA 41.00.11 and CPA 90.00.11 and possibly transactions related to ancillary activities. Second, the NAM is extended into a NAMEA by adding the corresponding flows of substances (water and pollutants) to the rows and columns of the NAM.

Scheme 1.2-1 A simplified National Accounts Matrix (NAM) for water (in monetary units)

				Goods and services (CPA products)	TOTAL ECONOMY											Rest of the world		TOTAL
					Production (by industry)				Use of disposable income			Capital account			Gross capital formation	Financial account	Current account	Capital account	
									Households	Corporations	Government	Households	Corporations	Government					
				1a 41,00,11 90,00,11 1n	2a 41.00 90.00 2m	3	4	5	6a	6b	6c	7a	7b	7c	8a 41.00 90.00 8m	9	10	11	
Goods and services CPA products		41.00.11 90.00,11	1a 1n	Trade and transport margins	**Intermediate consumption**				**Final consumption**			**Changes in inventories**			**Gross capital formation**		**Exports**		
TOTAL ECONOMY	Production accounts (by industries)	41.00 90.00	2a 2m	**OUTPUT**															
	Generation of income account	Compensation of employees	3a		**Net Value Added (basic prices)**														
		Other taxes less subsidies on production	3b																
		Operating surplus	3c																
	Allocation of primary income account	Households	4a																
		Corporations	4b																
		Government	4c	Taxes less subsidies on products															
	Secondary distribution of income account		5a 5b 5c					Current transfers											
	Use of disposable income accont		6																
	Capital account		7									**Capital transfers**							
	Gross capital formation by industry		8a 8m		**Consumption of fixed capital**							**Net fixed capital formation**							
	Financial account		9																
Rest of the world	Current account		10	**Imports**															
	Capital account		11																
TOTAL																			

Scheme 1.2-2 The NAM extended to a NAMEA for water



The A1 part of the above scheme is the NAM presented on the previous page, i.e. it sheds some more light on water-related economic transactions within the classical framework of national accounts: more detailed transactions on water-related products, detailed production accounts of water-related activities, expenditures for ancillary activities related to water within other activities (parts of the production accounts of non-water-related activities), taxes linked to water and to water-related activities (abstraction taxes, pollution taxes, etc.), subsidies in relation to water use, etc.

Matrix A2 translates into physical units some of the transactions reported in matrix A1, more precisely, those to which physical flows can be connected: flows of water and pollutants transported in water.

NAM A2 is then complemented by information on the exchanges between the economy and the environment: exchanges of water (part B) and exchanges of pollutants (part C).

Such a framework organises in a consistent way information which is necessary for the description of the various aspects of the uses of water by economic activities:

- economic transactions related to water,
- flows of produced (distributed) water and wastewater within the economic system,
- flows of water and pollutants between the economy and the environment: abstraction and returns of water (in m^3), water pollutants eliminated or discharged (in tonnes) by economic activities.

It can be later extended to describe exchanges within the environment: flows between soil and water, flows between the different components of the natural water system, and to describe the stocks and changes in stocks between two periods: monetary assets of the economy, physical stocks of water, etc.

The pilot tables

As a start to water accounting, the Task Force agreed on a set of 13 pilot tables (see Annex 1), concentrating on concerns common to all countries and for which data were thought to be available.

The water-related economic products have been: operation of irrigation systems, distributed water, wastewater treatment services. The selected economic activities related to water have been: abstraction, purification and distribution of water, collection and treatment of wastewater and finally production of administrative services for water supply and sewage systems.

Tables 1 to 4 are in monetary units, Tables 5 to 8 describe physical flows of water, whereas Tables 10 to 12 report the corresponding flows of pollutants, and finally the different prices are derived in Table 13. In the following, these tables are introduced and related to the Schemes 1.2–1 and 1.2–2 on the previous pages. The tables are located in a NAMEA in the Scheme 1.2–3 on the following page.

Table 1 Supply table of some water-related products in monetary units (part of the first group of columns of the NAM presentation (‘goods and services’) – See Scheme 1.2-1)

Table 2 Use table of some water-related products in monetary units (transposed part of the first group of rows of the NAM presented in Scheme 1.2-1)

Table 3 Economic accounts for some water-related economic activities (second group of columns of the NAM presentation in Scheme 1.2-1 (‘production account’ + elements of other sub-matrices – activities devoted to water only)

Table 4 Expenditure for some ancillary water-related activities (idem, but for other activities)

Table 5 Supply of water within the economy (physical flows corresponding to some transactions of Table 1 – NAM in physical units – Part A2 in Scheme 1.2-2)

Table 6 Use of water within the economy (physical flows corresponding to some transactions of Table 2 – NAM in physical units – Part A2 in Scheme 1.2-2)

Table 7 Total abstraction of water from water bodies and discharge of wastewater into water bodies (Parts of upper and left Part B in Scheme 1.2-2)

Table 8 Water abstracted from the water bodies for the preparing of drinking water (detail of Table 7 – restriction to drinking water and introduction of classes of water bodies qualities)

Table 9 Balance of flows of water between economy and water system (Complements to Table 7 and summary – Upper, middle and left Part B in Scheme 1.2-2)

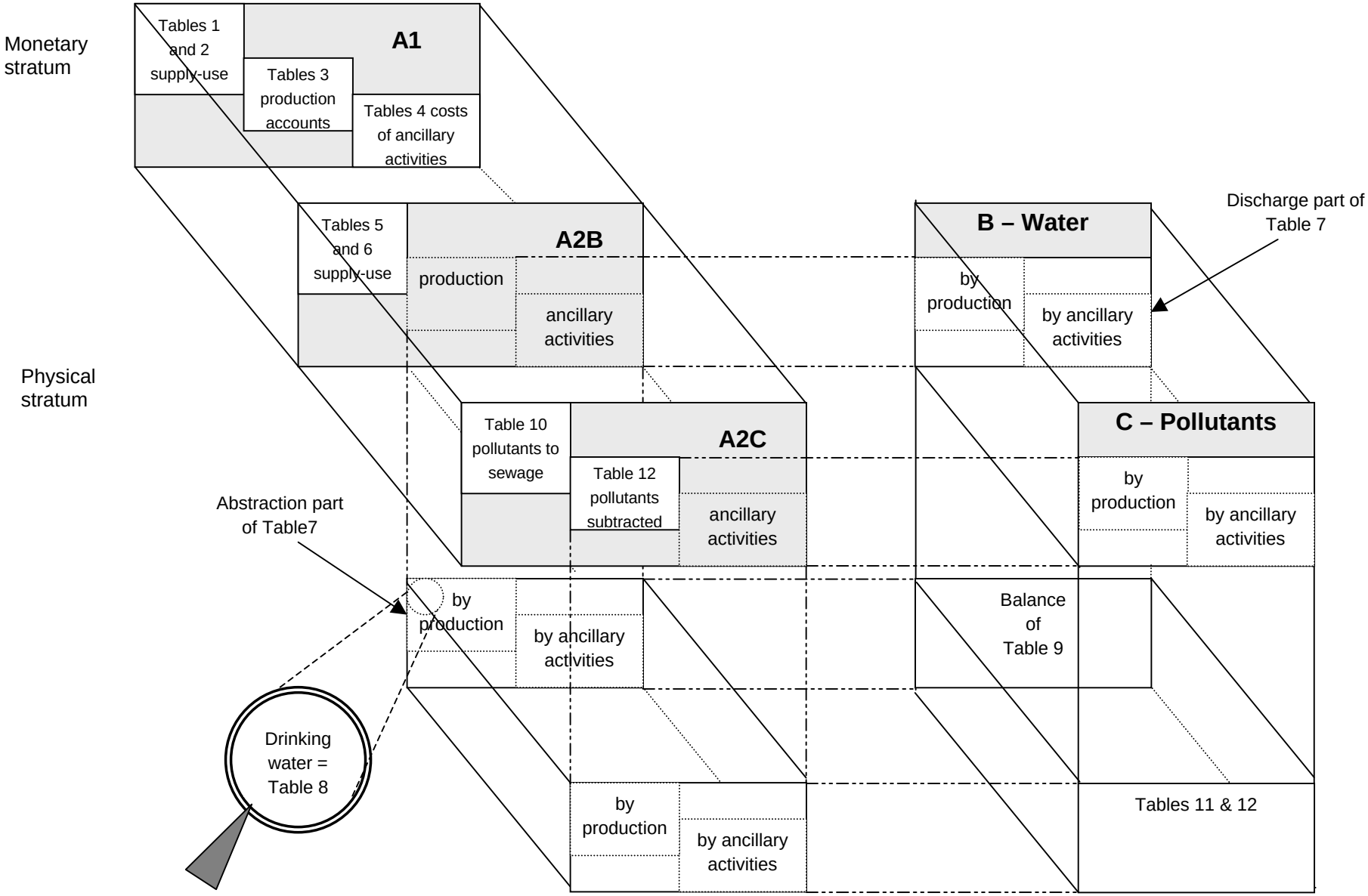
Table 10 Pollutants discharged by economic activities into the sewage network (physical flows corresponding to some transactions of Table 2 – NAM in physical units – Part A2 in Scheme 1.2-2)

Table 11 Pollutants discharged to water bodies by discharge of wastewater (Upper Part C in Scheme 1.2-2)

Table 12 Pollutants subtracted by economic activities either along with abstraction of water (Left Part C) or by purification and treatment (A2 matrix in Scheme 1.2-2)

Table 13 Average purchaser’s unit prices of some water-related economic products (simply derived from Tables 2 and 6) (not in Scheme 1.2-3).

Scheme 1.2-3 The pilot water accounts tables in a NAMEA-type framework



There is a direct correspondence between the proposed economic and physical tables. Some economic actions, though, are difficult to translate into physical units: this applies in particular to economic instruments such as prices, taxes etc., to construction works and their maintenance, to investment grants for wastewater treatment, to current transfers from national or regional budgets to local authorities in charge of water treatment, to capital formation, etc. In order to show how the activities of water supply and control are managed in the different countries, it might be interesting to investigate further the possibilities of including such data within the accounts and to clarify the questions of use and ownership of water-related fixed capital.

1.2.1.3 Limitations of the NAMEA-type framework for water

The supply-use tables in physical units (part A2) only encompass flows of distributed water between two economic units. The flows corresponding to ancillary activities related to water within the economic activities, notably re-used or re-circulated water, are not directly visible in the accounts.

Indirect emissions, i.e. flows of pollutants originating from the economy which at some point in time end up in the water system via air, soil etc., are not included in the present framework. The emissions of pollutants to the air or on the soil can be described in other parts of the environmental accounts but a bridge should be introduced with the water accounts since these pollutants will influence the state of the water system. In the pilot tables it has been proposed to collect at least information on fertilisers that might end up in aquifers.

The state of the water system influences the possible uses of water at present and in the future. Conversely, the uses influence the state of water. The present framework does not describe the state of the water system and the changes in this state that are due to economic activities. In order to identify the impacts of economic activities on the water system as an environmental medium, a complete integrated model of this environmental medium would need to be specified. This does not seem possible for the moment.

Availability of water for economic use means that the water has to be at the right place at the right time and in the right quality, i.e. the aspects of quality, time and location are relevant in this context. The present framework captures such issues only to a limited degree. When data are available, the framework may be applied, for relevant aspects, at regional scale (e.g. a watershed) or for short periods of time (e.g. a quarter).

Chapter 4 will address the issues of space and time, the concept of availability of water and other outstanding issues.

The economy/environment integration proposed here is modest in that it is limited to setting side-by-side economic and social activities and their direct impact on water, and measuring present costs for repair or prevention of damage to water. In this limited form, this integration does provide a reply to most of the concerns expressed in the Commission's Communication to the Council and to the European Parliament COM(2000) 97 final on water pricing policies: "… *The availability of information will be key to the development and use of these guidelines. Thus, Eurostat and the Commission will pursue their efforts to assess the availability, in Member States and also applicant countries, of statistics pertaining to costs of water services and water prices. This assessment will feed into the identification of robust and cost-effective methodologies for collecting cost, benefit and price information as requested in the proposed Water Framework Directive*… "

1.2.2 Other national presentations of water accounts

1.2.2.1 The Dutch NAMWA and the environmental themes

The NAMEA integration of economy/environment presented before has been developed in the Dutch CBS. Only part of the Dutch NAMEA model has been kept in the European exercise. In particular, the Dutch presentation later allocates the pollutants to 'environmental themes' in order to offer to the users a more synthetic presentation of the results. These theme indicators summarise the pressures on the environment.

This method of 'environmental themes' was also developed by the Netherlands in the early nineties: *"… The degradation of the environment due to pollution cannot be covered in an (other changes in) assets account, but should instead be summarised in an environmental themes account. This is related to the impossibility to incorporate the interaction between environmental pressure and the related environmental degradation. Changes in natural assets are caused by numerous divergent threats which may strengthen or weaken each other, not to mention the uncertainties in threshold levels of different ecosystems. Non-linear interactions should not be handled in the accounting framework. Complex ecological models are needed to estimate*

dispersion patterns of pollutants and subsequently the time and place of an occurring damage. In our opinion, ecological modelling should be excluded from a statistical framework like the NAMEA for that matter. That is why the NAMEA applies instead an environmental-themes account to compile summary indicators on the potential environmental degradation caused by pollution …"

Concerning water, three environmental themes on pollution have been considered: eutrophication[14], organic pollution[15] and dispersion of hazardous substances (restricted to heavy metals[16]). Pollution is recalculated into environmental theme equivalents[17] and subsequently aggregated by theme. Another environmental theme, namely 'water abstraction' relates to depletion of resources and not to pollution.

The emission account is therefore extended as in Table1.2-1: the pollutants are recalculated in terms of environmental theme equivalents and subsequently aggregated per theme. The result shows the contributions of each activity to the environmental themes related to water. The emissions of individual pollutants will be presented in Section 3.3.

Table 1.2-1 Contributions to environmental themes related to water, The Netherlands 1991

ORIGIN OF SUBSTANCES	Water abstraction	Water pollution		
		Eutrophication	Organic pollution	Dispersion of heavy metals
EMISSION BY CONSUMERS	704	197	15068	88946
EMISSION BY PRODUCERS				
Agriculture, hunting, forestry, fishing	430	2345	62	79053
Mining and quarrying	1	0	6	0
Manufacturing				
Food, beverages and tobacco industry	204	84	2133	1611
Textile, wearing apparel and leather industry	12	10	257	644
Wood and furniture industry	2	0	28	0
Paper, printing and publishing industry	102	14	283	490
Petroleum industry	30	0	0	73
Chemical industry	928	43	929	26310
Rubber and plastic industry	19	0	5	10
Construction materials, earthenware and glass		0	0	0
products industry	177	0	12	20
Basic metal industry	50	1	117	2017
Metal products and machinery industry	29	1	222	2551
Other manufacturing	37	0	180	0
Public utilities				
Electricity and gas	5150	0	10	0
Water supply*	1	0	22	0
Construction	5	0	209	0
Transport and storage	9	0	170	0
Environmental cleansing and sanitary services	**12**	**-83**	**-21511**	**-90831**
Water boards	0	0	0	0
Other services	230	77	3545	0
OTHER DOMESTIC ORIGIN				
Transport differences		0	5520	0
Waste dumping sites		0	0	122
Diffuse sources		0	0	49648
TOTAL	8131	2689	7267	160663

(*) excluding water abstraction for the production of drinking water

Source: Water accounts in the Dutch NAMEA: a 'NAMWA' for 1991 – CBS, May 1997

[14] Eutrophication is the enriching of water with nutrients, namely, nitrogen and phosphorus, which in certain conditions of temperature and sunlight, lead to excessive growth of algae. This increases the turbidity of water and a scum of algae may form on the surface.

[15] The organic pollution is quantified in inhabitant equivalents (i.e.), where one i.e. equals 54 grams of BOD.

[16] Besides heavy metals, for other topics covered by the NAMEA (i.e. air, waste), the environmental theme indicator for dispersion of hazardous substances also includes pesticides, organic compounds and radioactive substances.

[17] For instance, for the 'eutrophication theme', P is given a weight of 1 and N a weight of 0,1.

In one of its evaluations, Ireland also aggregated N and P into an indicator for eutrophication potential. Although not dealing with all activities, the results – shown in Table 1.2-2 - are not far from the Dutch ones. Please note that the Irish table applies the principle of net recording, showing the discharges into the environment, whereas the Dutch table applies gross recording, showing all emissions generated by all units in the Dutch economy. The depollution of wastewater by external cleansing industries (NACE 90) is thus recorded as a negative pollution by these industries in the Dutch tables.

Table 1.2-2 Eutrophication potential by industry, Ireland 1994

Sector	Eutrophication potential	
	in kg	in %
Agriculture, forestry, fishing	18 295	82
Chemical products	219	1
Food, beverages, tobacco	621	3
Textiles, clothes & footwear	n.a.	
Total industry (direct discharge)	840	4
Transport	n.a.	
Municipal works	3 250	15
Total services	3 250	
Residential (septic tanks)	n.a.	
Total accounted for discharges*	22 385	100

* Supplementary discharges could emanate from private septic tanks and agriculture.

Source: Compilation of Satellite Environments Accounts – ESRI, September 1998

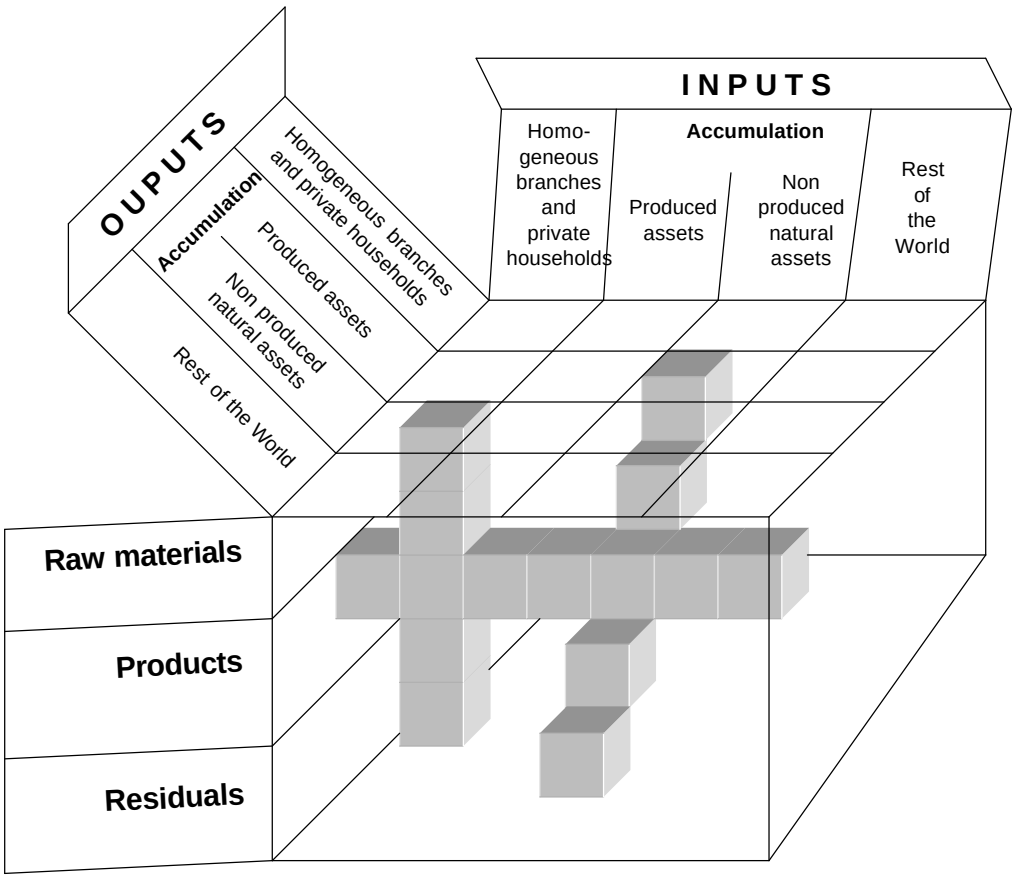
1.2.2.2 The German MEFIS Cube

Water accounts in the Federal Statistical Office of Germany are part of the overall framework of the material and energy flow information system (MEFIS). In this system, the economic processes (production and consumption) are understood as the transformation of materials and are represented in a cube: different materials (raw or already transformed) are transformed into other types of materials (economic products or residuals at the end of the economic processes).

" … *When represented in monetary units within the framework of the monetary input-output table, those different materials can be aggregated on the basis of market prices. Although representation in physical units generally allows aggregation too – for example through the weight unit – and provides useful information to some extent, it must be supplemented by presenting individual types or categories of material. Therefore, the MEFIS cube contains not only the two axes used in the monetary input-output table – forming the top side of the cube – but also a third axis showing the types of material, that is, every type of material forms a horizontal layer within the cube. This allows showing in physical units and for the total economy the abstraction of material from nature, the discharge into nature, and the material-related interaction within the economic system in a detailed breakdown by types of material*… "

In this representation, economic activities comprise the classical economic branches, plus a branch for external environmental protection activities, plus household consumption.

Scheme 1.2-4 The German MEFIS-Cube



Source: Water Flow Accounts as Part of Material and Energy Flow Accounts in Germany – (STABU 2000)

Water typically goes through the following main stages:

- abstraction from nature
- purification/distribution
- use in production or in consumption
- wastewater collection/treatment
- discharge into nature

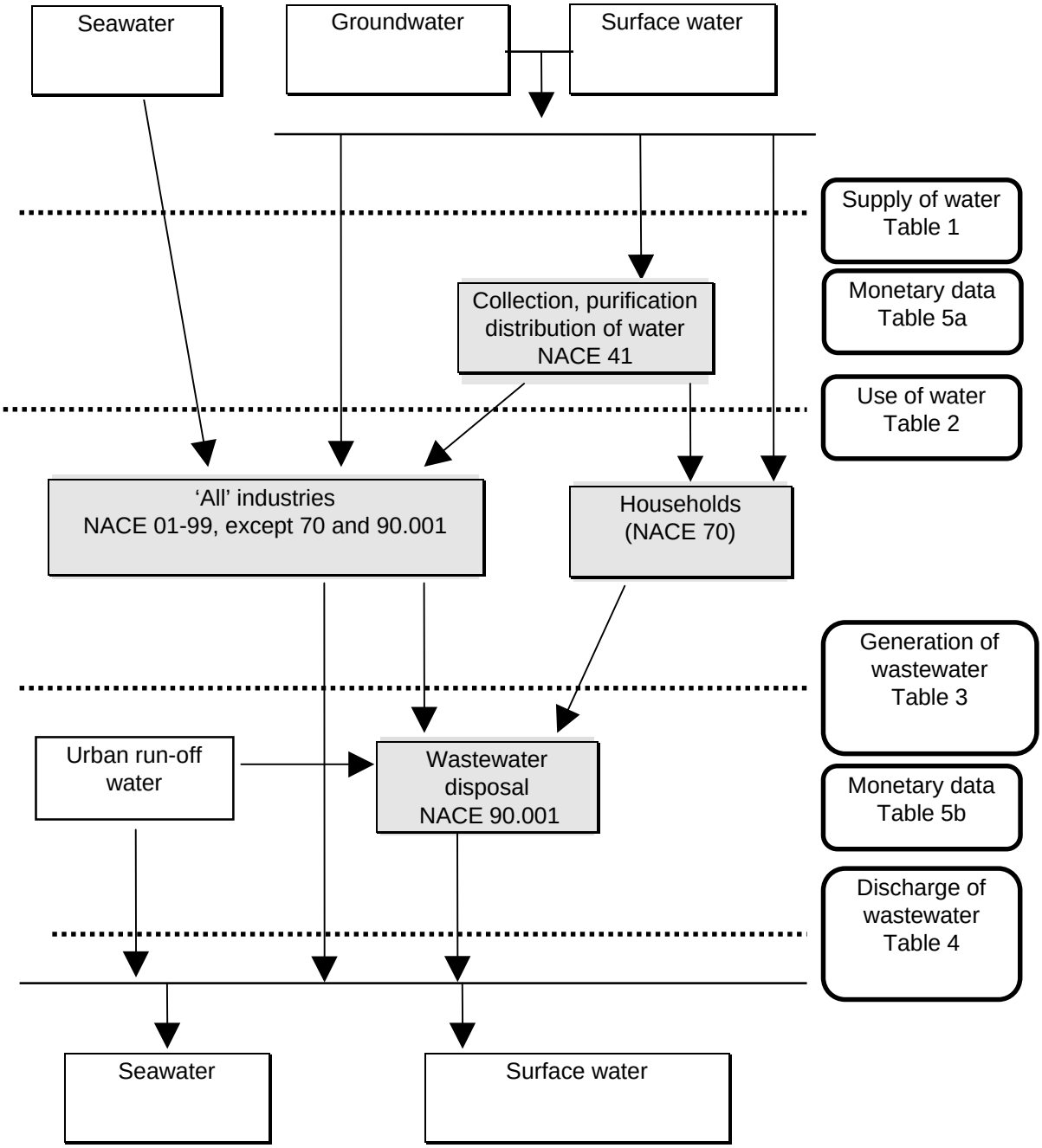
In terms of material accounts, water can be viewed as a different type of material at each stage: water abstracted from the non-produced natural assets, water distributed (after purification), water used and incorporated in products, water in wastewater collected by the environmental protection activities and water discharged back to nature, as a residual.

1.2.2.3 The Swedish water accounts

A NAMEA-type framework has also been used in Sweden: the focus is on water flows in the 'technosphere' as well, i.e. on water abstraction, use of water and emissions to water. Both distributed water and self-supplied water are included. But some variations have been introduced:

- seawater can be abstracted;
- households' purchases of water are attributed to the activity 'real estate' (NACE 70);
- four steps in the water flows are considered: abstraction, use, generation of wastewater, discharge of wastewater, each giving rise to a table, two steps being doubled by monetary data;
- and, above all, water is broken down according to four different uses:
  - cooling in production of electricity
  - other cooling
  - production processes
  - other uses.

Scheme 1.2-5 Sweden's water accounts framework



Source: Water Accounts. Physical and monetary data connected to abstraction, use and discharge of water in the Swedish NAMEA – Statistiska centralbyrån, December 1999

Table 1.2-3 Uses of water by economic activities and by purpose, Sweden 1995, in 1 000 m³

NACE code	Activity	Origin of water		Total	Use by purpose			
		Market produced	Non-market produced		Cooling water in production of electricity	Other cooling water	Production processes	Other uses
1	Agriculture		137 291	137 291				137 291
2	Forestry							
10/14	Mining and quarrying	1 312	42 594	43 906		271	41 659	1 977
15/16	Food products, beverages, tobacco	25 917	48 112	74 029		43 522	27 516	2 991
17/19	Textiles, textile products, leather	2 459	9 220	11 679	53	3 773	7 303	551
20	Wood, products of wood, cork, straw, etc.	1 249	18 531	19 780		669	18 256	855
21	Pulp, paper and paper products	3 327	975 075	978 402	24 615	279 730	665 309	8 748
22	Publishing, printing and reproduction	2 466	64	2 530		190	715	1 625
23	Coke, refined petroleum and nuclear fuel	271	126	397		260	87	48
24	Chemicals and chemical products	18 891	492 881	511 772	996	482 419	21 305	7 051
25	Rubber and plastic products	995	16 782	17 777		15 267	1 844	666
26	Non-metallic mineral products	2 716	12 175	14 891		7 796	5 492	1 602
27	Basic metals	8 592	351 862	360 454	20 916	257 659	78 422	3 457
28	Fabricated metals, except machinery	4 164	12 126	16 290	40	11 251	2 782	2 216
29	Machinery and equipment n.e.c.	5 473	19 815	25 288		19 013	2 947	3 328
30	Office machinery and computers	406	67	473		223	69	181
31/32	Electrical machinery, radio, TV, etc.	3 385	5 045	8 430		3 473	3 593	1 364
33	Medical, precision, optical instr., etc.	1 025	181	1 206		443	195	568
34/35	Motor vehicles and other transport eq.	6 446	10 130	16 576		9 452	4 162	2 962
36/37	Other manufacturing	695	360	1 055		137	480	438
	Not possible to disaggregate by sector	6 469	5 667	12 136				12 136
40	Electricity, gas, steam, hot water supply	6 681	113 551	120 232	105 880	4 866	6 057	3 429
41	Collection, purification, distrib. of water	180 596		180 596				180 596
45	Construction							
50/52	Wholesale and retail trade							
55	Hotels and restaurants							
60/64	Transport, storage and communication							
62	Financial intermediation	86 522		86 522				86 522
71/74	Renting and business activities							
80/99	Other, excluding 90.01							
90.01	Sewage disposal							
75	Public administration							
70	Real estate	527 975	88 449	616 424				616 424
	Unspecified use	38 269		38 269				38 269
	TOTAL	**936 301**	**2 360 104**	**3 296 405**	**152 500**	**1 140 414**	**888 193**	**1 115 295**

Source: Water Accounts. Physical and monetary data connected to abstraction, use and discharge of water in the Swedish NAMEA – Statistiska centralbyrån, December 1999

In fact, all Member States more or less deviated from the framework initially proposed by Eurostat and, as will be seen in the detailed chapters, Sweden's framework is only one example of these deviations. A summary of the major deviations will be made at the end of the report, as a contribution to the conclusion of this pilot exercise that was, it should be recalled, conceived as a test.

1.3 Summary of national contributions

1.3.1 Summary table of the national contributions

Country	Reporting organisation	Content	Date of completion
BELGIUM	Bureau Fédéral du Plan	Feasibility study on the possibilities of using the NAMEA framework to account for wastewater	January 2000
		1998 monetary and physical water accounts for water flows and water pollution. Estimates of pollution intensity and eco-efficiency ratios for the different industries.	February 2002
DENMARK	Statistics Denmark	1994 water accounts with special focus on water abstraction and use	April 1999
		Feasibility study investigating the data concerning the emission of wastewater by industries and households	April 1999
		Combination of the above described water flow accounts with connected economic data for 1995 and 1996	April 2000
		Update with 1997 data and presentation of a full analysis of the variation along time	April 2001
SPAIN	Instituto Nacional de Estadística	1995 monetary and physical water accounts for water flows developed on the basis of the tables proposed by the Task Force on Water Satellite Accounts	May 2000
		Water Satellite Accounts for Spain 1997-1999	September 2001
GERMANY	Statistisches Bundesamt	Emission Accounts combined with the German Input-Output tables – Economic key data on air emissions, waste and wastewater for 1990, 1991 and 1993	October 1997
		Water flows accounts for 1995 – German Input-Output data on water	August 1998
		A Physical Input-Output-Table for Germany 1995	June 2001
GREECE	National Technical University of Athens	Supply-use accounts for water, wood, fish, energy and non-energy materials in physical units, emissions to air	June 1998
		Continuation and systematisation of the above-mentioned report	April 2000
FRANCE	Institut Français de l'Environnement	Pilot application of a simplified method on accounting for the quality of water courses, carried out at the level of drainage basins for all of France	August 1999
		Investigations of the feasibility of establishing regional wastewater NAMEA-type emissions accounts	October 1999
		Methodology and results for the building of an expenditure account for water abstraction and distribution (SERIEE methodology)	October 1999
		Idem for water 'in situ' uses	December 1999
		Regional wastewater NAMEA-type emissions accounts for the Loire-Bretagne hydrological basin 1997	October 2000
IRELAND	The Economic and Social Research Institute	Emissions to air, discharges to water, solid waste, depletion of resources, 1994	September 1998
		Emissions to air, discharges to water, solid waste, energy use, depletion of resources, 1996. Revised method for calculating wastewater, allocation of the results to geographical areas	May 2000
		Tentative link to economic data: costs and revenues arising from water services, according to different sources – Survey of local water authorities	February 2001

LUXEMBOURG	Centre de Recherche Public Henri Tudor	Focus on emissions to air 1993, but with an assessment of the availability of data for waste, wastewater and natural resources	December 1997
		Feasibility study on the possibilities of estimating abstractions of water and emissions of pollutants to water with a breakdown by industry	March 2000
THE NETHERLANDS	Statistics Netherlands	The Dutch NAMWA for 1991 – Integrated water abstraction, emission of pollutants to water and monetary data	May 1997
AUSTRIA	Statistics Austria	Wastewater for 1994, with emissions in m^3 and tonnes of pollutants	November 1998
PORTUGAL	Instituto Nacional de Estatística	1998 monetary and physical water accounts for water flows developed on the basis of the tables proposed by the Task Force on Water Satellite Accounts	June 2002
FINLAND	Statistics Finland	Input-output tables, air emissions, waste, wastewater, use of peat and wood for 1993	July 1997
		Input-output tables, air emissions, waste, wastewater, use of peat and wood for 1985, 1989, 1990, 1992, 1993 and 1995	November 1999
SWEDEN	Statistics Sweden	Accounts based on the tables proposed by the Task Force on Water Satellite Accounts – Data in both monetary and physical units for 1995	December 1999
UNITED KINGDOM	Office for National Statistics	1994 preliminary results on water abstraction and emission loads to water bodies from England and Wales	1998
		Based on the matching of the consents register and the business register, estimates of 1998 emission coefficients by industry (per unit of turnover or per employee)	July 2000
NORWAY	Statistics Norway	Natural assets accounts (forest), solid waste, air emissions and, on the water issue, emissions of pollutants to water and economic information on the public wastewater sector	October 2000

1.3.2 Country-by-country summaries

BELGIUM

In **Belgium,** a feasibility study was carried out in 1999 to assess the possibilities of setting up NAMEA-type environmental accounts for water. Data on water and wastewater are collected, calculated and estimated at the level of the three Belgian regions (Flanders, Wallonia and Brussels). As different parameters, definitions and industry classifications are used, as the structure and the level of detail of the databases are different from one region to another, a number of breakdowns have to be estimated for Belgium as a whole.

This harmonisation work was finalised on the 1998 data, and Belgium could complete several of the tables proposed by Eurostat for testing. These include monetary and physical supply-use tables for water supply, monetary and physical supply for wastewater services, and discharges of wastewater into the water bodies in volumes with their detailed pollution content.

The economic data demonstrate the importance of water as an economic good while the environmental data allow the identification of the sectors responsible for the bulk of water pollution in Belgium. The results show for instance that more than half of total wastewater discharged in Belgium in 1998 was due to the power and water sectors, but also that these sectors actually discharged very large volumes of relatively clean water.

The environmental data have been subsequently combined with economic data in order to distinguish the industries that are important water polluters because of the kind of activity they perform from those that are important polluters because of their economic size. In order to make this distinction, eco-efficiency indicators have been calculated.

DENMARK

Denmark has submitted to Eurostat four reports regarding water accounting.

One report dealt with the feasibility of compiling data on discharges of **wastewater** and emissions of pollutants into water. The report found the possibilities good and suggested methods to adjust the available data to the framework.

Two other reports concerned **water abstraction and use** in Denmark, first in physical units (m^3) for 1994, secondly, in both physical terms and monetary units for 1995 and 1996.

The **physical data** included industrial and domestic use of water by type of water (natural/tap) and by purpose. A further specification of the purpose was introduced for some group of activities (agriculture, production and distribution of electricity, steam and hot water supply, collection and distribution of water, manufacturing industries) as well as for household consumption.

The **monetary data** included net payment of tap water charge by households and industries, investments of NACE 41 and physical and monetary accounts related to sewage removal and disposal. Implicit water prices according to the NAMEA were calculated. The NAMEA water accounts were compiled in co-operation with the national accounts department and will be used in the future to improve the data regarding water in the Danish national accounts.

The fourth report updated the third one with 1997 data and completed it with the presentation of a **full NAMEA** and an analysis of the variations over time.

The main differences between the Danish water NAMEA and Eurostat's framework for water accounts are that the Danish data include seawater (mainly used for cooling) and that an important focus of the Danish accounts is on the types of water use by industries and households.

GERMANY

In Germany, within the framework of the environmental accounts a comprehensive system has been developed which calculates the flows of different materials in the economy (MEFIS). In this framework, physical flows of raw materials, of goods and of residuals are illustrated from their withdrawal from nature to their discharge back into nature. Flows of water and wastewater are elements of this description.

With regard to **wastewater**, the 1997 report was based on the German MEFIS and PIOT (physical input-output tables) systems. It included data on wastewater for 1991 and data on the economy of water as well.

The 1998 report on water accounts included extensive **water flows** tables for 1995, covering almost all tables proposed by Eurostat's Task Force on water satellite accounting. These efforts were continued and a 2000 paper included a time series for aggregates for the former territory of the Federal Republic of Germany from 1960 to 1991 and for all of Germany from 1991 to 1995. In the future, these data will be updated. They concern water withdrawal from and discharge back into nature by industries and households. Further, information is available regarding direct and indirect discharge of water.

GREECE

For Greece**, water supply-use tables** in cubic meters were combined with symmetrical input-output tables in the NAMEAs for 1988 to 1996.

SPAIN

As far as data were available, INE has filled in **almost all the proposed tables** for 1995. The only tables not filled in were Table 4 regarding expenditure for ancillary water-related activities and tables 10 to 12 regarding polluting substances. All other aspects of the tables have been covered as far as possible. In a second trial, covering years 1997 to 1999, tables 4 and 12 have also been completed, based on the results from new surveys.

FRANCE

The French study on water investigated the feasibility of establishing **regional wastewater emissions** accounts. The study tested the results of a model estimating wastewater and pollutants emitted by industry against actual data at the experimental level of the Loire-Bretagne hydrological basin in 1997. An extension of the work to all of France is foreseen as part of future work. Estimations were based on the collection of

individual data and on a modelling developed at NUTS 3 level. This modelling authorises more 'homogeneous' (local) water accounts. The focus of the report was on emission of pollutants, thus on Tables 10 to 12 of the tables proposed by Eurostat.

In the absence of the data necessary for a sophisticated calculation, the French report on **quality accounts** for watercourses was based on a simplified method developed by IFEN. The pilot application of this simplified method was carried out at the level of drainage basins for all of France. A summary of the method could be: stretches of watercourses are classified by water quality, and the volumes of water flows are converted into a standardised derived unit of 'kilometres of standard river'. For each drainage basin, quality accounts, which are comparable at the national level, are produced by weighting the qualities of kilometres of standard river. The advantage of this simplified approach would be that the data are readily available and the costs are relatively low. For each basin, quality indicators have been presented for organic matter, nitrate and eutrophication, showing the overall quality of the basin. These indicators can be aggregated to overall quality indices on the national level. The results can be presented in tables or maps.

IRELAND

The first report for Ireland included an assessment of 1994 levels of nitrogen and phosphorus **emissions** into the soil from fertilisers and livestock waste in the agricultural sector, as well as data on emissions of BOD, N, P, and other eutrophication substances (in tonnes and in eutrophication potential) by industry.

In the second report, the method for calculating **wastewater** has been revised compared to the report for 1994. Quantifying industrial sources and volumes of BOD discharges, the results were allocated to main geographical areas and water recipients. The industrial breakdown is quite aggregated.

The aim of the third report was to link physical data with **economic information** on services related to water, in particular costs and revenues. Information was available for public water services and displayed the 'subsidies' granted to different sectors (household consumption, in particular, is now 100 percent subsidised). Another issue was the availability of information at a river basin level (as required in the Water Framework Directive). For this, local authorities have been surveyed.

LUXEMBOURG

The Luxembourg reports included a short **feasibility study** regarding NAMEA accounts for water. Possible future water accounts will deal with abstraction of underground and surface water, emissions to water and sewage treatment. Data on water abstraction allocated by industries could be obtained by bringing together dispersed data, but wastewater emissions could only be allocated to each industry by rough estimations. Finally, there was a lack of available data for connecting economic agents with sewage treatment activity.

THE NETHERLANDS

For the Netherlands, the NAMWA report included 1991 data on water abstraction, on emissions of pollutants to water and on economic activities related to water. The pressures of economic activities on all water systems were captured by a number of **environmental pressure indicators**. **Expenditures** related to water management were explicitly shown as well as wastewater emissions in inhabitant equivalents and emissions of nutrients, BOD, heavy metals to water bodies. Other **monetary data** regarding water were also included, i.e. sales and purchases of tap water, costs of internal environmental cleansing services related to wastewater treatment, taxes related to water pollution and to water abstraction.

AUSTRIA

The report from Austria showed **wastewater** emissions (partly based on information regarding water consumption) for 1994. Emissions of wastewater were shown in cubic meters and pollutant loads in tonnes. They had been calculated partly through emission coefficients and partly through measured data for main polluting activities. The report emphasised the fact that the results are rough estimates.

PORTUGAL

Many types of actors operate in the water sector in Portugal since there are several co-existing organisations: municipal services, public enterprises run by municipalities, private enterprises with public service concessions, associations (in the irrigation water domain), etc.

For the building of the 1998 pilot water accounts, two governmental bodies specialising in water policy, the Water Institute (INAG) and the Institute of Hydraulic and Rural Engineering and the Environment (IHERA),

could provide a lot of data to the national statistical institute of Portugal (INE). These sources were complemented by economic data currently available, notably through the Annual Industrial Production Survey. Finally INE carried out a specific survey of the municipalities.

Portugal tried to fill in most of the tables suggested by Eurostat's Task Force. A number of gaps were identified. Notably, it has not been possible to provide information on ancillary water-related activities. Some inconsistencies between sources were also identified. INE has now entered into specific protocols in order to regularly exchange information on water with relevant bodies of the Ministry of Environment.

FINLAND

In the first Finnish NAMEA (for 1993) **wastewater** in inhabitant equivalents was shown, using the Finnish industry classification.

The 1999 report gave a time series for 1985, 1989, 1990, 1992, 1993 and 1995, including data on wastewater, phosphorus and nitrogen. The economic part was based on the input-output system of the national accounts. The environmental data, supplementing the economical data, focused on nutrients and organic pollutants (in BOD_7). The report considered two related environmental themes: eutrophication and wastewater production and showed industrial profiles for specific industries. Finally, an assessment was supplied as regards the NAMEA framework and its feasibility in Finland.

The tables for 1985 – 1993 were compiled according to the Finnish Standard Industrial Classification (SIC-95), based on the NACE Rev.1 classification. The preliminary tables for 1995 differed from previous years because they were compiled according to the European System of Accounts (ESA95) and used a slightly different industry classification.

SWEDEN

In the Swedish report, the focus was on water in the so-called '*technosphere*' and **most of the tables** proposed by the Task Force on Water Accounting were filled in. The accounts connected physical and monetary data about the use of water and the treatment of wastewater. The data referred to 1995. Some attention was paid to the different uses of water, which were presented according to their purpose. Water used for cooling water, including seawater, was included.

UNITED KINGDOM

The United Kingdom carried out an extensive investigation regarding the possibilities of producing water resource and water pollution accounts.

A first draft of water accounts had been developed for England and Wales in 1998. It included a **water resource account** (natural + economic flows of water), abstractions and discharges by industry and some preliminary data for emissions of substances into controlled water. Built at an aggregated level, it was seen as a starting point for future developments.

A second study concentrated more systematically on **estimates of emission coefficients** (emissions per unit of gross output or per employee) for BOD, nitrates, phosphates and two heavy metals. The results regarding emissions of substances by industries must be viewed as preliminary. Further work is planned and the expectation is that the preliminary results will have to be revised substantially.

NORWAY

Within the NOREEA project (phase 2), two aspects regarding water have been studied: **emissions of pollutants** to water (19 types of heavy metals, phosphorus and nitrogen) and **economic information on the public wastewater sector**.

The Norwegian Pollution Control Authority (SFT) maintains a register of discharge licences which constitutes a major source of information. There is however a double counting problem to solve when firms discharge their wastewater into the sewage system, because emissions are also separately measured in the discharge by wastewater treatment plants.

Two sources have been used to assess public expenditures on wastewater (SERIEE-type analysis): a yearly survey of municipal wastewater treatment plants and the economic accounts of the 435 Norwegian municipalities. A new municipal reporting system will avoid discrepancies and new developments are expected from it, notably a better identification of the transfers between different administrative units.

2 Sources and methods

2.1 The water economy

2.1.1 Exercise suggested by Eurostat

2.1.1.1 Pilot tables to be filled in

The first four tables of the set of pilot tables (see Annex 1) are expressed in monetary terms and can be considered as extracts from ESA, with greater detail: more than 6-CPA-digit products, isolation of environmental taxes or subsidies, of costs of ancillary activities related to water, etc. Pilot table 13 regarding prices is also described in this section.

Pilot table 1: Supply table of water-related products

The purpose of this table was to report the *major economic outputs related to water* (as well as imports): production of drinking, non-drinking, irrigation water, production of sewage removal and treatment services.

Minor economic activities involving water were proposed to be reported only **optionally** or as second priority (in the last column 'minor products', to be defined during the exercise). They aimed, for example, at controlling water flows, including fighting against flooding, treating polluted water bodies or surveying the quality of water, etc.

However, when some of these 'second priority' activities are carried out mainly for water supply or wastewater treatment, attention should be paid to the delimitation of NACE 41 or 90: depending on the organisation of the water management in a country, or even in a region or district, some activities can be carried out by government units and classified as 'public administration and defence services activities' (NACE 75). For example, there is a danger that building a dam to create an artificial reservoir is recorded as fixed capital formation either by producers of distributed water (NACE 41) or by administrative services for water supply (NACE 75). To ensure comparability between countries from this point of view, it was decided to include as first priority the activities of public administration services regarding water supply and sewage operations, too.

The bulk of the (market or non-market) supply of water-related products should be recorded in rows 01*, 41, 75* and 90* and the rest of the table should be practically empty. However, any other activity may also produce and sell water or water-related services as a secondary activity. For instance, an enterprise producing chemicals may have built its own treatment plant and may offer neighbouring enterprises or municipalities to treat their wastewater against some participation in the costs.

In pilot table 1, the transition between the value of output at basic price and at purchaser's prices is detailed in order to show taxes and subsidies on products and within these the environmental ones.

Pilot table 2: Use table of some water-related products

Pilot table 2 is also a re-composition of ESA accounts. While pilot table 1 presents the conventional supply side of economic products, pilot table 2 reports the use side of the same products: practically all industries and households are users of drinking water and of wastewater removal and treatment services, while generally only industries use non-drinking water. Most probably, only farmers use the product 'operation of irrigation systems' (row A*).

The proposed detail regarding industries was considered provisional. As users of large volumes of water are not necessarily those who pollute it much, another solution could have been to draw two tables with different industry classifications: one focussing on water supply, the second on water treatment. To ensure consistency between the tables, the same level has been kept in the different tables although, depending on the tables, only some rows or columns have to be filled in.

Government and NPISH (non-profit institutions serving households) have been introduced as possible consumers, in order to cover the case that they produce non-market services (e.g. the monitoring quality of water bodies) which enter their final consumption expenditure.

Changes in inventories, which is a classic component in ESA supply-use tables, is probably insignificant. This row corresponds to water already prepared and stored in the distribution networks (e.g., in water towers).

Pilot table 3: Economic accounts for some water-related economic activities

Pilot table 3 has also been built according to ESA definitions and concepts but more detail is needed in comparison to ESA. The table is a reformatting of the standard ESA production and generation of income accounts for the main water-related activities. The table is actually a multiple table. It should be filled in at least for the 4 major water-related activities:

- operation of irrigation systems,
- production of distributed water,
- production of sewage removal and treatment services,
- production of administrative services for water supply and sewage systems.

Furthermore it was recommended to produce, if possible, more tables to separately cover the different types of water supplied (drinking, non-drinking) and the different stages of the production process:

- abstraction (e.g. activity of pumping), purification (filtration, chemical separation, etc.) and distribution (transport network) for NACE 41;
- collection of wastewater (network), treatment (de-pollution in treatment plants) and discharge (back to water bodies) for NACE 90.

Accounts for minor activities (such as the monitoring of the quality of water bodies) were proposed as one-off exercises to obtain a rough idea of the economic importance of such activities.

In the columns, producing units are grouped together by institutional sectors (ESA definitions), however NPISH and households may be rarely met in practice, and are only included for the sake of completeness.

Government may grant subsidies for the coverage of current expenditure (row 2.3: e.g. subsidies for pollution abatement) or investment grants to support new investment (row 4: e.g. financing of a new treatment plant).

Pilot table 4: Expenditure for some ancillary water-related activities

The pilot table 4 records the costs of ancillary (for own final use) water-related activities. These costs consist in compensation of employees, intermediate consumption, other taxes less subsidies on production paid for the direct extraction of water and own treatment of wastewater and consumption of fixed capital. The table is also a multiple table. It records information more or less similar to that in table 3 but for activities carried out:

- by an industry as an ancillary activity, i.e. for its own account and not for sale. For instance, under this category could be recorded the direct abstraction of water from a river by a manufacturer of basic metals for cooling purposes, or the operation of industrial wastewater treatment plants.
- by households for their own use. In this case, the interest is e.g. to know the costs of operating equipment for self-supply with water and of individual septic tanks in rural areas.

The activities under review are the same as in pilot table 3 except for the distribution of water and collection of wastewater which disappear, and internal recycling activities which is added.

The required information is not generally available through classical surveys on enterprises and households, except as concerns wastewater management through the SERIEE system (the European system for the collection of economic data on the environment). Specific surveys should be carried out for water self-supply.

The ‘second priority’ columns were considered as optional, as it was felt that they would probably necessitate a lot of estimations.

Table 13: Average purchasers' prices of some water-related economic products

This table is simply derived by dividing pilot table 2 (use table in monetary terms) by pilot table 6 (use table in physical terms). The results are average prices that allow comparing prices across industries and countries (or regions, according to the geographical level at which these tables have been built).

A similar table could be built to evaluate average costs of ancillary activities, if the tables needed for the calculation (pilot tables 4 and 7) have been entirely filled in. A summary table of all costs (main, secondary and ancillary activities) could also be built. This has not been done during the pilot exercises.

2.1.1.2 Participating countries

10 countries volunteered to test (at least partially) the economic part of the set of pilot tables.

Table 2.1-1 Countries that participated in the topic 'water economy'

	B	DK	E	F	IRL	NL	P	FIN	S	NO
Pilot table 1: economic supply table										
Irrigation			yes				yes			
Distributed water (CPA 41)	yes	yes	yes		yes	yes	yes	yes	yes	
Wastewater services (CPA 90.00.1)	yes	yes	yes		yes	yes	yes		yes	
Administrative services			yes		yes	yes	yes		(yes)	
Pilot table 2: economic use table										
Irrigation			yes				yes			
Distributed water (CPA 41)	yes	yes	yes		(yes)	yes	yes	yes	yes	
Wastewater services (CPA 90.00.1)		yes	yes		(yes)	yes	yes		yes	
Pilot table 3: economic accounts										
Irrigation			yes	yes						
Water supply (NACE 41)		yes	yes	yes	yes	yes	yes	yes	yes	
Wastewater management (NACE 90*)			yes		yes	yes	yes		yes	(yes)
Administrative services			yes			yes	yes			
Pilot table 4: expenditure for ancillary activities					(yes)					
Irrigation			yes							
Water supply (NACE 41)			yes						(yes)	
Wastewater management (NACE 90*)			yes			yes			yes	
Pilot table 13: implicit prices										
Irrigation			yes				yes			
Distributed water (CPA 41)		yes	yes		yes		yes		yes	
Wastewater services (CPA 90.00.1)		yes	yes		yes		yes		yes	

Pilot tables 1 and 2 for the supply and use of distributed water have been included in the studies by Belgium, Denmark, Spain, Ireland, The Netherlands, Portugal, Finland and Sweden.

In most of these countries, monetary information regarding wastewater services (CPA 90.00.11 Sewage removal and treatment) has been included too. Denmark, Spain and Portugal have also included data on average purchasers prices of distributed water and of wastewater services (pilot table 13). Ireland has also provided information on prices, but on a different basis (local prices).

Pilot table 3: economic accounts. Spain, The Netherlands, Ireland, Portugal and Sweden have included detailed monetary data on expenditure related to water distribution and to wastewater treatment. Denmark, France and Finland supplied partial data. Norway also made a trial to identify costs but on a field limited to the public wastewater sector. Improved monetary data related to water will in future be available as a consequence of the implementation of ESA 95 in all Member States.

Pilot table 4: expenditure for ancillary activities in relation to water, e.g. expenditure related to direct abstraction of water by agriculture or treatment of wastewater by manufacturing industries. Sweden and The Netherlands included data on the treatment of wastewater that came from surveys on the expenditures by industries for the protection of the environment. Spain carried out different surveys, depending on the activity of the enterprises and some (aggregated) data are also available for this country.

The methods and sources used for filling in the tables will be presented first by theme (supply-use tables, production accounts, ancillary costs) and then by type. The different types of methods and sources that will be distinguished are:

- **surveys**: economic units are asked about their behaviour as regards water-related issues. These surveys can be specific, i.e. made with the aim of a better knowledge of economic water uses, or

general, i.e. with questions about water included in a multipurpose questionnaire (for instance, surveys gathering Structural Business Statistics). In some cases, these surveys include physical measurements.

- **use of administrative data**: information about water is a by-product of administrative records collected for other purposes: for instance, the turnover of enterprises producing water-related services can be derived from the yearly declaration of these enterprises to the tax offices. A particular case of administrative data is the analysis of the content of licenses or taxation registers (licenses to abstract water or to discharge wastewater, taxes on water abstraction or water pollution, etc.).
- **enterprise environmental reports**: in some countries large enterprises produce environmental reports in parallel to their annual economic accounts from which information about water is derived.
- **application of coefficients**: a certain behaviour of the economic units has been observed in the past, or on a small population to be extrapolated (monographs), or has been noted in the literature: the economic units with the same characteristics are supposed to have a behaviour directly linked to another economic variable, for instance the same consumption of litres of water per euro of turnover. In a way, this method is very close to the survey method but is based on a weaker foundation.
- **modelling**: this method is similar to the method of coefficients but is more sophisticated in the sense that several variables are used and that the link can be non-linear.
- **mixed methods**: in a large number of cases, the information given by one method is insufficient and has to be completed: for instance, for manufacturing industries survey results are available, coefficients are used for the services industries and a model is applied to agriculture.

2.1.2 Compiling supply-use tables

2.1.2.1 Use of administrative data: DENMARK

The water industry in Denmark is considered as providing a good, 'tap' water, which is charged according to the volume metered, and two kinds of services: the renting of meters to households and industries and the connection of new users to the distribution system. Wastewater collection and treatment are charged together with the water and in most cases according to the volume of water. Both the price of tap water and the price of sewage have a strong regional dependence.

The main data treatment carried out during the pilot study essentially consisted in establishing a matching between information on the water prices available for each municipality in the Danish Water Supply Association (DVF) and information on the reimbursement of a water tax to individual enterprises. This matching used the geocode of each enterprise.

Statistics Denmark's publication on the use of drinking water[18], based on reports by the counties was also used in this process of estimating total uses, households uses, own use by the water production and distribution units (filter back-washing) and distribution losses.

The DVF data

The DVF has very detailed data at the level of municipalities. It covers 125 municipalities, i.e. 45 % of all municipalities in Denmark and 67 % of the water distributed. For each municipality, the DVF has data on:

- the number of inhabitants in the area of distribution,
- the abstraction and consumption of water,
- a distribution pattern between three different types of consumers: households, industries and 'institutions',
- an estimate of the losses,
- the different elements of the price: unit price for water, renting of the meters and connecting fees
- water taxes,
- sewage taxes for private households,
- and, finally, investments in new plants.

[18] Forbruget af drikkevand 1997

DVF data were used to obtain data on prices covering all 276 municipalities. The regional location has been supposed to be the primary determinant for the prices and missing municipalities were attributed the average price of their region, determined by their geocode.

The water tax reimbursement file

The second data source was the reimbursement file on water taxes. Tap water is taxed at a uniform rate (4 DKK/m^3 in 1997), and most industries qualify for reimbursement of their water taxes. It is therefore possible to convert the reimbursements into physical uses. Data on each of these companies' reimbursements, in combination with information on the appropriate industry have been used to determine the total use of tap water by industry. The quantities were directly assessed from the taxes and the price was known through the company's location and the DVF data. As a result of this exercise, a preliminary physical and monetary use account concerning tap water and sewage was obtained for 98 out of the 130 industries in the national accounts system.

Other sources used

The third data source, which was used for industries not qualifying for the reimbursement of their water taxes, was employment data. Most of these industries only use water for their employees' personal needs, and a use of 10 m^3 of water per year per employee has been assumed. For more water intensive industries such as hospitals, schools etc. the number of employees was increased by the corresponding number of patients or pupils.

The next step consisted in allocating the fixed payments for metering and for the connection of new users: the determination of the fixed payment amount depends on two factors: first, on the municipal location of the unit, and secondly on the unit's peak demand for water.

- The fixed payment part for households was estimated by using the information available in Statistics Denmark's Central Register of Buildings and Dwellings, (BBR). A rate was attributed to each of the 8 categories of homes listed.
- For companies, an appropriate size of meter was assigned according to the amount of tap water used.

Physical and monetary supply-use tables were then available for all economic products of NACE 41 and 90.

2.1.2.2 Use of surveys: BELGIUM and SPAIN

BELGIUM

In Belgium, the integration of economic and environmental data is essential for sustainable development policy. Water management is faced with both quantity and quality problems: abstraction (including for cooling) is around 43 % of total available fresh water resources, but 80 % of groundwater resources. And only 28 % of urban wastewater is treated, which exacerbates pressures on surface water.

A feasibility study, made in 1999, concluded that data harmonisation work among regions was necessary before being in a position to compile national data. In 2002, a first set of NAMEA-type accounts for water was completed with 1998 as the reference year.

The 'Structural Business Survey' (SBS) was used to build the supply as well as the use side of the supply-use table for water collection, purification and distribution activities. The SBS distinguishes, within the detailed turnover of NACE 41, between sales to electricity producers, to water distributors, to 'other industries' and to domestic users. For most of the 'other industries', the SBS also gives information on the purchases of water by enterprises. The results from this survey were extrapolated by applying a ratio relating purchases of water to total purchases. The difference between total sales of NACE 41 to 'other industries' and purchases by the 'other industries' covered by the SBS was distributed between non-covered industries according to their total intermediate consumption.

It must be noted that an important part of water is exchanged between NACE 41 units. Some operators distribute to end-users water that they purchase from other producers. In order to avoid double counting, these exchanges have been excluded.

As concerns wastewater services, only the total output was available, without any breakdown by categories of users.

SPAIN

As recalled in the Spanish report, "*Water is a vital natural resource for a country's economic development. Because Spain has based its economic and social structure on a strong agricultural sector within which irrigation farming is always on the increase, and a powerful tourism sector in which sun and water are crucial, the future development of these sectors is closely tied to the availability of water when it is needed and where it is needed."*

This statement explains the importance of water in the Spanish economy, which, contrary to most of the North-European countries, also suffers from periodic draughts. Information on water management is therefore a priority, and Spain has tried to build as many of the pilot tables as possible.

Water supply and wastewater services were separated. Economic pilot tables and pilot tables 5 to 7 on flows of water (see section 2.2 below) were filled-in in parallel. Furthermore, Spain also carried out a trial to capture the overall costs of the services provided by the government (water-related administrative services in pilot tables 1 and 2).

Water supply

The main statistical source used for drawing up the supply-use table for distributed water is INE's[19] survey of the supply and treatment of water[20]. Supplementary information from the following surveys is also used: the survey of industrial enterprises[21], the survey of the use of water in industry[22] and the survey of the use of water in services[23]. The data from these surveys allowed transactions to be valued according to the accounting standards of the ESA. Water abstraction, production and losses, expressed in cubic metres, were also estimated using the non-monetary survey data.

In particular, the surveys of the use of water in industry and in services provided information on the use of water distributed through public water supply networks to the respective industries, giving intermediate consumption in monetary terms and use of water in cubic metres.

Water abstraction for own use and discharges into the environment by industries in cubic metres were estimated using the data from the surveys on the use of water in industry and in services.

Public wastewater services

The main data source is INE's survey of the supply and treatment of water, although information from the following surveys is also used: the survey of sewage and refuse disposal[24], the survey of the use of water in industry and the survey of the use of water in services.

Discharges, expressed in cubic metres, are estimated using the non-monetary data from the survey. A study entitled 'Aguas residuales industriales' (industrial wastewater) by the COTEC Foundation permitted a check of the reliability of the results obtained.

Water-related administrative services

The output of activities carried out by public administrations units providing services relating to water (Directorate-General of Hydraulic works and Water Quality and Directorate-General of Rural Policy -irrigation plans) has been derived from the annual reports on the *Public sector expenditure on environmental protection*, Ministry of the Environment and from the *Yearbook of the Ministry of Internal Development*.

19 Instituto Nacional de Estatistica

20 *Encuesta sobre en suministro y tratamiento del agua*

21 *Encuesta de Empresas Industriales*

22 *Encuesta sobre el uso del agua en la industria*

23 *Encuesta sobre el uso del agua en servicios*

24 *Encuesta de saneamiento público*

2.1.2.3 Mixed methods: Portugal and Sweden

PORTUGAL

In Portugal, different sources were used to build the monetary supply-use tables: general government statistics (administrative data), industrial statistics (survey) and, as regards irrigation water, data from IHERA (Institute of Hydraulic and Rural Engineering and the Environment).

Supply-use tables for CPA products 41.00 and 90.00.11 were already available from the framework of the national accounts.

The supply-use tables for water-related administrative services were built on the basis of an identification of the administrative units carrying out these activities.

The supply-use tables for irrigation systems were based on a survey of the "associations of beneficiaries" that IHERA yearly carries out. These "associations of beneficiaries" run irrigation systems in the areas under State agricultural development projects. These projects do not cover the entire irrigated area. Information on private or local irrigated areas was not available. The survey by IHERA includes monetary data.

SWEDEN

In Sweden, as in many other countries, water and wastewater services are charged together, and in the national accounts, for the market production, water and wastewater services are mixed together. The data sources used are total supply of water and wastewater services from the Swedish association of water and wastewater services producers (VAV) and an old edition of 'Statistics of intermediate consumption', as allocation key to break down the uses between the different NACE codes.

After discussion with national accounts services, it was decided that these estimates were less reliable than calculations based on physical information on the use of water, as collected during this pilot study. National accounts will be able to use this information in the future.

Two procedures were applied, depending on the nature of the goods and services produced: Sweden went a step further than Denmark, since ancillary costs have also been estimated (see section 2.1.4).

Four different sources with monetary data have been analysed and used for the pilot study:

- Information from national accounts;
- Data collected by VAV;
- The survey 'Municipal accounts 1995', by Statistics Sweden;
- The survey 'Environmental protection expenditure in industry, 1997', by Statistics Sweden.

The general procedure can be summarised as follows:

a. Total expenditures were taken from VAV.
b. The expenditures were broken down by NACE with the help of the physical use of water by each NACE. Adjustments were necessary: rather big amounts of water are lost through the water network and public waterworks have their own use of water. The information on the distribution of uses within the manufacturing industry was rather good, while a detailed distribution outside the manufacturing industry has been much more difficult to make.

2.1.3 Compiling production accounts

2.1.3.1 Use of surveys only: Spain

The same main statistical source used for drawing up the supply-use tables for distributed water, i.e. INE's survey of the supply and treatment of water, was used for constructing the production accounts of the water-related activities.

2.1.3.2 Mixed methods: Ireland, Norway, Sweden and Portugal

IRELAND

In Ireland, the exercise was more particularly viewed as a preparation to the implementation of the future European Water Framework Directive. Two sub-objectives were pursued: (1) to be able to associate discharges to water and uses of water services, in quantities, with the economic activities and (2) establish the costs and revenues arising from water services.

The information on water comes from several different sources, built for different purposes. One conclusion of the report is that considerable possibilities exist for exploiting these sources better with minor alterations to the existing information system.

The different sources used were:

a. The Environmental Protection Agency (EPA) database on discharges to water.
b. The national accounts in the Irish Central Statistical Office (CSO) for information on public water services for both water supply and wastewater services. In this area, the national accounts are themselves largely based on information coming from the Department of the Environment & Local Government (DoELG).
c. The Census of Industrial Production, especially a questionnaire, Form W, which collects detailed information on the value of the output and on the costs of inputs and labour.
d. The more specific addition of the pilot study was the specific survey of individual water authorities on a limited area (Greater Dublin).

NORWAY

The public (municipal) sector accounts for the majority of wastewater treatment in Norway. There are also private industrial treatment plants of various types and sizes and some private treatment plants that serve small numbers of households. Economic information on these types of installations is not easily available and for this reason Norway focused on the public wastewater sector.

Two sources were used for the public (municipal) wastewater sector:

- The annual municipal wastewater survey conducted by Statistics Norway (SSB) in co-operation with the Norwegian Pollution Control Authority (SFT), which includes questions regarding investment and running costs since 1993[25].
- The economic accounts of the 435 municipalities reported to Statistics Norway and used for compiling the national accounts. These economic accounts are currently being revised.

A general comparison has been made between the SSB/SFT survey information and the 'old' municipal economic accounts data. For some municipalities there is a reasonably good agreement between these two sets of data but not for others. There are a number of possible reasons for these discrepancies. A major difference lies in the level of detail with which the financing of investments is being reported. The data obtained from the annual survey are generally more complete than the municipal account because of greater detail. However, some municipalities reported budget data and not actual expenditure. Another problem are the transfers between different levels of general government, which are not available in the survey.

The study was a good test for the application of the new reporting system of municipal accounts.

SWEDEN

The same sources as in the building of supply-use tables (see section 2.1.2) were used, i.e. the data collected by VAV and the survey 'Municipal accounts 1995' by Statistics Sweden.

VAV annually collects information on production costs for distributed water and wastewater treatment. Main problems are that not all municipalities report their costs to VAV and that some municipalities buy water and/or wastewater treatment services from inter-municipal enterprises. Some adjustments had therefore to be made. The breakdown of the production costs between distribution of water and wastewater treatment is about 40/60, a proportion that is rather stable over time and across municipalities, according to VAV. It might be used as a distribution key for splitting expenditure in national or municipal accounts.

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[25] Capital costs are calculated using an annuity method: a specified interest rate (with a 1% risk premium added) and depreciation of the investments over a 20 year period (excluding subsidies).

The fact that the revenues do not fully cover the costs was clear from the municipal accounts for the function water and wastewater. About 7 percent of the total production costs are not covered by the diverse fees and revenues.

The different sources did not exactly match. Production costs amounted to 9 307 million SEK in the municipal accounts against 10 108 million in the VAV data. One possible explanation for this difference is the treatment of replacement investments. These costs are included in VAV production costs, whereas at least those financed via the capital budget are treated as capital formation in the municipal accounts. Another possible reason could be that inter-municipal enterprises are incorporated in VAV data.

PORTUGAL

The information necessary for compiling the economic accounts for water-related activities mostly comes from the national accounts which are built with great detail in Portugal: accounts are available for each industry and also by institutional sector. The information regarding NACE 41 and 90* was therefore already available.

As water-related administrative services do not match a CPA product, the corresponding accounts could not be extracted from the national accounts and administrative units carrying out these activities had to be identified one by one for the generation of the related economic accounts. Investment grants were also estimated this way since only specific administrative units are entitled to grant such subsidies.

It has not been possible to build such accounts for irrigation systems.

2.1.4 Estimating costs for ancillary activities: The Netherlands and Sweden

For this kind of information, only one method was applied by the two testing countries. Spain also partially filled in the pilot table 4.

THE NETHERLANDS

Most of the economic transactions included in the NAMWA come from the detailed regular national accounts.

However, some estimation had to be made for ancillary wastewater treatment activities (internal environmental cleansing services). A CBS study[26] provided statistics on environmental costs broken down by domain for all enterprises with 20 or more employees in the mining, manufacturing industry and public utility sectors. The internal costs for water treatment were grossed up to take into account the smaller enterprises and further supplemented with data on other industries provided by the environmental cost model (RIM) of the National Institute of Public Health and the Environment. As this model only provides an inventory of environmental protection facilities and does not give very reliable data on the corresponding costs, the NAMWA data should be considered as a preliminary estimate for the internal expenditure for wastewater treatment.

SWEDEN

Two different approaches were used, one for the industries' wastewater treatment ancillary activities and the second for water abstraction for irrigation.

Industry

For wastewater, the 1997 survey of environmental protection expenditure in industry gives current and capital expenditure by enterprises, including expenditure aiming at reducing emissions to water. Current expenditure includes both payments for external services (municipal wastewater treatment) and in-house expenditure for energy, chemicals, labour, etc. related to own treatment.

Purchases of external services have probably been underestimated, partly because the wastewater part is difficult to isolate from the water part.

[26] Milieukosten van bedrijven 1991

Agriculture

The main source used was the report 'Irrigation 2000'. An extensive survey on irrigation in Sweden was carried out in 1985. In 1991, the Swedish National Board of Agriculture got an assignment to investigate the future need of irrigation in agriculture and a questionnaire was sent to about 800 farming enterprises. Only limited changes were observed in comparison with the 1985 results. Two main elements introduce some variation in the costs for irrigation: the proportion of variable and fixed costs and the origin of the water abstracted (surface or groundwater).

2.1.5 Comparison of the methods

Preliminary conclusions of this examination of the methods used by the countries in order to build the 'economic' part of the framework, are the following:

- The choice of the method depends on the organisation of the national water management system. In countries where the water supply and wastewater management are under the responsibility of the municipalities, data could often be collected through these municipalities' normal accounts. When taxes related to water use exist they generally provide a useful source of information.
- Supply-use tables of water products in monetary units are generally drawn up in parallel with corresponding tables in physical units. It means that pilot tables 5 and 6 of Eurostat's framework (supply-use tables in m^3) will often be straightforwardly built.
- The collection of costs of ancillary activities related to water need a specific survey. For wastewater management such surveys often exist, and will be further developed for the purpose of SERIEE and within the Structural Business Statistics Regulation. This is not the case for self-supply of water, except for irrigation in some countries.
- New methods were tested and new results obtained that could also be used for the national accounts.

2.2 Volumes of water flows

2.2.1 Exercise suggested by Eurostat

As indicated in section 1.2.1, the objective of set of pilot tables was to put in parallel monetary and physical information on water. Therefore, the second sub-set of pilot tables (tables 5 to 9) records the physical flows corresponding to the monetary transactions described in the first sub-set of pilot tables (tables 1 to 4). All tables presented in this part are therefore expressed in cubic metres.

2.2.1.1 Tables to be filled in

Pilot tables 5 and 6: Physical flows of water corresponding to economic transactions recorded in pilot tables 1 and 2

These tables are the replicas in physical units (m^3) of pilot tables 1 and 2. The only exceptions are the pure monetary rows of pilot table 1 (taxes and subsidies) which have been eliminated in pilot table 5. Water-related administrative services and minor (optional) activities recorded in the last column of pilot tables 1 and 2 are generally difficult to translate into volumes of water and no physical data have been asked, even optionally, for these activities.

Activity 41, as well as activity 90* include several intermediary activities, for which different corresponding flows of water can be recorded.

- NACE 41 abstracts water from the environment, purifies it and distributes it to industries and households.
- NACE 90 collects wastewater from industries and households, treats it and discharges it back to the environment.

Flows of water to be recorded in pilot tables 5 and 6 are the physical counterpart of the economic transactions, i.e. flows of water delivered to users (corresponding to sales and purchases) for the supply and uses of NACE 41 products and flows of wastewater collected by the sewage network for the supply and uses of NACE 90* products. In order to get a more precise description of wastewater services, in the pilot table 5, a column also asks for the volumes of water that enter the wastewater treatment plants.

Flows of water between the economy and the environment will be studied through pilot table 7 (abstractions and returns). Leaks, losses, or additions (e.g. rain water drained into sewers) are described in the reconciliation pilot table 9, which presents a complete balance of water between economy and hydrological system.

Pilot table 7: Total abstraction of water from the water bodies and total discharge of wastewater directly into the water bodies

These flows correspond to the initial flows (abstraction) for the production of distributed water and the final flows (discharges) for the wastewater removal and treatment services.

The columns of the table correspond to the **OECD/Eurostat questionnaire** categories of water resources (surface water, groundwater, other water) and flows between economy and environment (abstraction, discharge and return). These definitions have been given in Section 1.1.6.

In order to keep consistency with the previous tables, abstractions and discharges of water for purposes other than use, in particular for actions taken against undesirable water (water pumped from mines and drainage water, etc.) are not included in the table.

Two exceptions were made because of measurement problems and because monetary counterparts are included to some extent in the pilot tables 1 to 4:

- leaks and losses in the distribution network: costs of extracting water that is subsequently lost participate to NACE 41 costs of production,
- rain water drained and discharged into wastewater sewers, which influences the NACE 90* costs of production.

Estimates are often necessary as regards direct discharges by industries and households as these are less well known. When wastewater is discharged by these users, it may either run off (to surface water) or infiltrate and later join either a surface or a groundwater body. In certain cases, it may also evaporate and thus should not be considered as discharged but as consumed. When estimates are difficult to make, a column 'unknown' can be added in pilot table 7.

Pilot table 8: Abstraction from the water bodies for the preparation of drinking water

Objective of this pilot table was to introduce different quality classes for surface and groundwater at the time of abstraction. Practically, the issue of water quality fell outside the pilot tables tested.

Pilot table 9: Balance of flows of water between economy and water system

This table synthesises pilot tables 5, 6 and 7 and adds reconciliation flows. It calculates, as a balance, the consumption of water by each industry. Two additional data sets are required, in relation to previous pilot tables:

- leaks and losses at the different steps, notably in the networks,
- rainwater drained in towns, which is sometimes collected by the sewerage networks and thus added to the wastewater discharged by households and industries.

2.2.1.2 Participating countries

Table 2.2-1 Countries that participated in the topic 'volumes of water flows'

	B	DK	D	EL	E	IRL	NL	A	P	FIN	S	UK
Pilot table 5: water/wastewater supply												
Irrigation water					yes				yes			
Water delivered	yes	yes	yes	yes	yes		yes		yes	yes	yes	
Wastewater collected	yes	yes	yes		yes		yes		yes		yes	
Pilot table 6: water/wastewater use												
Irrigation water					yes				yes			
Water received	yes	yes	yes	yes	yes		yes		yes	yes	yes	
Wastewater discharged to sewers	yes	yes	yes		yes		yes		yes		yes	
Pilot table 7: water abstraction/discharge												
Water abstracted from nature		yes	(yes)		yes		yes		(yes)		yes	yes
Wastewater discharged to nature	(yes)	yes	(yes)		(yes)		(yes)	(yes)	(yes)	(yes)	yes	yes
Pilot table 9: reconciliation flows												
Leaks and losses		yes	yes		yes	yes			yes		yes	
Urban drainage			yes								yes	

With more or less detail, pilot tables 5 and 6 have been filled in by Belgium, Denmark, Germany, Spain, the Netherlands, Portugal and Sweden for the two main products considered, i.e. distributed water and wastewater services. Data on supply and use of marketed irrigation water have also been provided by Spain and Portugal.

Finland and Greece supplied data only for water supply. Portugal could not deal with water-related ancillary activities. Therefore, in tables 7 and 9, only flows linked to water-related activities carried out as main activity have been reported. In table 5, separate figures were provided for wastewater collected and wastewater treated.

The same 7 countries (Belgium, Denmark, Germany, Spain, the Netherlands, Portugal and Sweden) plus the United Kingdom, also filled in pilot table 7, but only in a few cases (those without parentheses in the table above) it was possible to break down the abstraction or discharge by type of receiving water bodies. In some countries (e.g. Denmark and Sweden) seawater abstracted for cooling purposes has been included too.

The balance table (pilot table 9) contains the totals from pilot tables 5, 6 and 7 and further data on leaks and losses (available for Denmark, Germany, Spain, Ireland, Portugal and Sweden), urban drainage (Germany and Sweden) and the 'net' consumption of water (i.e. the water that 'disappears' during use mainly due to evaporation), which has been specified by Denmark, Germany and Spain, but in each country with somewhat different definitions.

Indicators on reconciliation flows were included in studies not specifically dedicated to water volumes by France and Ireland.

Again, the methods and sources used by these countries will be grouped by type (survey, use of administrative data…).

2.2.2 Use of administrative data: Denmark, Finland and the United Kingdom

2.2.2.1 Denmark

The general aim of Statistics Denmark was to build a full NAMEA system. Different steps were needed, and in this part, only the building of accounts for physical flows of water will be reported. Four types of water were considered in the Danish model: surface water, groundwater, seawater and tap water. This latest category should be assimilated to 'drinking water' in the European classification, since only this type of water is supplied by the water supply industry in Denmark.

Abstractions

Two major institutions provide data used in computing water abstractions of groundwater[27] in Denmark:

- The DVF, the Danish Water Utilities Organisation. The DVF gets data from two different sources: the public and private collective water production and distribution units, on the one hand, and the counties, acting as regional water management control units, on the other.
- The GEUS (Geological Survey of Denmark and Greenland) which covers almost all other water abstractions. The 15 Danish counties report to the GEUS, which publishes annually the total registered abstraction of groundwater according to 7 categories of users or uses[28]. The abstractions are either directly metered, or indirectly measured, for instance through actual running hours or electricity consumption, or estimated by the municipality or county.

However, many computations have been necessary:

- Some residual abstractions are not covered by the GEUS,
- The full coverage of water production and distribution units is not achieved by DVF (survey is not obligatory),
- Until recently, reporting by counties was not completely reliable,
- GEUS and DVF sources diverge on what they should have in common and, for collective water production and distribution units, the DVF source has been chosen.

To build the NAMEA, further estimates had to be made, since the GEUS-categories of users were not sufficiently detailed:

- For instance, the water abstracted by the 'non-collective water production and distribution units' (less than 1% of the overall quantities abstracted in Denmark) has been attributed to farms and households (50% each).
- The GEUS-category 'institutions' has also been subdivided into General public services (defence): 40%, Hospitals: 40%, Primary education: 10% and Social institutions for adults: 10%.

Additional sources such as the number of pig and cow farms, environmental reports and accounts of power plants, etc., were used to further break down the GEUS-category 'industry'[29]. The abstraction by the remaining 55 industries was then determined with the help of a survey on water consumption within manufacturing industry, carried out by the Danish Environmental Agency in 1990. Environmental reports and accounts by firms and surveys also enabled estimates of sea and surface water uses.

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[27] 99% of the abstraction of fresh water in Denmark is groundwater.

[28] 1. Public water production and distribution units, 2. Private collective water production and distribution units, 3. Non-collective water production and distribution units, 4. Institutions, 5. Watering of fields, horticulture and fish farming, 6. Industries and 7. Other abstraction.

[29] Surface water used by fish farming has been excluded from the study in spite of the significant polluting effects, because (1) of the difficulty to obtain data, (2) because water is returned to its source.

The GEUS-category, 'other extraction', includes other private drillings and protection drillings made by production and distribution units. This later case corresponds to polluted groundwater abstracted in order to prevent it from penetrating into non-polluted resources. Water abstracted by the protection drillings has been recorded as supplied to and used by the water supply industry.

The Building and Dwelling Register (BBR) of Statistics Denmark has been used to identify the number of farms and houses not connected to the water supply system. For households, an average consumption rate has been applied. For farms, a more complicated method took account of the number of cows and pigs in the respective farms.

Uses of tap water

Own use of tap water by water production and distribution units for filter backwashing has been calculated as the abstracted groundwater less the water pumped out into the distribution network.

Total amounts of tap water supplied, i.e. actually used by industries or households, has been estimated from the water production and distribution units practising metering (60 to 70% of them): the difference between the pumped out amounts and the estimated amounts sold provided an estimate of the losses in distribution.

In the DVF statistics, three types of consumers are identified: *households, institutions, and industries*. This breakdown has been used, with adjustments in order for instance, to take into account the losses or to avoid double counting.

For the further breakdown by industries, two sources of information have been used: the tax register and the employment statistics. Use of the tax register has been presented in section 2.1.2 above; it covers 98 industries.

Employment statistics was used for the breakdown of the remaining 30 industries (4% of the volume) with adjustment to take into account the potential differences in the water use: for hospitals, schools, etc. the number of employees has been extended by the relevant number of patients, pupils, etc.

2.2.2.2 Finland

The Finnish water study was carried out within a more general study aiming at producing a full NAMEA dealing with all the main environmental themes: global warming, ozone depletion, acidification, waste and wastewater production, eutrophication and depletion of natural resources.

A first attempt was completed with 1993 data; then Finland extended its NAMEA and produced, in particular, a NAMEA time series for 1985-1995. Statistics Finland filled in the pilot tables for the flows of water (water part of pilot tables 5 and 6). As concerns wastewater, only the discharges of wastewater to nature were studied (wastewater part of pilot table 7).

The total use of distributed water by small industry, services and households can be obtained from the Municipal Water Supply statistics. Household use is calculated on the basis of an average consumption of 155 litres/inhabitant/day.

Information on the average consumption of water is available for different kinds of buildings: schools, hospitals, indoor swimming pools, shops, offices, theatres, private apartments, etc. Statistics Finland also has a register of the cubic capacity of all buildings according to their industrial sector. The breakdown of the other water consumption was obtained by combining this information with the building register.

As concerns wastewater the most important data source is the Finnish Environment Institute's water register, which could be used in the case of large manufacturing industries. For small industries and services several assumptions and estimations had to be made, notably that these small production units produce as much wastewater as they use water.

Finally, 15% of the wastewater collected by the network is leakage water and water from melting snow. These flows have been ignored in the NAMEA on the assumption that they hardly contain harmful substances – basically sand and clay.

2.2.2.3 THE UNITED KINGDOM

Water industries, defined as fishing, water transport, water distribution and sewage treatment, make up about 1% of the UK's economy. Because this result only concerns monetary transactions, it greatly understates the importance of water for industries such as agriculture and electricity generation. Acknowledging this, the central Statistical Office (CSO) undertook in the early nineties, independently of the present pilot applications, studies which led to the publication of '*An illustrative water account for England and Wales*' in the *United Kingdom 1998 Environmental Accounts*.

The work focussed on abstractions and discharges (corresponding to pilot table 7). Most of the data were gathered by ECOTEC Research and Consulting, in the framework of a research for the DETR (Department of the Environment, Transport and the Regions).

Accounts were drawn up at regional level before being aggregated into a total for England and Wales. Most data come from the Environment Agency, since it records all significant abstractions, i.e. over 20 m^3 per day. The abstraction data are available for 3 categories of water bodies: rivers and lakes, groundwater and the sea.

Discharges were estimated using the following assumptions about the average rate of return of water for different uses.

Table 2.2-2 Rates of return for different uses – England and Wales, 1994

Water supply	70%	Spray irrigation	10%
Other agriculture	80%	Hydroelectricity	100%
Electricity supply	100%	Industry	70%
Mineral washing	70%	Fish/cress farming	100%
Other	100%		

Source: United Kingdom Environmental Accounts 1998

However, it has not been possible to obtain a very detailed breakdown by industry. The 7 broad categories used by the Environment Agencies were not further broken down in this first attempt.

2.2.3 Specific surveys: Spain and the Netherlands

2.2.3.1 SPAIN

The statistical sources used by Spain in this part are identical to those used in the 'economy' part of the accounts (see section 2.12), namely:

- As regards water abstraction and supply-use of distributed water, mainly INE's survey on supply and treatment of water, supplemented by the survey of industrial enterprises, the survey on the use of water in industry and the survey on the use of water in services.
- As regards volumes of wastewater treated and of discharges of wastewater, again, the INE's survey on supply and treatment of water constituted the main source, together with the survey of sewage and refuse disposal and the study on industrial wastewater by the COTEC Foundation.

Irrigation water

In Spain, irrigation water is produced by specific economic units, called '*Comunidades de Regantes' (irrigation associations)*. The entire output of these units has been considered as consumed by the agriculture and forestry industry. The main statistical source used is INE's survey of the use of water in the agricultural sector[30]. Other sources include the survey on the structure of agricultural holdings[31]*, the statistical yearbook of the Ministry of Agriculture, Fisheries and Food* and the annual reports from the Spanish Water Boards (The *Confederaciones Hidrográficas,* under the supervision of the Ministry of the Environment).

[30] *Encuesta sobre el uso del agua en el sector agrario*

[31] *Encuesta de estructuras agrarias*

2.2.3.2 THE Netherlands

In the framework of its NAMEA, the CBS calculates national fresh water resources and evaluates their depletion over time. The water quality control authorities periodically measure the water flows in different parts of Dutch rivers. This information is used to determine the total annual inflow of surface water into the Netherlands. The total outflow of surface water to the sea cannot easily be measured directly, due to too high tides. It is calculated as the annual inflow (from rivers that enter the country) plus precipitation, minus evapo-transpiration and the decline in the groundwater stock. Information on precipitation and evapo-transpiration is provided by the KNMI (Royal Dutch Meteorological Institute) and by the CBS. These fresh water resources are then compared to the uses.

Most of the data on direct abstraction of water by economic activities come from a survey of mining, manufacturing and electricity production industries. This survey is carried out every five years. Water use in agriculture is estimated with the help of a survey by the Economic Institute for Agriculture.

Total tap water production is known from a CBS survey. Tap water use by economic activity and households is estimated on the basis of the national accounts use table.

Data on the collection and discharges of wastewater by public wastewater treatment plants are collected by the CBS in the framework of the 'Water quality management' statistics programme.

Finally, a rough estimation of the total abstractions of groundwater by the water boards is based on information from the Ministry of Transport and Public Works. This source is also used for information on the annual changes in groundwater resources. The average annual decline in the groundwater table is estimated to be 1 cm. Because there is no direct information on the net uses (consumption) of water, it has been presumed that all abstractions are discharged later.

2.2.4 Mixed methods: Belgium, Germany, Sweden and Portugal

2.2.4.1 Belgium

The general objective of Belgium, as mentioned in Section 2.1.2.2, was to build as many pilot tables as possible. Some tables devoted to the volumes of water flows could be completed, namely tables 5 and 6, as well as the part of table 7 which deals with discharges of wastewater (but with no breakdown according to the type of receiving body). The other part of table 7 (on abstractions) could not be filled in.

The approaches differed according to the type of flows surveyed. Flows of distributed water could be derived from a survey type methodology, while flows of wastewater came from administrative records.

Water supply

As the 'Structural Business Survey' asks for both quantities and values of water sales, it was also used to estimate water supply in physical units. However, not all NACE 41 firms answered to the question about the quantities. Their output in physical terms was estimated with the help of the average unit price calculated on the basis of the responses received.

A first rough breakdown of the water uses between households, electricity producers, water distributors and other industries has also been possible on the basis of the SBS.

The average unit price was then used to estimate the breakdown of volumes between industrial users, dividing purchases of water by this average price. This method gives only rough estimates, since it is based on the assumption that prices do not vary very much among industries and regions.

Wastewater services

The data about the volumes of wastewater collected and treated by sewage removal and treatment services came from the regional environmental administrations. Wastewater is considered as treated when it is directed to water treatment plants.

2.2.4.2 Germany

As explained in section 1.2.2, water accounts complied by the Federal Statistical Office of Germany are part of the overall framework of the material and energy flow information system (MEFIS).

The water flow accounts have been obtained from a lot of statistical sources. Basic statistics had to be converted into the concepts of the German Environmental Accounts (UGR), and data gaps were filled through estimates.

The most important data source were the water surveys of the Federal Statistical Office of Germany, which have been conducted at intervals since the late 1950's. These surveys interrogated mining and manufacturing enterprises with more than 20 employees. The most recent ones were carried out in 1991, 1995 and 1998. For the years not covered with surveys, an updating process was developed essentially on the basis of production trends and of data compiled by economic associations.

For the years covered by the water survey, the calculation procedure was the following: the water flows were calculated and broken down by industries using the data on public water supply and wastewater collection, on the one hand, and on water abstraction and discharge in mining, manufacturing industries and thermal power plants, on the other. These data cover 90 % of the flows.

To achieve the transition from industries to homogeneous branches, some reallocations of secondary activities had to be made. This mainly concerned power generation and water-related activities. Internal wastewater treatment by enterprises in industrial wastewater treatment plants (IWWTP) has been considered as an ancillary activity and thus was not reallocated.

Abstraction

Water abstracted from nature was broken down into two main components: first, infiltration and rain water[32], and, secondly, ground, spring, surface water and bank filtrate. The data on infiltration and rainwater drained by the public wastewater sector were taken directly from the statistics of this sector. The abstraction of other types of water resources is based on several sources but basically on:

- the statistics of public water supply,
- the water survey of mining and manufacturing industries, for enterprises with 20 or more employees.

Water use by enterprises with less than 20 employees has been estimated step by step. The total difference between the quantity of water supplied by public water supply and the amount of water received by the industries covered by water statistics has been broken down according to the turnover, assuming that the water use coefficient is the same for large and small enterprises. It has also been assumed that the small enterprises do not withdraw water directly from nature, except for agriculture and some specific branches of mining and manufacturing industries. The share of small enterprises in the water abstraction in mining and manufacturing industries amounts to about 2.5%.

Direct water abstraction by private households has been estimated on the basis of information on the number of households not connected to the public water supply network and on the assumption that the water use by not connected households is equal to the water use of connected households. It amounts to about 1.5% of the total water received by households. The amount of water received by connected households is obtained from the public water supply statistics.

Discharges

The same sources were used to calculate the quantity of water discharged: the public water supply statistics also provide data on wastewater collected. However, those data are broken down according to only two categories: private and commercial customers. The results of the survey were used to break down the ‘commercial’ total, with the difference again allocated to small enterprises.

Discharge of water into nature has also been subdivided into several elements:

- Discharge of infiltration and rainwater which corresponds exactly to the amount withdrawn.
- Losses occurring in water distribution are taken from the statistics of public water supply.

[32] Infiltration and rain water here applies to water collected in the wastewater network through urban rainwater run-off or pumped or drained out of cellars, underground structures, etc.

- Water indirectly discharged is provided by the statistics of public water supply, combined with the results of the survey.
- Water directly discharged comes from the survey and other sources, as for abstraction.

Other flows

For the water flows not covered above (e.g. irrigation, incorporation into other products or evaporation), specific data or estimation methods have been used:

- In agriculture, water use has been calculated separately for irrigation and livestock farming. The amount of water withdrawn by agriculture for irrigation has been determined on the basis of data provided by the Federal Association for Agricultural Irrigation. This amounts to about 1.5% of the total quantity of water withdrawn from nature. Water used in livestock farming has been estimated by means of the animals' average demand for drinking water provided by the Committee for Technology and Construction in Agriculture. Those ratios are combined with data on the stock of such animals, taken from agricultural statistics. This amounts to less than 2% of the total quantity of water withdrawn from nature.
- Data on the water quantities used in the construction and services have been derived from information on the purchases of water (monetary input-output table). Those branches together account for slightly less than 1.5% of the total amount of abstracted water.
- As far as evaporation and other losses are concerned, direct information or estimation approaches are available only for some branches and items, notably for the share of evaporation in irrigation water. Therefore, that value has been obtained – for both the overall economy and the detailed branches – as a residual value.
- Data on water exports and imports are available through the public water supply statistics.
- Water incorporation into other materials and water removal from other materials occurs in agriculture, food and beverages industry and in household consumption.
- It has been assumed that 1% of the irrigation water is incorporated into the plants and that the remaining share evaporates.
- The incorporation of water into animal products (meat, milk, eggs) has been determined on the basis of the quantities produced and the average water content of such products.
- Incorporation of water into farm manure (liquid manure, slurry) has been ascertained through the number of animals and the average manure production of each animal.
- In the food industry, water incorporation as well as water removal occurs. What was explicitly estimated was only water incorporation during the production of beverages, taking as a basis the quantities of beverages produced.
- Water removal in households was determined through the water content of the beverages and food consumed.

2.2.4.3 Sweden

Water flows

The survey carried out by the VAV is, again, the main source to assess the diverse flows of water within the economy and between the environment and the economy. Through a questionnaire to all municipalities VAV collects annually information on:

- total population
- population connected to the public water system
- population connected to the public wastewater system,
- water abstracted from groundwater or surface water,
- purchases or sales of water to other municipalities,
- use of water by industries, households, public uses (e.g. schools), own uses and losses
- number of water production and distribution units and wastewater treatment plants
- quantity of treated wastewater

16 municipalities (out of 286) did not answer the 1995 questionnaire. Estimates for these missing municipalities used their population and the national average abstraction and use rates.

For **water abstracted directly by industries,** Statistics Sweden carried out in 1995 a survey which covered 930 establishment with 1 280 000 employed persons and corresponded to roughly 90% of the water uses. For the rest of users (7 512 establishments with 470 900 employed persons) the abstraction and use of water was estimated by coefficients for the industrial sector, based on a 1983 survey on water use.

For **households** not connected to public water systems, the average use observed in the public network (189 litre/day/person) was applied. Second homes were assumed to be used by three persons over 60 days per year.

Two main uses were considered for **agriculture:** irrigation and livestock. The results of a 1985 survey were used to assess the water needs for **irrigation** in a dry summer**.** A 1991 survey of 800 farming enterprises by the Swedish board of agriculture did not show any fundamental change. For water needed by **livestock**, coefficients were applied to the number of animals, taken from agricultural statistics:

Table 2.2-3 Estimated water need for different animal breeding activities, Sweden, m^3/year

Dairy cows	30,0	Piglets	0,05
Sucker cows, heifers, calves	16,0	Sheep	2,5
Horses	16,0	Laying hens	0,1
Boars, sows	13,0	Young fowls, slaughter chickens	0,04
Fattening pigs	0,875		

Source: Water Accounts. Physical and monetary data connected to abstraction, use and discharge of water in the Swedish NAMEA – Statistiska centralbyrån, December 1999

Wastewater flows

The Swedish environmental protection law requires all large point sources of emissions to water to report their main emission parameters in annual environmental reports to their supervision agency (generally a local authority). The supervision agencies deliver copies of the reports to the County administrative board and to the Swedish Environmental Protection Agency. The EPA also receives every second or third year almost 500 reports from the MWWTP (municipal wastewater treatment plants) serving more than 2 000 inhabitant equivalents, defined in Sweden as 70 grams of BOD_7 per day. The *pulp and paper industry* is subject to a specific report by the Swedish EPA.

Some treatment parameters are also reported annually in the VAV survey of municipalities: number of treatment plants, volume of treated water, inhabitant equivalents served, permanent population.

2.2.4.4 Portugal

Only flows of water and wastewater due to the intervention of public systems could be surveyed in Portugal and not flows induced by own use of water or of wastewater services. Most information on water volumes came from INAG, an institute which monitors the quality of water at abstraction for human use. INAG also collects information on wastewater volumes discharged by urban wastewater treatment plants.

Irrigation flows could also be partially measured and the method used by Portugal in order to estimate irrigation flows is rather original. The total volume stored in the dams at the beginning of the irrigation period has been considered as the supply, while the use was derived from the volumes provided to the State's agricultural development projects, volumes which are metered and charged (source: IHERA).

It must be reminded that the State's agricultural development projects do not cover the whole irrigated area of Portugal (124 000 out of a total of 988 000 ha). The method used leads to an important discrepancy between supply and use, discrepancy that is allocated to "change in inventories". For the estimation of the monetary tables, these flows were multiplied by the average price charged to the State's agricultural development projects.

2.2.5 Methods studied by Luxembourg

Luxembourg only made a short feasibility study regarding NAMEA accounts for water. The water division of Luxembourg's environment administration has a great deal of quantitative data for reasons of authorisation or evaluation, but these data are not yet centralised.

Water abstraction

In Luxembourg, water is abstracted by urban districts, grouped or not into associations, by enterprises for their own needs and by households. Urban districts and their associations produce annual reports which can supply data, but attention should be paid to the possible exchange of water between the districts. A survey should be conducted for enterprises (around 25). No data exist on households, except for those who had applied for a subsidy in order to establish a system for recovering rainwater.

Wastewater discharge

There is no centralised data on water consumption by households since it is billed by urban districts. However, it could be estimated if the unit price and the breakdown between households and enterprises are known. The Environment Administration calculates a technical coefficient with the help of the inhabitant equivalent of each wastewater treatment plant. For the enterprises, it is envisaged to attribute such a coefficient to the number of employed persons.

Wastewater treatment

Wastewater is treated either by the associations of urban districts (public WWTP) or by the manufacturing enterprises themselves. A number of data are collected by the Environment Administration, on both kinds of WWTP, but it would be difficult to allocate the pollution treated to each source without applying arbitrary coefficients.

2.2.6 Comparison of methods

An obvious distinction has to be made among the diverse water flows, the quantification of which was reviewed in this section: flows transiting through the public networks and exchanged between different economic units on the one hand, flows directly abstracted and discharged by one economic unit for its own use, on the other.

Flows linked to public networks

These flows are generally known without difficulties, at least for their totals. Caring about the volumes is a natural concern by the public networks operators, since their costs are somehow proportional. It seems however more difficult to allocate total abstraction and discharges to the economic activities that use the water. As prices are not uniform at the national level (they depend on local hydrological and geographical conditions), the supply-use tables in monetary terms are not easily translatable into physical units.

A one-shot survey has been the solution in most cases, with the exception of Denmark whose taxation system allows direct allocation to industries, with the use of administrative data. Administrative data generally distinguish categories of users; however these categories are often too broad to allow a detailed breakdown. Therefore, various methods and assumptions are used to disaggregate data: coefficients, ratios, etc.

Individual flows

These flows correspond to direct abstraction and discharges of water by industries and households. Methods are rather similar across countries: the majority of pilot applications used a specific survey for the flows due to industrial uses and coefficients for the flows due to household uses.

Denmark, Finland and the UK have regular systems for the recording of abstractions as a by-product of administrative sources. However, these administrative sources generally provide an insufficiently detailed breakdown by economic activities (7 categories of users in Denmark and in the UK). The breakdown of users in administrative sources is often based on the type of use of water rather than on the economic activity itself. The type of use appears as a key element for the breakdown and this could merit further analysis.

Specific methods were generally observed for the agricultural sector, which does not require the same level of consideration in all countries.

2.3 Flows of pollutants

2.3.1 Exercise suggested by Eurostat

2.3.1.1 Pilot tables to be filled in

Different types of water pollutants are generated by economic activities of production and consumption. Dispersed in wastewater, these pollutants are discharged[33] into the water bodies, either directly or after a transit through the sewage network and wastewater treatment plants. In this last case, NACE 90 activities – sewage and refuse disposal, sanitation and similar activities – may reduce the polluting load of the original wastewater by appropriate treatment, and it may be interesting to compare how much pollution enters and leaves the sewage system in order to evaluate the effectiveness of this de-polluting activity.

As regards flows of pollutants associated with water uses, the proposal was to follow three kinds of information: (1) pollutants discharged with wastewater into the public sewage network, (2) pollutants eliminated by NACE 90 activities before discharge back into the natural water bodies and (3) pollutants finally discharged into the natural water bodies (either directly by industries or households not connected to the sewage network or by the sewage system operators).

Different basic types of flows should be distinguished: addition of pollutants to water by nearly all economic activities and absorption of pollutants by some activities; this absorption takes two forms: subtraction of pollutants *before* use by economic activities (notably for drinking purposes) – this is generally the task of NACE 41 in the water purification stage– and subtraction *after* use (wastewater treatment), one of the tasks of NACE 90.

Based on the lists of pollutants appearing in various European directives related to water (see Annex 3), the most important pollutants (either in terms of quantity or in terms of dangerousness) were selected, namely:

- Biological oxygen demand (BOD)[34]
- Chemical oxygen demand (COD)[35]
- Suspended solids
- Heavy metals:
  - Arsenic (As)
  - Cadmium (Cd)
  - Mercury (Hg)
  - Copper (Cu)
  - Chromium (Cr)
  - Nickel (Ni)
  - Lead (Pb)
  - Zinc (Zn)
- Eutrophication agents:
  - Phosphorus – total
  - Nitrogen – total

It should be noted that NACE 41 also subtracts biological pollution such as germs, coliforms, salmonella, etc., which is not traced in these tables.

Pilot table 10: Pollutants discharged by economic activities into the sewage network

The purpose of this table was to report the pollutants discharged by economic activities into the sewage network. Columns of the table correspond to the pollutants listed above, whereas the rows correspond to economic activities (industries and households as final consumers).

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[33] OECD/Eurostat questionnaire's definition of a 'discharge' is: the amount of water (in m^3) or substance (in kg BOD/day or comparable) added/ leached to a water body from a point or a non-point source.

[34] Biological oxygen demand: mass concentration of dissolved oxygen consumed under specific conditions by the biological oxidisation of organic and/ or inorganic matter in water.

[35] Chemical oxygen demand: mass concentration of oxygen consumed under specific conditions by the chemical oxidisation with bichromate of organic and/ or inorganic matter in water.

Pilot table 11: Pollutants discharged to water bodies by economic activities

The purpose of this table was to report the pollutants discharged by economic activities to water bodies, either discharged directly by industries or households or by the sewage network. The structure of the table is identical to the structure of the table 10.

It must be noted that this table traces only part of the flows of pollutants discharged to water bodies and induced by economic activities. Notably, a case not taken into consideration is the pollution 'leached': pollution of aquifers by landfill sites or through fertiliser spread on the soil does not result necessarily from a use of water through networks. It can be due to natural rainfall. Pollution originating from in situ uses of water (navigation, fishing, aquaculture, etc.) was excluded as well. However, an exception was proposed for pollutants originating from fertilisers (appearing as a memorandum item in table 11).

In the absence of leaching from the networks or of addition of pollutants with water such as urban rainwater run-off, pollutants treated by NACE 90* should be equal to the row total of pilot table 10 minus the row for NACE 90 from pilot table 11.

Pilot table 12: Pollutants subtracted by economic activities

This table intends to record two types of subtraction of pollutants. It covers at the same time

- pollutants abstracted before use (e.g. in the process of purification of water before distribution, or the filtering of suspended solids before use for cooling), and
- pollutants abstracted by the units of the NACE 90* industry (wastewater treatment plants).

The table does not cover pollutants abstracted by the industrial wastewater treatment plants.

It should be noted that a final balance, in the same way as for volumes of water flows, could not really be made for pollutants, for various reasons:

- when wastewater is discharged on the soil (after or without treatment), the natural filtration should be estimated in order to know the proportion of pollution which will finally join the surface or the groundwater body;
- indirect/diffuse emissions to water (through air, such as acid rains, or through soil, such as leaching of landfill sites) are difficult to measure and allocate to industries.

Participating countries

These three tables have been filled out by Belgium, Germany, France, Ireland, the Netherlands, Austria, Portugal, Finland, Sweden, the United Kingdom and Norway to different degrees, notably as regards the pollutants examined. Spain has filled in pilot table 12, but on the basis of different concepts.

Table 2.3-1 Countries that participated in the topic 'flows of pollutants' and pollutants followed

	B	D	E	F	IRL	NL	A	P	FIN	S	UK	NO
Pilot table 10: Pollutants discharged to network												
BOD/COD	yes	yes		yes		yes	yes	(yes)	yes		yes	
Heavy metals	yes			yes		yes	yes				yes	
P/N	yes	yes		yes		yes	yes	(yes)	yes			
Pilot table 11: Pollutants discharged to water												
BOD/COD	yes			yes	yes	yes	yes	(yes)	yes	yes		
Heavy metals	yes			yes		yes	yes			yes		yes
P/N	yes			yes	yes	yes	yes	(yes)	yes	yes		yes
Pilot table 12: Pollutants subtracted												
BOD/COD	yes		(yes)	yes		yes		(yes)		yes		
Heavy metals	yes		(yes)	yes		yes						yes
P/N	yes		(yes)	yes		yes		(yes)		yes		

Most of the countries used a combination of different sources to build up the information: exploitation of administrative data (such as licences to pollute), average measured emissions multiplied by grossing-up coefficients (for instance, to estimate emission of pollutants by households). Therefore the classification by methodology presented hereafter is somehow arbitrary. One country carried out a specific survey (Austria).

Noticeable is the fact that France and Ireland made an attempt to build emissions accounts at the level of catchment areas[36]. The United Kingdom built accounts for the Environment Agency's operational regions that roughly correspond to the major water basins. There are also plans for such regional accounts in the Netherlands.

2.3.2 Use of coefficients: Germany and Ireland

2.3.2.1 Germany

The main sources of data on discharges of wastewater and their pollutant load were the statistics derived from a survey of the public water supply and of the sewage operators and treatment plants. The survey was carried out in 1991. The calculation steps were the following:

A. Estimation of the absorption coefficient by the sewage treatment (from the 1991 survey, except for nitrogen where an approximate efficiency coefficient of 50% was taken as the average between the main types of treatment: mechanical, biological and advanced treatment.
B. From (A) and from the load measured at the discharge point (from the 1991 survey), estimation of the pollutant load of the flow entering the wastewater treatment plants.
C. Estimation of the pollutant load in the untreated sewage.
D. (B) plus (C) result in the pollutants discharged into the sewage system[37].
E. Estimation of the pollutants discharged into the sewage system by households on the basis of the number of connected inhabitants and of average emission coefficients[38].
F. Estimation of the discharge to the sewage system by industries as the difference between (D) and (E).
G. The discharge of the sewage into nature results from the discharge by the treated sewage works and from (C).
H. Estimation of the direct emissions of the households into nature on the basis of the number of inhabitants not connected to the sewage system and average emission coefficients.
I. Finally, estimations of the direct emissions from the industries were inferred from statistics (German Federal Statistics Office, 1997) for COD and BOD and from literature (German Federal Environmental Agency, 1994) for nitrogen and phosphorus.

Pollutants collected from industries by sewage operators must still be broken down by industry. The envisaged method is to use process-related coefficients for large industries. For small industries, coefficients can be applied to the turnover of the industry.

2.3.2.2 Ireland 1

Two different approaches were followed. The first evaluation was based on the use of coefficients and is described below. The second evaluation used tax register data and will be described in section 2.3.3.

First evaluation

The first Irish NAMEA report (with 1994 data), mainly devoted to air emissions, only gave a brief indication of discharges into water. Three pollutants were reviewed: BOD, supposed to arise mainly from sewage, slurry and silage effluent, and nitrogen and phosphorus, the latter two essentially coming from fertilisers and manure.

The figures came from literature. The amounts going into water from agricultural sources were very approximate: the figure for BOD came from an estimate made over a decade ago, figures for N and P were estimated from nutrient balances. The industries were also poorly covered: they may discharge wastewater either directly into water bodies, which requires a licence from the EPA, or through municipal sewers. In this latter case, discharges into water appear as discharges from Government Services (Municipal Works).

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[36] Germany also tried to build accounts for the Upper Rhine region in 1996 in another context.

[37] It is assessed that all pollutants result from discharges, i.e. that e.g. rain water run-off does not add any important loads.

[38] Coefficients used: 60 g BOD5, 120 g COD, 11 g nitrogen and 2.5 g phosphorus per inhabitant per day.

Discharges from the residential sector (septic tanks only, municipal sewers being again accounted for in 'Municipal Works') seemed difficult to evaluate precisely, as the potential rate of BOD removal by septic tanks is rather uncertain.

In addition to the uncertainty about the data supplied, the first report also put a theoretical warning on the results:… *the extent to which discharges have a polluting effect is highly dependent on the state of the receiving waters and surrounding terrain. In addition it is largely the concentration rather than the quantity of discharges that matters*….

2.3.3 Use of licence and tax registers: Belgium, Ireland, Netherlands, Finland, UK, Norway

2.3.3.1 Belgium

In Belgium, data about wastewater is collected in order to calculate taxes on sewage, but, as these taxes come within the remit of the 3 regions (Wallonia, Brussels-Capital and Flanders), their application is subject to regional differences.

In **Flanders**, the wastewater taxation system dates from 1971 and was subject to a major revision in 1991. A distinction is made between small (less than 500 m^3) and large consumers.

For the first category (households, small firms, service industries and often farms), taxes are calculated in connection with an assumed discharge of pollutants (expressed in g or mg per person per day). An equivalent fixed amount is also required from small consumers that abstract water themselves. The respective allocation of the pollutants to households and to services and small industries is problematic because of the absence of data on the levels of water consumed. The average level for households in Wallonia has been used to make this breakdown.

Large consumers can choose between having their emissions actually measured or estimated according to a profile typical of their activity. The following parameters are taken into account: BOD, COD, suspended matters, nitrogen and phosphorus, and heavy metals. Discharges of cooling water are taxed differently. Data have been provided for 1 500 enterprises for years 1995 to 1997 with the exception of cooling water. Given the size of these enterprises, 80% of the industrial emissions are actually measured.

Estimates have also been made for 'diffuse' sources of pollution by farms on the basis of the SENTWA model, considering data on production, fertiliser consumption, precipitation and meteorological conditions.

In **Wallonia**, the wastewater taxation system is based on a 1990 decree. Levels of taxes for industrial firms are set in relation to the average 24-hour sewage flow recorded during the month with the highest activity. From 1994 onwards, suspended matters, COD, heavy metals, nitrogen, phosphorus, and temperature of cooling water are taken into account. Load, in terms of BOD, is not available. Available data (on about 600 enterprises broken down according to 7 types of industries) are reported in the OECD/Eurostat questionnaire on inland water.

For households, taxes are based on the volume of water consumed or, if not known, on a flat rate basis (100 m^3 per household per year). Services industries and households are grouped together. For services industries, taxes are calculated in connection with the number of employees, and pollution content has been estimated using the Flemish average per employee.

Estimates have also been made for 'diffuse' sources of pollution by farming enterprises on the basis of their production and the number of cattle.

In **Brussels-Capital**, the legal basis for the wastewater taxation system dates from 1996 (first year available: 1997). For industrial plants, taxes are calculated either in relation to actual pollution or, when the level of pollution is low, according to a flat rate calculated on the volume of consumed water. Firms have to make monthly internal controls and a yearly external control. Parameters taken into account are: BOD, COD, suspended matters, nitrogen, phosphorus, and heavy metals. The information is still partial: concentrations have been given for 80 important enterprises but corresponding flows have not been recorded yet, which prevents the calculation of loads in kg.

For domestic uses (which includes all firms with less than 7 employees), most of the time a flat-rate tax is calculated on the basis of the water consumption level.

At the time of the pilot study, the information from this taxation system was not available for 1998 yet, and the Federal Planning Bureau used the Flemish data to estimate the pollutant loads for the Brussels-Capital region.

2.3.3.2 Ireland 2

The second evaluation by Ireland was carried out on the basis of 1996 data, with a totally new method: the source was the submission to the OSPAR Convention[39] by the EPA (Environmental Protection Agency).

The EPA database contains discharges of BOD, Nitrogen and Phosphorus for 40 basic hydrological areas (later grouped into three main regions). The information is derived from various sources, and includes information on agricultural activity, population, etc. In particular information stemming from licenses issued to industrial enterprises (IPC = Integrated Pollution Control system) is used.

This source enables a regional breakdown (the three large catchment areas were retained) and by type of water bodies. On the other hand, the industrial breakdown is less detailed: it is based on the EPA coding system, which is process oriented and not directly comparable with NACE Rev.1. A provisional transition table between EPA classification and NACE had to be built.

The figures on industrial discharges are estimates based on the licence consents: the assessment is that companies tend to release 25 percent of their consent limit.

A third report used the same methodology as the second, but data were updated and complemented by economic data.

2.3.3.3 The Netherlands

The Dutch emission accounts are part of the 'NAMWA' integrated framework (see section 1.2.2.1). They include direct emissions to surface water, emissions to the sewage system and, in the case of agriculture, emissions to soil. Emissions into salt and brackish water are neglected[40].

The emission of heavy metals is to a large extent derived from the "emission register" which displays the discharges recorded by the Water Quality Control authorities. The Water Quality Control authorities estimate the discharge of heavy metals into sewage networks and into surface waters. Using information on sewage sludge, the total discharge of heavy metals into wastewater, including non-registered emissions, is estimated.

A particularity of the Dutch accounts is that they also estimate the inflow of pollution into the Netherlands via the river system and attribute it to the *Rest of the World*. Again, this inflow of pollutants via rivers into Dutch territory is estimated by the Water Quality Control authorities. At the other end, some pollution is considered as 'exported':

" …The total pollution loads from the Dutch territory into open sea is estimated with the help of annual average concentrations at the lower end of the river system, measured at Maasluis, and the total annual water outflow. Maasluis is the most important, but not the only location where inland water reaches open sea… "

In this way the NAMWA describes also the destination of pollutants: pollution accumulated in Dutch inland waters and outflow of pollution to the open sea.

2.3.3.4 Finland

The Finish NAMEA for water is part of a more global NAMEA which also deals with air, waste and natural resources. A preliminary trial was made with 1993 data. Afterwards, the project was extended to cover the years 1985, 1989, 1990, 1992 and 1995.

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[39] Oslo and Paris conventions for the protection of the marine environment of the North-East Atlantic.

[40] Subsequently, the Eems and Schelde rivers are outside the scope of the accounts, since these rivers are already brackish by the time they reach the Netherlands' borders.

The main source for nutrients (P and N) and organic pollution (BOD) is the water register maintained by the Finnish Environment Institute. This register covers all industrial establishments not connected to the municipal sewage system and that have to report on their water emissions. 70% of all industrial establishments are registered. It comprises in particular all the paper production units, which are the most significant industrial water polluters.

The classification used in the register is not fully consistent with SIC-95 (the Finnish industrial classification) and some adjustments had to be made.

The register information is supplemented by information on WWTPs, obtained from the Municipal Water Supply statistics (Finnish Environment Institute) and by estimates (by the Finnish Environment Institute, too) of water emissions from rural settlements: agriculture, fish breeding, milk farming, forestry and peat production.

The information collected for industrial establishments is 'net', i.e. it relates to pollutants emitted into the watercourse, after eventual abatement inside the establishment. For municipal WWTPs, both 'net' and 'gross' emissions are available.

Finally, the total figures on pollutants loads were taken from the report *'A Proposal for Targets of Water Protection until the Year 2005*', drafted by the Finnish Environment Institute.

Another source, the Association of the Finnish Forest Industry, publishes data on nutrients and wastewater for this specific sector. However, the published figures on BOD, N and P were higher than the figures from the water register. For consistency, the latter were used.

Several assumptions and estimations had to be made. A first assumption has been that units produce as much wastewater as they consume water. Household consumption has been estimated at about 155 litres/inhabitant/day. The rest of the distributed water consumption has been attributed to small industries and services. Data on how much water is consumed altogether by small industry, services and households can be obtained from the Municipal Water Supply statistics. The nutrient emissions were allocated accordingly.

Leakage water and water from melting snow (up to 15% of the wastewater) were finally ignored in the building of the NAMEA, on the basis of the assumption that they do not contain hazardous substances (basically only sand and clay).

2.3.3.5 The United Kingdom

In 1998, an initial set of water accounts was produced by the ONS for the DETR (Department of the Environment, Transport and the Regions). A framework was established for the development of water resource and water pollution accounts. Regarding water pollution, the main preliminary elements were emissions (in tonnes per year) of main pollutants broken down by economic activity. Direct discharges by industries to the water bodies, discharges by WWTPs, as well as diffuse discharges (e.g. discharge of fertiliser to groundwater) were considered.

Different sources were used, according to the substance:

- the database maintained by the Environment Agency for the UK submissions to the OSPAR Convention and Third North Sea Conference Declaration,
- Water companies data on consents for firms,
- Ministry of Agriculture, Fisheries and Food surveys on pesticides and fertilisers,

but a number of estimating methods, using US emission coefficients, areas for each crop, etc., had to be applied.

This first attempt demonstrated that for national water accounts the conceptual framework was adequate but that a comprehensive set of accounts was not possible due to methodological problems and gaps in data availability.

In particular, it had not been possible to allocate the discharges from the sewage networks to the various industries at the origin of the pollution. Fine-tuning was needed and undertaken in the framework of a pilot

study. Its general objective was to determine the levels of pollutants emitted by each industrial sector in terms of load per employee, but the pilot study was also "*intended:*

- *to test the relationship between the levels of discharges which the sector had permission to discharge (known as the consent), and the amounts actually discharged;*
- *to explore the stability of discharges over time;*
- *to establish whether there are differences in the emissions coefficients between regions and whether company size was an important determinant of the loads emitted."*

Approach

The ten water companies in England and Wales hold 'consents' registers of firms. Unfortunately, these registers do not give much indication on the economic activities of the firms. Therefore, the listing of addresses from the consents register was matched with a listing from the Inter-Departmental Business Register (IDBR) which contains more detail: industrial sector, number of employees, turnover, etc.

Although the matching was only carried out for sectors which had been identified as likely to have consented discharges, many problems had to be faced:

- Not all pollutants selected in the previous study are subject to a consent.
- As they are maintained at a district level, the consents data are not centrally collected and are not easily accessible. Often, the data are confidential under the terms of the Water Industry Act 1991. Only five water companies' registers could be exploited.
- The IDBR holds information at different levels, or for different units. For instance, for companies with more than one site, information on number of employees may be held for each 'local unit', whilst information on turnover is only available for the company as a whole.

A software tool calculated, for a selection of pollutants**,** a load per employee by industrial sector, by multiplying the mean concentration by the total volume of water supplied[41].

The results were finally extrapolated in order to take into consideration the firms for which no information was available. Two different approaches were tested, one based on individual firm coefficients and the other based on the total load for all matched firms within a sector.

2.3.3.6 Norway

The work on emissions into water in Norway has focused on emissions of a number of heavy metals, on the one hand, and on emissions of nitrogen and phosphorus, on the other.

Heavy metals

The available information primarily came from the INKOSYS, an administrative register of discharge licences issued by SFT (Norwegian Pollution Control Authority). However, firms that emit below the legal permit level, or firms that should have obtained licences but have not applied, do not report to the INKOSYS.

There might be double counting in this database when effluents by a firm are later treated by a wastewater treatment plant which is also recorded in the database. The importance of this problem has been difficult to estimate: enterprises are asked whether they are connected or not to the municipal wastewater system, but this information is not often provided.

There are approximately 65 different types of discharge licences listed in the database. This number changes with new regulations.

19 heavy metals have been chosen for closer examination: either heavy metals stated as toxic substances by the Ministry of the Environment[42], or covered by the OECD/Eurostat Joint Questionnaire for Inland Waters.

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[41] This method was compared with the alternative using the mean (concentration x flow) for a small subset of Yorkshire data. The majority of the ratio between the two estimates (74%) lies between 0.5 and 2.

[42] White Paper to the Parliament No. 58.

Three years of data (1995 to 1997) were examined in order to test the variability of the emissions reported over time and according to NACE categories, but the coverage was not the same: notably, NACE 90 appears only from 1996 onwards.

Another problem with the INKOSYS database was the NACE code allocation to the enterprises, which is correct only at the 2-digit level.

The calculations must be considered as very preliminary, and a list of areas needing closer examination and perhaps revision, notably because of major discrepancies over the 3-year period under review, is provided in the report.

In addition to the INKOSYS database, estimates of heavy metals in the sludge from the municipal wastewater treatment plants have also been used. These are not emissions to water but rather the amount of pollutants removed from the wastewater. The content of heavy metals in the sludge removed from wastewater systems is measured and reported annually for each WWTP to another SFT administrative database (known as 'SESAM'). Data for seven heavy metals are available: cadmium, chromium, copper, mercury, nickel, lead and zinc.

Phosphorus and nitrogen

Concerning these two pollutants, the INKOSYS database has also been used. A conclusion was that this database could be improved. In particular, the information regarding the connection to municipal wastewater systems is incomplete.

Apart from this database, use has been explored of a complex model developed to calculate the emissions of nitrogen and phosphorus to the North Sea, taking into account retention rates along the different watersheds and the location of the major emissions sources from enterprises, treatment plants, agricultural areas and natural areas. This model, known as TEOTIL, provides information concerning the emissions at the geographic boundaries of the country[43]. It is used to report to the OSPAR convention about emissions to the North Sea.

The TEOTIL model is run only with four major categories of sources: agriculture and forestry, municipal wastewater, 'industry' and natural run-off from pristine areas. The model calculates concentrations of nitrogen and phosphorus to the various recipient bodies of water and in particular to the North Sea. The model's predictions are relatively close to the measured values for phosphorus, but not as good for nitrogen.

The four categories used by TEOTIL are too aggregated to be used in a NAMEA. Currently, the 'industry' category refers to INKOSYS data on NACE 13, 15-37 (and 90). There had not been any attempt to allocate emissions from the municipal wastewater systems to households, enterprises or administrations.

2.3.4 Specific survey: Austria

The first Austrian attempt of a NAMEA, completed in January 1998, was the development of a NAMEA on air pollutants. Unlike air, for which emissions were calculated by applying process-specific coefficients, emissions to water have been based on actual measurements or, when not available, estimated on the basis of authorisations and limit values laid down for the different economic activities in the Ordinance on Wastewater Emissions. It has then been assumed that the emission was 50% of the relevant limit value.

Only 'net' emissions have been measured, that is to say, emissions have been measured at the point where pollutants enter surface water or groundwater. Thus, if the emissions of a plant pass through a treatment plant, the effects of the treatment have been taken into account in order to estimate the 'gross' corresponding emissions, either by using data from that precise wastewater treatment plant or from a standardised WWTP of similar size.

The data were acquired by means of a questionnaire. The largest companies were contacted by telephone. Data were provided either by the companies themselves or by professional associations. In some cases (food, beverages and tobacco industry, electrical and electronics industry), professional associations sent the questionnaire to their members. In others (chemical industry, paper and paperboard industry), the professional associations took over the survey themselves.

[43] It should be noted that fish hatcheries and fish farms are excluded if located in salt-water areas (fjords).

Altogether, approximately 500 enterprises were surveyed. In terms of water consumption, the rate of coverage by industry ranged from 22% to 100%, with an average of 59%.

Individual data were entered into a database, complemented by extra data such as links to the treatment plants, number of days worked, etc.

If data were not available from some plants of a given industry, an extrapolation of annual loads was carried out on the basis of data available from the responding individual plants and from the water consumption by the whole industry, provided by the Austrian Central Statistical Office.

Separate estimates were made for water used in the production process and for water used for sanitation. Cooling water was excluded.

As stated above, the survey was completed by estimates. For instance, when only data on volumes of wastewater were available, loads from sanitary waters were estimated according to the number of employees. For a number of services (public administration, education, banking, etc.) loads were based on the calculation of sanitary waters only.

The following other sources were used:

- Federal Ministry for agriculture and forestry: sewage emission regulations, protection of the aquatic environment report, various information, e.g. N and P loads for agriculture,
- Offices of the State governments: sewage and sewage works data,
- Austrian Central Statistical Office: information about water consumption in 1994,
- Literature data: abating performance of the wastewater treatment plants for AOX and heavy metals, heavy metal emissions per inhabitant equivalent.

The resulting tables cover households as well as industries emissions. Due to the heterogeneous nature of the data, there is no single reference year but only a reference period 1994-1997.

2.3.5 Monitoring network: Portugal

In Portugal, water quality is regularly monitored by the INAG (Portuguese Water Institute): a network of sampling points has been constituted in order to measure the quality of water at abstraction (to ensure compliance with the norms established for abstraction for human use). But INAG also surveys the emissions of pollutants. It was therefore able to supply INE with data on:

- quality of wastewater arriving at treatment plants,
- quality of wastewater at the point of discharge into water bodies.

However, only public wastewater systems are surveyed by INAG. The information on emissions is subsequently partial. No information could be provided on discharges by industrial wastewater treatment plants as well as on wastewater directly discharged either by industries or by households (64% of the population is connected to a public sewage system).

The information on wastewater quality in the public wastewater system is not as regularly supplied as that on abstracted water quality.

2.3.6 Modelling: France

An emission model had been conceived in a larger framework, in order to answer the multiple requests from the OSPAR convention, the European Directives on water, the IPPC Directive, etc. A consortium was organised between EEA Topic Centre for Inland Waters at the European level, OIEau and *Ifen* to develop a flexible model, which was tested on the Loire-Bretagne water basin.

Since a comprehensive national inventory for wastewater discharges does not exist in France, combination of data had to be used: detailed data on emissions of wastewater and of pollutants in water by the industry on the one hand, and the use of models to estimate pressures by households and the agriculture, on the other.

Different approaches were used, according to the origin of the discharges.

Industry

The 6 Water Agencies, established by the 1964 Water Act, are responsible for the implementation of the national water policy at the local level. Until recently, they were collecting taxes and fees levied on the water abstracted and on the estimated wastewater or pollutants releases. Although independent, they use common methodologies.

Pollution taxes are calculated according to the gross emission produced by each site. These data are either estimated or measured. Larger points sources emissions are usually monitored. Estimates for smaller plants are based on technical coefficients applied to the level of activity of the site. The coefficients have been drawn for 375 activities grouped into 15 categories. They are based on the level of activity of the highest producing month. Since data are available according to a process-oriented classification (TEF), a correspondence had to be drawn with the NACE nomenclature.

The tax is based on the gross emission but can be reduced if part of the pollution is removed. The final (net) tax paid is then theoretically consistent with the final pollutants discharged. The following parameters are considered: Total Suspended Solids (TSS), Total Organic Compounds (TOC), Toxic substances (Tox) especially metals, Nitrogen (N) and Phosphate (P).

Another source of data consists of the monitoring carried out by the Regional Industry and Environment Public Boards (DRIRE) on installations which need a specific authorisation. These data are regionally collected and then centralised at the national level by the French Ministry of the Environment.

Finally, two types of organisms, the Water Agencies and the technical assistance service for WWTP operators (*SATESE*) collect data on urban wastewater treatment plants: capacity, expressed in organic matter (MO), actual load and abatement rate for MO, total N, total P and TSS.

Agriculture

A model, using CORINE Land Cover data and data from the 1988 national agricultural census, has been developed to estimate nitrogen surplus and phosphorus at the 'canton' level (NUTS 3). The model provides the nutrient input, on the basis of uses of fertilisers and manure. It is considered that 80% of the nutrient surplus, defined as nutrient input less 'exportation' (i.e. absorption by crops) is discharged into water bodies.

Other diffuse emissions

All the rainwater run-off was considered as directly discharged into the river system. Impervious area was calculated from CORINE Land Cover database (urban and industrial surfaces). An abatement factor of 50% was applied for urban surfaces and of 20 to 25% for industrial surfaces. Nitrogen loads from rainwater run-off were calculated from the HYDROSOL database[44].

Integration

A model (called NOPOLU) was then developed to estimate emissions to water. It follows different steps according to the source categories (households, agriculture, industries, urban and industrial diffuse sources), the emission channel and categories (gross emission, direct discharge, connection to a sewage network, to a WWTP, final discharge) and the geographical coverage of the information (watershed, river basin or administrative level).

The basic principle of the model consists in applying a coefficient specific to the characteristics of an activity to the units fulfilling this activity. The coefficient may come from the literature, from a statistical measurement or from another model.

The pilot study tested this model for the Loire Bretagne water basin, by comparing the results with data supplied by other sources. Four procedures were successively used and the results systematically compared:

- the already aggregated tables of emissions issued by the Loire-Bretagne Water Agency were applied using a correspondence table between the Agency's nomenclature of processes and NACE;

[44] HYDROSOL is a database created by IFEN combining administrative units with hydrographic boundaries at NUTS 5 and giving the area of each of the 44 CORINE Land Cover types.

- individual data from the Loire-Bretagne Water Agency database of industrial sites was aggregated on the basis of their actual NACE code for 80% of the enterprises;
- the NOPOLU model was fed with individual data, applying the correspondence TEF/NACE;
- the NOPOLU model was fed with individual data with their NACE code when known.

Table 2.3-2 Example: nitrogen in the Loire-Bretagne basin, tonnes N per day

Sources	Gross emission	Direct emission to the environment	%	Transferred	Treated	Net emission	%
Agriculture	903	582	80.0	0	322	582	80.0
Scattered population	37	2	0.3	0	35	2	0.3
Urban Population	123	7	0.9	117	0	80	11.0
Urban diffuse	28	28	3.8	0	0	28	3.8
Industrial, discharges	71	15	2.1	28	28	27	3.8
Industrial, diffuse	9	9	1.3	0	0	9	1.3
Total	**1 171**					**727**	
Received in sewage	143	1	0.1	142	0		
UWWTP	142	13	1.7	72	58		
Final discharge	72	72	9.9				
TOTAL		**727**			**442**		

Note: data refer to 1997 except agricultural data, which refer to 1990.

Source: Ifen, BETURE-CEREC.

2.3.7 Using environmental reports of enterprises: Sweden

Statistics Sweden has been developing an economy-wide material flow account, but water was not included until this pilot study. What was expected from it was a set of supply-use tables in a NAMEA-type framework and recommendations for improvement and further development of the accounts.

The project was seen as the first step to set up accounts for water. It focussed on water flows in the 'technosphere', i.e. on water abstraction and use and on emission of pollutants to water. Only readily available data, in both physical and monetary units, were used, with recalculation when needed for adaptation to the accounts.

The Swedish environmental protection law requires all large point sources of emissions to water to report their main emission parameters to a supervision agency, which is generally a local authority. In most cases emissions are measured. The reporting unit is generally the local unit (establishment), not the enterprise.

For the largest establishments, the supervision agencies deliver copies of the reports to the County administrative boards and to the Swedish Environmental Protection Agency (EPA).

For the pulp and paper industry (65 plants), the aggregated results from the EPA annual publication have been used. Estimates of nitrogen discharges for some other industries have also been taken from the EPA.

For their part, the almost 500 MWWTPs serving more than 2 000 inhabitant-equivalents[45] are required to produce environmental reports. They treat about 90 % of the municipal wastewater.

The 25 largest MWWTPs (more than 100 000 inhabitant-equivalents each, treating around half of the wastewater) are surveyed every two or three years. Data were taken from these surveys.

Some treatment parameters reported annually to the Swedish Water and Wastewater Association (the VAV) by the municipalities have also been used in the estimates: number of treatment plants, volume of water treated, number of inhabitant-equivalents served, permanent population.

[45] inhabitant equivalent is defined in Sweden as 70 grams of BOD_7 per day

Only emissions stemming from the large point sources have been included in the tables supplied. No attempt to estimate pollution content of the smaller sources has been made. The pollution by small MWWTPs may amount to a supplementary 10 %. Similarly, a non-negligible part of the industrial discharges might have fallen outside the environmental reporting system.

Most of the data refer to a single year, 1995.

2.3.8 Methods studied by Luxembourg

It is difficult to obtain detailed data on wastewater in Luxembourg: total amounts are well known, but they are not allocated to the different industries. 16 industrial plants dealing with heavy metals have their own IWWTP and provide data to the Environmental Administration from 1995 onwards. Some other industries (breweries notably) also have their own IWWTP.

For each public WWTP, annual data on the amount of wastewater, on BOD, COD, nitrogen and phosphorus at the entry and exit flows and pollutants' content of sludge are available. However the origin of the wastewater is unknown. A coefficient should be used for allocation of incoming flows of wastewater to small industries and services, and the number of employees was proposed. As regards households, data on water use is available in districts or associations of districts but has never been centralised. Exploitation seems possible on the basis of unit prices. No data is available on diffuse pollution.

2.3.9 Comparison of methods

As regards information on the discharge of pollutants into water, European countries are not at the same stage. Some are just looking for data collected at local levels, which could make it possible to build aggregated information, some are organising a comprehensive reporting system, while others are already trying to relate environmental pressures on water bodies to their state.

Whereas some countries, within this pilot exercise, only tested the feasibility of building accounts with readily available data, others also questioned the quality of the available data.

However, an overall conclusion could be that the availability of basic data are most often linked to strict legislation on water uses, combined with monitoring and surveying, that is to say, a rigorous water policy.

3 Results and analyses

This chapter presents the results of the pilot applications, country by country. Due to the 'pilot' nature of the different exercises carried out in the countries, and notably in connection with the data available in each of them, the results are not harmonised and it is difficult to compare the countries' results. Each country adapted the tables proposed by Eurostat to its own concerns, system and data. These adaptations in themselves provide interesting conclusions as concerns the feasibility and usefulness of Eurostat's proposal.

For each country, two types of results will be presented: first rough results, that is to say, more or less the pilot tables proposed by Eurostat, secondly, short analyses which have been carried out by certain Member States with the help of derived indicators. Examples of such analyses are evolution of indicators over time, comparison of industries' performances with regard to their water use, overall economic dependency on water, etc.

It was of course difficult to make the selection. Fourteen Member States plus Norway supplied reports, some of them supplying several reports. Results were chosen either because of their representativeness of the common features of the reports or on the contrary, because of their peculiar point of view, when the underlying idea seemed to merit discussion at European level.

3.1 The water economy

3.1.1 Denmark

Tables

In Denmark, because it was possible to use data with enterprises as the recording units, very detailed use tables could be drawn up: the information is given for as many as 128 industries.

The following table gathers information included in pilot tables 2 and 13. Some data from pilot table 6 (water flows corresponding to uses) have also been added, as the element necessary for calculating 'implicit' prices. Furthermore, detail is available for the different components of the use value: the water value (proportional to the quantity), fixed payment (renting of the meter) and connection fees (one-off payment), as well as the value of wastewater services.

The results were compared to the national accounts use table of the product 'distributed water'. With equal totals (coming from NACE 41 output), different breakdowns were obtained. For instance, in 1996, while households accounted for 67,5% of the uses in the national accounts, they amounted to 65,5% according to the results of the pilot study. At the level of the different industries, the importance of the differences increases. For instance, according to exercise, construction activities use more than three times as much as they are supposed to do in the national accounts.

The water-related taxes showed larger differences between the two sources, even in the totals: national accounts valued them at around 18% more in 1995 and 10% more in 1996 than the present exercise.

All these differences will be later analysed by the national accounts and the environmental accounts departments.

Table 3.1-1 Physical and monetary supply-use table for tap water and sewage services, Denmark 1997

		Tap water							Sewage	
NACE		*Quantity*	*Water value*	*Fixed payments*	*Connection fees*	*Total*	*Implicit price excl. fixed payment*	*Implicit price incl. fixed payment*	*Quantity*	*Service value*
		1,000 m^3	1,000 DKK	1,000 DKK	1,000 DKK	1,000 DKK	DKK/m^3	DKK/m^3	1,000 m^3	1,000 DKK
	Total supply=total use	*412600*	*1658743*	*709882*	*275486*	*2644111*	*4,02*	*5,74*	*354581*	*3951234*
	Households' use	*265600*	*1053835*	*538898*	*159960*	*1752693*	*3,97*	*6,00*	*254976*	*2799395*
	Industries' use, total	*147000*	*604907*	*170984*	*115527*	*891418*	*4,12*	*5,27*	*99604*	*1151839*
011009	Agriculture	33932	94275	40411	4804	139490	2,78	3,97	3030	37948
011209	Horticulture, orchards etc.	1454	5478	1760	317	7554	3,77	4,98	325	4203
014000	Agricultural services; landscape gardeners etc.	380	1263	1447	343	3053	3,32	7,13	340	4310
020000	Forestry	77	346	675	93	1114	4,49	13,27	69	844
050000	Fishing	210	585	1260	2	1847	2,79	8,80	187	2355
110000	Extr. of crude petroleum, natural gas etc.	2	15	11	0	26	6,11	10,50	2	21
140009	Extr. of gravel, clay, stone and salt etc.	103	496	160	14	671	4,82	6,38	92	1059
151000	Production etc. of meat and meat products	5941	20637	3079	179	23896	3,47	3,99	5304	55287
152000	Processing etc. of fish and fish products	3113	9145	2048	96	11289	2,94	3,60	2780	33504
153000	Processing etc. of fruit and vegetables	793	2359	374	177	2910	2,97	3,45	708	8593
154000	Mfr. of vegetable and animal oils and fats	342	1475	109	35	1618	4,31	4,63	306	3943
155000	Mfr. of dairy products	3788	16442	1246	224	17912	4,34	4,67	3382	41140
156009	Mfr. of starch, chocolate and sugar products	2466	10407	858	1052	12318	4,22	4,57	2202	26826
158109	Mfr. of bread, cakes and biscuits	436	1460	237	14	1712	3,35	3,90	389	4489
158120	Bakers' shops	181	633	772	7	1412	3,50	7,76	105	1305
158300	Manufacture of sugar	153	1076	47	85	1208	7,04	7,34	137	1425
159000	Mfr. of beverages	5792	28849	1679	1092	31619	4,98	5,27	4278	44172
160000	Manufacture of tobacco products	70	471	14	78	563	6,74	6,94	62	614
170000	Mfr. of textiles and textile products	1980	6399	1125	381	7905	3,23	3,80	1768	17828
180000	Mfr. of wearing apparel; dressing etc. of fur	84	270	478	32	780	3,22	8,91	75	798
190000	Mfr. of leather and leather products	127	592	95	17	705	4,67	5,42	113	1525
200000	Mfr. of wood and wood products	767	3057	603	565	4225	3,99	4,77	685	9403
210000	Mfr. of pulp, paper and paper products	438	2163	221	120	2504	4,93	5,44	391	4737
221200	Publishing of newspapers	84	459	126	34	619	5,47	6,98	75	806
221309	Publishing activities, excluding newspapers	59	277	573	81	931	4,69	14,40	53	531
222009	Printing activities etc.	163	647	951	200	1798	3,97	9,81	145	1704
230000	Mfr. of refined petroleum products etc.	584	2319	13	0	2332	3,97	3,99	521	6646
241109	Mfr. of industrial gases and inorganic basic chemicals	113	428	77	28	534	3,79	4,48	101	1062
241209	Mfr. of dyes, pigments and organic basic chemicals	399	1706	100	47	1852	4,27	4,52	357	4842
241500	Manufacture of fertilizers etc.	978	2227	285	8	2519	2,28	2,57	873	5963
241617	Mfr. of plastics and synthetic rubber	205	567	125	1	693	2,77	3,38	183	2630
242000	Manufacture of pesticides and other chemical products	1	4	4	87	96	4,54	9,73	1	11
243000	Mfr. of paints, printing ink and mastics	132	907	67	46	1020	6,88	7,38	118	1084
244000	Mfr. of pharmaceuticals etc.	4204	30703	487	119	31308	7,30	7,42	3753	32640
245070	Mfr. of detergents and other chemical products	1627	5100	593	81	5774	3,13	3,50	1453	15035
251122	Mfr. of rubber products and plastic packing goods etc.	598	2656	336	468	3460	4,44	5,00	534	6676
252300	Mfr. of builders' ware of plastic	23	89	48	76	213	3,92	6,01	20	225
252400	Manufacture of other plastic products n.e.c.	161	755	221	63	1038	4,70	6,08	143	1992
261126	Mfr. of glass and ceramic goods etc.	176	777	298	41	1117	4,42	6,12	157	2001
263053	Mfr. of cement, bricks, tiles, flags etc.	108	291	74	46	410	2,68	3,36	97	1258

Physical and monetary supply-use table for tap water and sewage services, Denmark 1997. Continued.

		Tap water							Sewage	
NACE		*Quantity*	*Water value*	*Fixed payments*	*Connection fees*	*Total*	*Implicit price excl. fixed payment*	*Implicit price incl. fixed payment*	*Quantity*	*Service value*
		1,000 m^3	1,000 DKK	1,000 DKK	1,000 DKK	1,000 DKK	DKK/m^3	DKK/m^3	1,000 m^3	1,000 DKK
266080	Mfr. of concrete, cement, asphalt and rockwool prod.	988	4242	655	398	5295	4,29	4,96	882	11462
271000	Mfr. of basic ferrous metals	86	305	46	86	436	3,53	4,07	77	1299
272030	First processing of iron and steel	126	307	102	196	605	2,43	3,24	113	1357
274000	Mfr. of basic non-ferrous metals	83	181	51	189	421	2,18	2,79	74	882
275000	Casting of metal products	1	3	17	11	32	3,67	23,66	1	8
281009	Mfr. of construct. materials of metal etc.	593	2434	1507	1013	4954	4,11	6,65	529	6086
286009	Mfr. of hand tools, metal packaging etc.	476	1809	717	210	2737	3,80	5,31	425	4820
291000	Mfr. of marine engines, compressors etc.	280	1084	248	177	1509	3,88	4,76	250	2927
292000	Mfr. of other general purpose machinery	247	975	440	480	1895	3,96	5,74	220	2543
293000	Mfr. of agricultural and forestry machinery	92	436	207	238	880	4,75	7,01	82	948
294009	Mfr. of machinery for industries etc.	144	644	465	204	1314	4,47	7,69	129	1474
297000	Mfr. of domestic appliances n.e.c.	106	388	111	114	613	3,67	4,73	94	843
300000	Mfr. of office machinery and computers	2	9	49	0	59	4,92	31,06	2	21
310000	Mfr. of other electrical machinery and apparatus	169	759	499	676	1934	4,49	7,45	151	1715
320000	Mfr. of radio and communicat. equipm. etc.	405	1235	348	70	1653	3,05	3,91	361	3935
330000	Mfr. of medical and optical instrum. etc.	93	455	349	394	1198	4,88	8,62	83	1078
340000	Manufacture of motor vehicles etc.	237	715	192	612	1519	3,01	3,82	212	2293
351000	Building and repairing of ships and boats	450	2164	348	200	2713	4,81	5,59	401	5959
352050	Mfr. of transp. equipm. excl. ships, motor vehicles etc.	50	185	72	45	302	3,72	5,17	44	610
361000	Mfr. of furniture	303	988	899	1896	3783	3,26	6,24	270	3390
362060	Mfr. of toys, gold and silver articles etc.	61	195	509	87	790	3,21	11,59	54	716
370000	Recycling of waste and scrap	23	128	8	0	136	5,66	6,02	20	221
401000	Production and distribution of electricity	5242	26145	1680	2847	30673	4,99	5,31	2895	36656
402000	Manufacture and distribution of gas	26	112	25	80	217	4,25	5,21	23	290
403000	Steam and hot water supply	806	2447	564	1273	4284	3,04	3,74	50	624
410000	Collection and distribution of water	264	1047	587	146	1780	3,96	6,19	236	3045
450000	Construction of new buildings	772	3477	11134	0	14611	4,50	18,92	690	8530
501009	Sale of motor vehicles, motorcycles etc.	426	1700	1867	1316	4882	3,99	8,37	381	4456
502000	Repair and maintenance of motor vehicles	350	1228	2582	555	4365	3,51	10,88	313	3731
505000	Service stations	1289	6129	1292	87	7508	4,76	5,76	1151	13627
510000	Ws. and commis. trade, exc. of m. vehicles	6854	38826	10945	5032	54803	5,66	7,26	6120	63493
521090	Retail trade of food etc.	1113	5697	4392	242	10330	5,12	9,06	994	11742
522990	Department stores	533	2617	230	582	3429	4,91	5,34	476	5935
523000	Re. sale of phar. goods, cosmetic art. etc.	40	182	583	4	769	4,56	19,21	36	434
524190	Re. sale of clothing, footwear etc.	61	234	2440	82	2756	3,84	43,99	54	623
524490	Other retail sale, repair work	307	1242	7267	1948	10457	4,05	27,71	274	3318
551009	Hotels etc.	2675	10485	2225	771	13481	3,92	4,75	2388	29248
553009	Restaurants etc.	1244	4995	5524	1578	12097	4,02	8,46	1110	13185
601000	Transport via railways	516	3591	210	3	3804	6,96	7,36	461	4834
602100	Other scheduled passenger land transport	119	630	269	10	909	5,28	7,53	107	1249
602223	Taxi operation and coach services	225	1081	508	25	1614	4,80	7,06	201	2373
602409	Freight transport by road and via pipelines	319	1078	3482	176	4736	3,38	14,30	285	3381
610000	Water transport	432	2583	385	4	2972	5,98	6,87	386	3942
620000	Air transport	60	436	80	1	517	7,25	8,59	54	564

Physical and monetary supply-use table for tap water and sewage services, Denmark 1997. Continued.

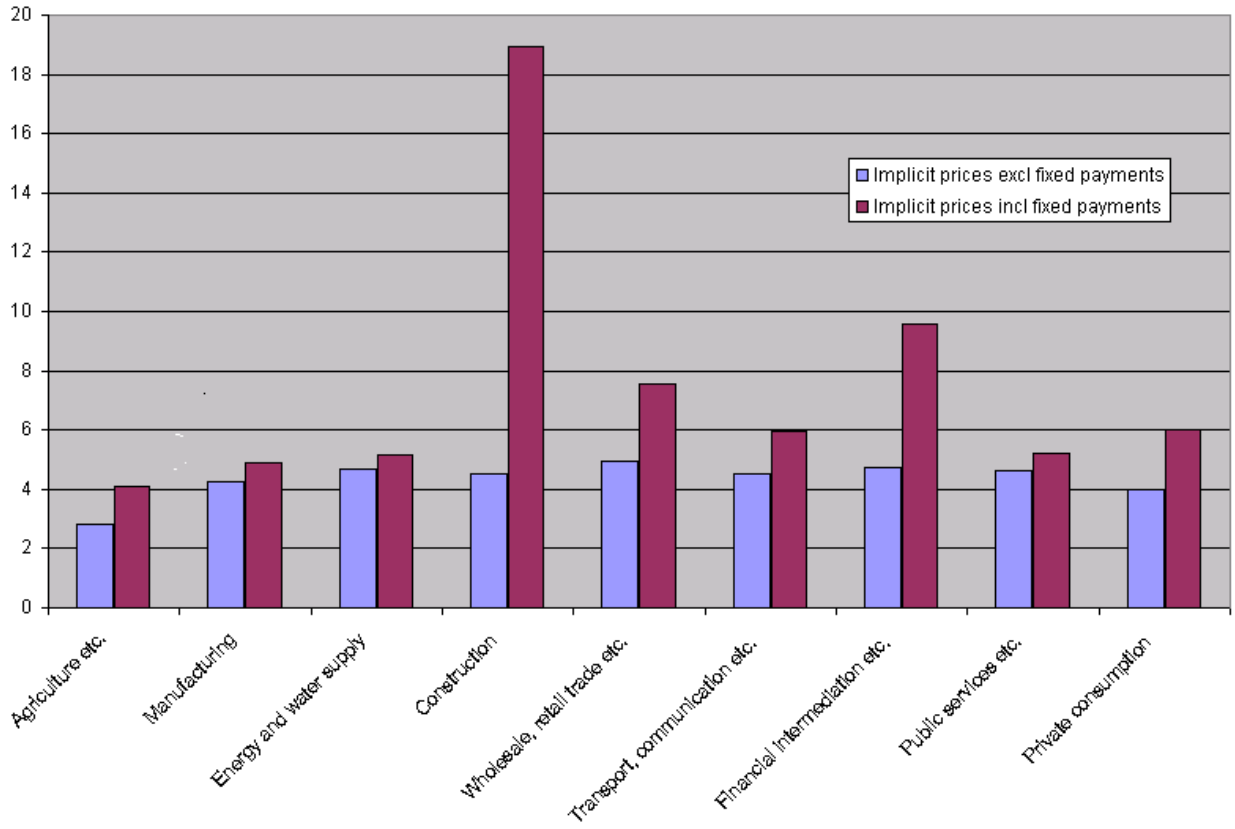
		Tap water							Sewage	
NACE		*Quantity*	*Water value*	*Fixed payments*	*Connection fees*	*Total*	*Implicit price excl. fixed payment*	*Implicit price incl. fixed payment*	*Quantity*	*Service value*
		1,000 m^3	1,000 DKK	1,000 DKK	1,000 DKK	1,000 DKK	DKK/m^3	DKK/m^3	1,000 m^3	1,000 DKK
631130	Cargo handling, harbours etc.; travel agencies	3164	12415	1322	368	14105	3,92	4,34	2825	33288
634000	Activities of other transport agencies	95	381	469	115	965	4,02	8,96	85	944
640000	Post and telecommunications	357	1642	824	6	2471	4,59	6,90	319	4068
651000	Monetary intermediation	404	2039	913	10	2961	5,04	7,30	361	4132
652000	Other financial intermediation	78	447	176	431	1054	5,74	7,99	70	787
660102	Life insurance and pension funding	27	162	60	1	224	6,06	8,31	24	285
660300	Non-life insurance	128	772	289	0	1061	6,03	8,29	114	1254
670000	Activities auxiliary to finan. intermediat.	31	213	71	0	284	6,79	9,05	28	281
701109	Real estate agents etc.	237	1304	1105	23	2432	5,51	10,19	211	2261
702009	Dwellings	437	1658	4168	64504	70331	3,80	13,34	390	4643
702040	Letting of non-residential buildings	587	2101	1845	3862	7808	3,58	6,73	524	6504
710000	Renting of machinery and equipment etc.	97	327	796	155	1279	3,39	11,63	86	917
721009	Computer activities exc. software consultancy and supply	47	276	429	1	706	5,88	14,99	42	496
722000	Software consultancy and supply	22	99	1326	50	1474	4,55	65,34	19	211
730001	Research and development (market)	11	62	26	0	88	5,47	7,73	10	125
730002	Research and development (other non-market)	70	385	159	0	544	5,47	7,73	63	776
741100	Legal activities	95	497	214	1	712	5,24	7,49	85	978
741200	Accounting, book-keeping, auditing etc.	166	801	375	13	1189	4,82	7,07	148	1744
742009	Consulting engineers, architects etc.	127	643	2596	168	3407	5,05	25,42	114	1225
744000	Advertising	99	546	224	44	814	5,52	7,77	88	1005
747000	Industrial cleaning	352	1656	794	7	2457	4,71	6,97	314	3717
748009	Other business activities	381	2043	860	163	3065	5,36	7,62	340	3966
751100	General (overall) public service activities	613	2822	294	0	3116	4,61	5,09	547	6581
751209	Reg. of public service activities exc. for business	181	1088	408	760	2256	6,02	8,28	161	1851
751300	Reg. of and contribution to more eff. op. of business	98	580	221	0	800	5,93	8,19	87	990
752000	Provision of services to the community	1167	5307	2633	176	8116	4,55	6,81	1042	12230
801000	Primary education	12198	51382	3863	678	55923	4,21	4,53	10891	132771
802000	Secondary education	4135	19600	1309	113	21023	4,74	5,06	3692	43266
803000	Higher education	1814	10691	574	21	11287	5,89	6,21	1619	18417
804001	Adult and other education (market)	31	140	15	48	203	4,56	5,04	27	329
804002	Adult and other education (other non-market)	258	1177	124	0	1301	4,56	5,04	230	2768
851100	Hospital activities	4078	20526	1291	20	21837	5,03	5,35	3641	43448
851209	Medical, dental, veterinary activities etc.	597	2671	1347	434	4452	4,48	6,73	533	6416
853109	Social institutions etc. for children	6242	28320	2998	57	31375	4,54	5,02	5573	67508
853209	Social institutions etc. for adults	2146	9434	1031	2505	12971	4,40	4,88	1916	23111
900010	Sewage removal and disposal	573	2063	350	350	2763	3,60	4,21	512	6111
900020	Refuse collection and sanitation	136	566	291	38	895	4,17	6,31	121	1541
900030	Refuse dumps and refuse disposal plants	395	1915	175	353	2444	4,84	5,29	353	4320
910000	Activities of membership organiza. n.e.c.	369	1885	834	82	2801	5,10	7,36	330	3837
920001	Recreational, cultural, sporting activities (mrkt.)	265	1397	84	3147	4628	5,26	5,58	237	2725
920002	Recreational, cultural, sporting act. (other non-mrkt.)	1601	8427	507	1108	10041	5,26	5,58	1429	16444
930009	Service activities n.e.c	2156	11002	4384	502	15888	5,10	7,14	1925	22198
950000	Private households with employed persons	7	38	16	0	54	5,42	7,68	6	73

Source: Statistics Denmark – 1997 water accounts related to NAMEA

Graphic analyses

Graphic presentations of the prices have been introduced in the report in order to summarise the information collected.

Figure 3.1-1 Implicit water prices by industry (NACE 1-digit level), Denmark 1997, DKK/m³



Source: Statistics Denmark – 1997 water accounts related to NAMEA

The 'implicit' price presented in the graph corresponds to the ratio [value of uses/volumes]. It excludes connection fees, since this component does not actually provide information about price variations.

From this rather aggregated breakdown of activities, some quick conclusions can be drawn: agriculture pays water at a lower price than other activities. Construction activities and financial intermediaries contribute substantially to the 'fixed payment' element. However, Denmark Statistics noted that location is probably the main element that explains the price. Rural/urban area could also be a discriminating element. Some water operators prefer relatively low unit prices and higher fixed payment and some the inverse. The minimum unit price observed in 1996 among DVF members was 0.5, the maximum 11.25 DKK/m^3. The minimum fixed payment was 0, the maximum 1 150 DKK/year.

NAMEA

A full 128x128 input/output table was established with the information collected. A reduced form of the Danish NAMEA is reproduced on next page. The water supply activity (NACE 41) has been isolated.

Table 3.1-2 Danish water NAMEA 1997

	Production activity									Final demand					Total	Water discharges			
	1	2	3a	3b	4	5	6	7	8	Private consumption	Gov. consumption	Gr. fixed Cap. Form.	Exports	Other		Added to products	Discharge to sewer	Other discharge	Total
Opening stock																			
1. Agriculture, fishing and quarrying	10 630	44 921	3 922	1	1 802	327	22	74	613	3 434	1 089	1	18 079	1 335	86 250	508	4 045	429 931	434 484
2. Manufacturing	7 742	72 294	470	43	29 651	13 270	5 602	12 390	9 126	50 160	1 210	25 061	219 929	5 872	452 821	3 971	35 743	209 787	249 501
3a. Electricity, gas and heating supply	1 059	5 546	1 873	71	95	2 762	682	973	3 274	15 300	0	0	3 962	227	35 823	0	2 968	5 217 687	5 220 655
3b. Water supply	146	195	30	94	15	115	39	85	220	1 788	0	0	0	0	2 728	0	236	469 614	469 850
4. Construction	1 168	1 909	1 907	460	1 214	1 333	3 127	14 608	5 706	5 547	6 095	89 779	13	23	132 889	0	690	82	772
5. Wholesale and retail trade; hotels and restaurants	5 416	28 564	226	19	15 407	12 179	6 687	4 009	7 312	116 649	1 660	19 501	30 685	2 036	250 350	0	13 297	1 995	15 292
6. Transport storage and communication	1 689	12 446	69	125	2 995	24 438	24 167	9 802	12 551	26 273	837	4	61 656	792	177 844	0	4 723	564	5 287
7. Financial intermediation, business activities	3 809	19 614	687	428	19 893	29 018	8 303	37 350	21 842	122 298	3 295	7 068	6 150	42 193	321 946	0	3 031	365	3 396
8. Public and personal services	1 197	4 900	162	132	1 496	4 822	2 580	6 518	19 498	56 037	267 210	113	1 067	2 484	368 217	0	34 872	5 479	40 351
9. Households																0	254 976	28 505	283 481
Imports	8 239	95 381	3 378	23	14 605	13 517	44 982	5 221	12 258	58 064	1 818	35 190	69 609	7 609	369 893				
Taxes, net	-2 081	-1 046	103	18	727	3 782	2 353	13 271	16 277	105 304	1 315	23 151	-4 259	347	159 263				
Compensation of empl., operating surplus	47 236	168 096	22 996	1 313	44 989	144 786	79 300	217 648	259 539	0	0	0	0	-31 051	954 853				
Total (Mio DKK)	86 250	452 821	35 823	2 728	132 889	250 350	177 844	321 946	368 217	560 854	284 529	199 868	406 891	31 867	3 312 877				
Groundwater	389 819	52 967	4 070	467 926	0	400	0	0	1 267	17 881									934 330
Surface water	8 507	6 107	1 386	1 660	0	0	0	0	24	0									17 684
Sea water	0	149 326	5 209 125	0	0	0	0	0	0	0									5 358 451
Tap water	36 158	41 101	6 074	264	772	14 892	5 287	3 396	39 060	265 600									412 604
Total (1 000 m^3)	434 484	249 501	5 220 655	469 850	772	15 292	5 287	3 396	40 351	283 481						4479	354 581	6 364 009	6 723 069

Source: Statistics Denmark – 1997 water accounts related to NAMEA

3.1.2 Spain

Spain used the set of pilot tables practically in its entirety to present its results, which proves the proposal's feasibility, at least in the Spanish case. It must be remembered that Spain's data collection system is based on surveys. As already mentioned, water is particularly important for the Spanish economy, and well monitored.

The next pages reproduce pilot tables 1 and 13 without any adaptation.

Spain is a one of the two countries, together with the Netherlands, that conducted a tentative evaluation of the central or regional government expenditures regarding water management (CPA column Part 75.12.13 in the pilot table 1). The production of water-related administrative services, related to the production of water supply activity is 2,6% in Spain whereas it amounts to 32% in the Netherlands (output of 'Water Boards').

As in Denmark, agriculture does not pay the same price as other activities, even for drinking water: the results suggest less than 10 pesetas against an average of 83 pesetas. Agriculture is also the only activity where the price of wastewater treatment services surpasses that of distributed water (together, this time, with mining and quarrying of energy-producing materials). These 'rough' results would need more in-depth analysis: according to the volumes of water flows not all wastewater is treated in rural areas.

Table 3.1-5 and Table 3.1-6 correspond to the multiple pilot tables 3 and 4 of Eurostat's set. These multiple tables have been aggregated into one, including all water-related products.

In Table 3.1-6 (expenditures for ancillary activities related to water), among current expenditure, only the purchases of intermediate consumption products could be estimated, and not the compensation of employees.

Table 3.1-3 Supply table of water-related services, Spain 1999, million ESP

CPA code of the product		Part 01.41.11	41.00.11	41.00.12	41.00.20.01	41.00.20.02	**41.00**	Part 75.12.13	90.00.11
Product Economic activities		Operation of irrigation systems	Drinking water	Non drinking water	Distribution services of drinking water	Distribution services of non drinking water	**Total distributed water**	Water-related administrative services	Sewage removal & treatment
	total production at basic prices	61 060	303 014	13 220	40 435	28 820	**385 489**	9 563	108 423
O1*	Operation of irrigation systems	61 060							
A*	Agriculture, Hunting and forestry								
B	Fishing								
CA	Mining and Quarrying of energy producing materials								
CB	Mining and Quarrying except energy producing materials								
DA	Manufacture of food products; Beverages and tobacco								
DB	Manufacture of textiles and textile products								
DC	Manufacture of leather and leather products								
DD	Manufacture of wood and wood products								
DE	Manufacture of pulp and paper products; publishing and printing								
DF	Manufacture of coke, refined petroleum products and nuclear fuel								
DG	Manufacture of chemicals, chemical products and man-made fibres								
DH	Manufacture of rubber and plastic products								
DI	Manufacture of other non-metallic mineral products								
DJ	Manufacture of basic metals and fabricated metal products								
DK	Manufacture of machinery and equipment n.e.c.								
DL	Manufacture of electrical and optical equipment								
DM	Manufacture of transport equipment								
DN	Manufacturing n.e.c.								
41	Collection, purification and distribution of water		303 014	13 220	40 435	28 820	**385 489**		
E*	Electricity, gas and water supply								
F	Construction								
75*	Public administration and Defence; compulsory social security							9 563	
90*	Sewage removal and treatment								108 423
R*	Others activities (G to Q, except 75* & 90*)								
Taxes on products		487	1 640				**1 640**		2 948
	Of which environmental								
Subsidies on products		1 768	3 846				**3 846**		1 803
	Of which environmental								
Imports CIF									
Total supply at purchasers prices		59 779	300 808	13 220	40 435	28 820	**383 283**	9 563	109 568

* Specifically defined classes. Source: Eurostat Working Paper n° 2/2001/B/6 – Water Satellite Accounts for Spain 1997-1999

Table 3.1-4 Average purchasers' prices of water-related products, Spain 1999, ESP/m³

Economic product / Economic agent	Part 01.41.11 Operation of irrigation systems	41.00.11 Drinking water	41.00.12 Non drinking water	41.00.20.01 Distribution services of drinking water	41.00.20.02 Distribution services of non drinking water	41.00 Total distributed water	90.00.11 Sewage removal and treatment
01* Operation of irrigation systems		90.26		33.81			31.63
A* Agriculture, hunting and forestry, except 01*	3.02	9.89	27.56	1.38	11.62	28.40	34.59
B Fishing		98.27		13.84		120.62	31.32
CA Mining and quarrying of energy producing materials		25.96		3.74		49.83	52.36
CB Mining and quarrying except energy producing materials		27.58		4.26		69.28	12.64
DA Manufacture of food products; beverages and tobacco		83.26		11.60		116.68	72.71
DB Manufacture of textiles and textiles products		96.35		13.40		183.10	83.24
DC Manufacture of leather and leather products		78.19		10.08		168.08	63.68
DD Manufacture of wood and wood products		61.70		8.35		84.35	54.61
DE Manufacture of pulp, paper; publishing and printing		65.93		9.20		124.82	49.42
DF Manufacture of coke, refined petroleum and nuclear fuel		54.74		7.64		74.90	68.27
DG Manufacture of chemicals, man-made fibres		71.14		9.91		100.58	66.12
DH Manufacture of rubber and plastic products		69.81		9.72		112.77	54.64
DI Manufacture of other non-metallic mineral products		75.29		10.69		97.47	45.93
DJ Manufacture of basic metals and fabrication of metal products		78.84		10.99		98.55	49.28
DK Manufacture of machinery and equipment n.e.c.		84.86		11.79		114.14	76.55
DL Manufacture of electrical and optical equipment		80.52		11.26		106.70	44.51
DM Manufacture of transport equipment		61.76		8.59		73.69	42.30
DN Manufacturing n.e.c.		66.27		9.31		88.12	46.39
41 Collection, purification and distribution of water							83.03
E* Electricity, gas and water supply, except 41		87.84		12.28		118.80	67.58
F Construction		78.28		10.93		91.91	29.80
75* Public administrative services for water supply and sewage systems		95.73		14.62		113.04	44.15
90* Sewage removal and treatment services		62.43	20.32	8.75	34.40	60.30	
R* Other services (G to Q, except 75* and 90*)		81.48	33.19	11.79	10.67	89.22	34.90
Average price of intermediate consumption of industries	3,02	71.25	26.44	10.24	76.72	86.18	44.09
Average price for households' final consumption		90.86	32.71	11.82	1.75	99.71	41.82
Average FOB price for exports							
Average purchaser's price	3,02	83.51	27.79	11.23	60.58	94.00	42.43

Source: Eurostat Working Paper n° 2/2001/B/6 – Water Satellite Accounts for Spain 1997-1999

Table 3.1-5 Economic accounts for water-related economic activities, Spain 1999, million ESP

	Non-financial corporations	General Government	NPISH	Households	Total
Production and generation of income accounts					
1 Total intermediate consumption	291 314	1 670			292 984
2 Total value added, gross	263 658	7 893			271 551
2.1 Compensation of employees	138 554	3 030			141 584
2.2 Other taxes on production	3 045				3 045
Of which: environmental taxes					
2.3 Less other subsidies on production	2 554				2 554
Of which: environmental subsidies					
2.4 Consumption of fixed capital		4 863			4 863
2.5 Net operating surplus	124 613				124 613
3 Total output at basic prices	554 972	9 563			564 535
3.1 Market	554 972				554 972
3.2 Non-market		9 563			9 563
Supplementary information about fixed capital and labour inputs					
4 Investment grants					
5 Gross fixed capital formation	137 198	54 030			191 228
6 Closing stocks of fixed assets					
7 Total hours worked (number of hours)	65 674	941			66 615

Source: Eurostat Working Paper n° 2/2001/B/6 – Water Satellite Accounts for Spain 1997-1999

Table 3.1-6 Expenditure for ancillary water-related activities, Spain 1999, million ESP

Economic activities	**Current expenditure**		**Capital expenditure**
	Intermediate consumption	Other current expenditure	
01* Operation of irrigation systems			
A* Agriculture, hunting and forestry, except 01*	5 324		1 590
B Fishing	125		35
CA Mining and quarrying of energy producing materials	167		715
CB Mining and quarrying except energy producing materials	205		680
DA Manufacture of food products; beverages and tobacco	167		7 358
DB Manufacture of textiles and textiles products	1 295		1 052
DC Manufacture of leather and leather products	121		997
DD Manufacture of wood and wood products	116		140
DE Manufacture of pulp, paper; publishing and printing	719		732
DF Manufacture of coke, refined petroleum and nuclear fuel	416		722
DG Manufacture of chemicals, man-made fibres	1 410		11 748
DH Manufacture of rubber and plastic products	121		5 009
DI Manufacture of other non-metallic mineral products	65		2 262
DJ Manufacture of basic metals and fabrication of metal products	279		515
DK Manufacture of machinery and equipment n.e.c.	132		459
DL Manufacture of electrical and optical equipment	80		442
DM Manufacture of transport equipment	263		472
DN Manufacturing n.e.c.	29		419
E F, 75*, 90*, R*	no data available		
Total industries	11 034		35 347
Households for final consumption			
Total	11 034		35 347

Source: Eurostat Working Paper n° 2/2001/B/6 – Water Satellite Accounts for Spain 1997-1999

3.1.3 Ireland

National accounts data

The public suppliers of water and wastewater services in Ireland are the local authorities. The Central Statistics Office receives data on production costs from the DoELG (Department of the Environment & Local Government), on water supply and on wastewater treatment separately, data to which are added estimates for private water schemes mainly in rural areas and for some administrative expenditures which cannot be broken down between water supply and wastewater treatment.

The DoELG also provides data on:

- receipts from charges on the household sector (recently abolished) and from the commercial sector (no breakdown between water supply and wastewater services),
- contributions to the capital cost made by industry,
- quantities of water consumed and of wastewater collected.

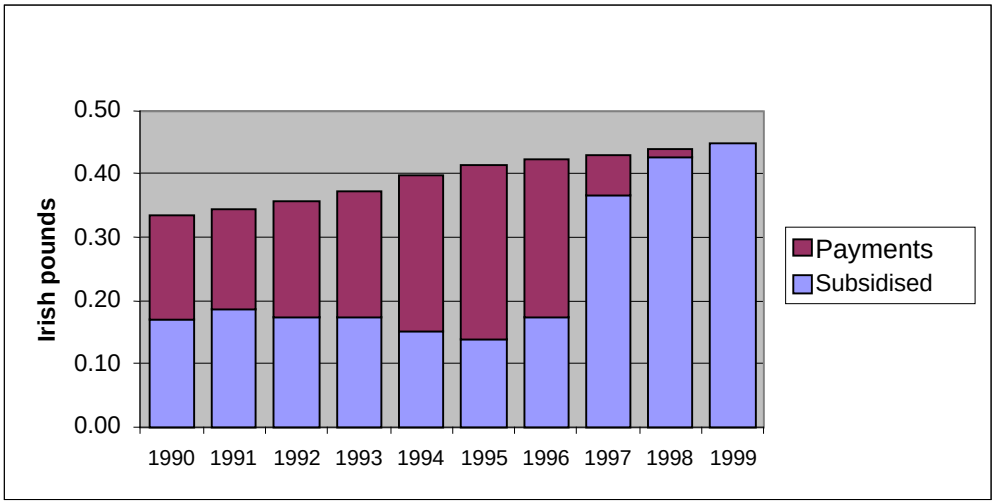
Using the data described above, interpolating for the years in-between and assuming general stability of proportions, a rather coherent time-series of water consumption was elaborated for the 1991-1998 period.

Table 3.1-7 National accounts data on water-related services, Ireland 1991-1998, 1 000 IEP

		1991	1992	1993	1994	1995	1996	1997	1998
PUBLIC WATER SUPPLY									
CURRENT									
Expenditure incl. Admin.		83 364	87 038	91 652	99 917	106 427	112 002	116 974	123 294
Of which:	Domestic	54 186	56 575	59 574	63 947	67 049	69 441	71 354	73 977
	Non-domestic	29 177	30 463	32 078	35 970	39 378	42 561	45 620	49 318
Receipts from charges*		48 780	55 650	60 490	72 030	77 650	74 920	45 860	42 310
Of which:	Domestic	24 890	29 030	32 110	39 780	44 880	40 870	10 400	2 310
	Non-domestic	23 890	26 620	28 380	32 250	32 770	34 050	35 460	40 000
CAPITAL									
Expenditure incl. Admin		55 347	47 329	27 726	30 418	68 080	66 173	82 208	n.a
Quantity of water consumed (million m^3)		240	246	252	259	265	272	279	287
	Domestic	157	158	159	161	162	164	166	168
	Non-domestic	83	88	93	98	104	109	113	119
Current cost per m^3 (IEP)		0 35	0 35	0 36	0 39	0 40	0 41	0 42	0 43
Of which:	Domestic	0 34	0 36	0 37	0 40	0 41	0 42	0 43	0 44
	Non-domestic	0 35	0 35	0 34	0 37	0 38	0 39	0 40	0 42
WASTEWATER SERVICES									
CURRENT									
Expenditure incl. Admin		37 187	39 881	41 215	43 652	45 212	48 449	51 483	56 518
Of which:	Domestic	31 609	33 899	35 033	37 105	38 431	41 181	43 761	48 040
	Commercial	5 578	5 982	6 182	6 548	6 782	7 267	7 722	8 478
Receipts from charges		5 600	6 260	6 670	7 390	9 490	9 230	8 580	7 630
Of which:	Domestic	1 100	1 190	1 260	1 340	3 250	2 740	1 820	10
	Commercial	4 5	5 070	5 410	6 050	6 240	6 490	6 760	7 620
CAPITAL									
Expenditure incl. Admin		52 114	57 476	45 871	65 905	56 654	67 615	104 440	n.a.

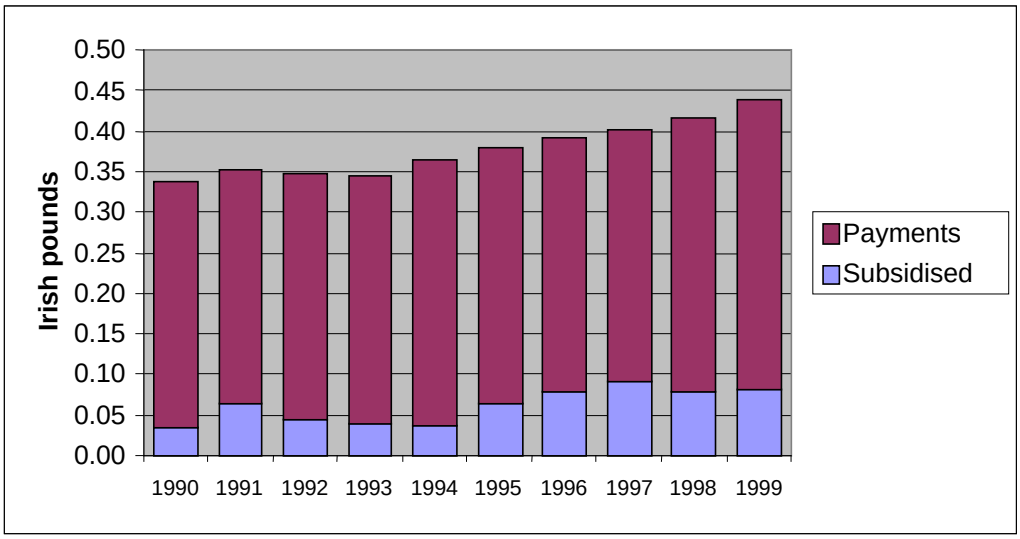
Source: Environmental accounts: Time series + eco-taxes – ESRI, February 2001

Figure 3.1-2 Current costs, payments and 'subsidy' per cubic metre of water consumed by households, Ireland



Source: Environmental accounts: Time series + eco-taxes – ESRI, February 2001

Figure 3.1-3 Current costs, payments and 'subsidy' per cubic metre consumed by industries, Ireland



Source: Environmental accounts: Time series + eco-taxes – ESRI, February 2001

Water supply data based on the Census of Industrial Production (CIP)

In this census, enterprises from the NACE 41 sector have been asked for the total volume supplied and for the value of water broken down according to four types of customers: other water enterprises, public administration (street cleaning), households and industries.

The CIP only covers water supply, that is NACE 41, and not wastewater treatment. The rationale for this is that water supply is considered to be the provision of a good, whereas wastewater treatment is considered to be a service.

There is a close correspondence between the value of gross output of water supply given by the CIP and National Accounts raw data that exclude the cost of administration.

Table 3.1-8 Comparing national accounts and industrial census data for water supply, Ireland, million IEP

	1991	1992	1993	1994	1995	1996
CIP Gross Output	68.3	71.7	81.2	82.8	84.2	94.2
National accounts data (excluding administrative expenditure)	69.0	71.5	75.3	81.9	88.1	93.0

Source: Environmental accounts: Time series + eco-taxes – ESRI, February 2001

The CIP data provide the production account for water-supply industry. There is however some uncertainty as concerns the operating surplus ('remainder of net output'), whose level fluctuates over time. According to the comments made by ESRI some purchase of outside services and contracted work or capital outlays may be included.

Table 3.1-9 Production accounts of water supply operators, Ireland 1994 – 1998, million IEP

	1994	1995	1996	1997	1998
Gross Output	82.77	84.25	94.24	84.87	67.69
Materials	13.12	15.18	18.00	20.17	19.97
Energy	9.47	9.10	9.18	9.13	9.24
Industrial input	22.59	24.28	27.18	29.30	29.20
Net output (GVA)	60.18	59.97	67.06	55.57	38.49
Wage bill	28.22	29.49	29.42	31.31	33.85
Remainder of net output (operating surplus)	31.96	30.48	37.64	24.26	4.64
Employed persons in thousands	2.15	2.12	2.03	2.08	2.06
Volume of water distributed in million m^3				550	570

Source: Environmental accounts: Time series + eco-taxes – ESRI, February 2001

It should also be noted that according to the CIP statistics 570 millions m^3 of water have been produced in 1998 whereas only 287 millions m^3 were delivered to the final users according to the national accounts. A reason for that is leakage due to the apparently poor state of the network.

3.1.4 Portugal

For the economic part, Portugal compiled supply-use tables as well as economic accounts for water-related activities (Eurostat pilot table 3). Only economic accounts are reproduced below, notably to show, by comparison with the same table provided by Spain (see table 3.1-5), the possible analyses.

Unfortunately, as in Spain, the detail according to the type of activity (water supply, sewage services, water-related administrative services) has not been supplied. Unlike in the Spanish table, the activity of operation of irrigation systems is not included. Both countries included the accounts for water-related administrative services.

The participation of the general government seems much higher in Portugal than in Spain (through the role of the municipalities). Unlike in Spain, general government in Portugal does not only supply administrative services, it is directly involved in the provision of water supply and wastewater services, for the main part as a non-market supplier.

The shares of the intermediate consumption within the output are not very different: 47% in Portugal, 52% in Spain, but the shares of the compensation of employees are radically different: 4% in Portugal and 25% in Spain. The net operating surplus is sufficient to cover the gross fixed capital formation in Portugal, but not in Spain. However, detail is needed on the ownership of the capital. In Portugal, the “upstream” water management for the water supply (from abstraction to reservoirs) is often delegated to private enterprises, while the “downstream” management (distribution) is the responsibility of the municipalities, indicating that, at least, the distribution network is owned by the general government sector.

Table 3.1-10 Economic accounts for water-related economic activities, Portugal 1998, million PTE

	Non-financial corporations	General government	NPISH	Households	Total
Production and generation of income accounts					
1 Total intermediate consumption	46 339	8 640			54 979
2 Total value added, gross	58 219	39 174			97 393
2.1 Compensation of employees	3 849	7 817			11 666
2.2 Other taxes on production	169	0			169
of which environmental taxes	0	0			0
2.3 Less other subsidies on production	1 137	0			1 137
2.4 Consumption of fixed capital	13 186	34 060			47 246
2.5 Net operating surplus	42 152	-2 703			39 449
3 Total output at basic prices	104 558	47 814			152 372
3.1 Market	104 558	17 231			121 789
3.2 Non-market		30 583			30 583
Supplementary information about fixed capital and labour inputs					
4 Investment grants	11 793				11 793
5 Gross fixed capital formation	21 214	51 876			73 090
6 Closing stocks of fixed assets					
7 Total hours worked					

Source: Source: Water accounts project 1998 – Final report to Eurostat – June 2002

3.1.5 Sweden

Supply-use table of water-related products

Every year, the VAV carries out a rather detailed survey about production costs and investments within public waterworks and MWWTP in Sweden. Total expenditure has been derived from this survey, after some adjustments. The expenditure has then been broken down by NACE according to the uses of water by each NACE, after deduction of public waterworks' own use.

Pilot tables 1 and 2 are presented together below. Investments for public water services are reported in the same table.

Table 3.1-11 Supply and use of water-related products, Sweden 1995, million SEK

NACE code		Distributed water			Wastewater services		
		Supply	Use	Investment	Supply	Use	Investment
1	Agriculture						
2	Forestry						
10/14	Mining and quarrying		7			10	
15/16	Food products, beverages, tobacco		132			191	
17/19	Textiles, textile products, leather		12			18	
20	Wood, products of wood, cork, straw, etc.		6			9	
21	Pulp, paper and paper products		17			24	
22	Publishing, printing and reproduction		13			18	
23	Coke, refined petroleum and nuclear fuel		1			2	
24	Chemicals and chemical products		96			139	
25	Rubber and plastic products		5			7	
26	Non-metallic mineral products		14			20	
27	Basic metals		44			63	
28	Fabricated metals, except machinery		21			31	
29	Machinery and equipment n.e.c.		28			40	
30	Office machinery and computers		2			3	
31/32	Electrical machinery, radio, TV, etc.		17			25	
33	Medical, precision, optical instruments, etc.		5			8	
34/35	Motor vehicles and other transport eq.		33			47	
36/37	Other manufacturing		4			5	
	Not possible to disaggregate by sector		33			48	
40	Electricity, gas, steam and hot water supply		34			49	
41	Collection, purification, distribution of water	4 127		583			
45	Construction						
50/52	Wholesale and retail trade						
55	Hotels and restaurants						
60/64	Transport, storage and communication						
62	Financial intermediation		728			1 056	
71/74	Renting and business activities						
80/99	Other, excluding 90.01						
90.01	Sewage disposal				5 981		1 220
75	Public administration						
70	Real estate (Households)		2 681			3 886	
	Unspecified use		194			282	
	TOTAL	4 127	4 127	583	5 981	5 981	

Note: The lump sum for construction etc., includes a subsidy from the municipalities to all other economic sectors of 256 million SEK for distributed water and of 371 million SEK for wastewater treatment.

Source: Water Accounts. Physical and monetary data connected to abstraction, use and discharge of water in the Swedish NAMEA – Statistiska centralbyrån, December 1999

Breakdown of production costs

The VAV survey also makes it possible to distribute current and capital costs according to various components. Although this presentation is not in line with pilot table 3 (production accounts) it provides interesting information: magnitude of the consumption of fixed capital within current costs and distribution of investment.

Table 3.1-12 Breakdown of production costs for water supply and wastewater treatment, Sweden 1995, million SEK

	Water supply	Wastewater treatment
Current costs	**4 127**	**5 981**
Production	1 159	1 968
Distribution	1 028	1 131
Pressure intensification	99	299
Administration	375	479
Consumption of fixed capital	1 466	2 105
Investment	**583**	**1 220**
Distribution network	373	563
Reservoirs	28	89
Water plants	178	563
Other purchases	4	6

Source: Water Accounts. Physical and monetary data connected to abstraction, use and discharge of water in the Swedish NAMEA – Statistiska centralbyrån, December 1999

The report indicates: "the production costs should (in principle) be financed through one fee for both services. According to the 'Municipal accounts 1995', however, the gross receipts from the fee do not cover the total costs. A difference of 7 percent has been considered as a subsidy from municipalities to their customers". (see footnote on table 3.1-10)

Ancillary activities related to water (pilot table 4)

Not all the necessary information could be collected on this topic. Expenditure for self-supply of wastewater services was available through the SERIEE studies, but the expenditure for self-supply of water was not available. Tentative estimates of irrigation costs have been added.

Table 3.1-13 Environmental protection expenditure for water in industry, Sweden 1997, million SEK

NACE code		Services produced for own account (ancillary activities)	Purchased services*	Total	Investment
10/14	Mining and quarrying	4	1	5	13
15/16	Food products, beverages, tobacco	93	71	164	48
17/19	Textiles, textile products, leather	8	26	34	15
20	Wood, products of wood, cork, straw, etc.	5	3	8	10
21	Pulp, paper and paper products	383	5	387	537
22	Publishing, printing and reproduction	1	1	2	12
23	Coke, refined petroleum and nuclear fuel	11	0	11	0
24	Chemicals and chemical products	136	11	148	47
25	Rubber and plastic products	1	2	3	2
26	Non-metallic mineral products	5	4	9	3
27	Basic metals	102	10	112	23
28	Fabricated metals, except machinery	36	7	43	57
29	Machinery and equipment n.e.c.	9	6	15	29
30	Office machinery and computers	0	0	1	0
31/32	Electrical machinery, radio, TV, etc.	40	6	46	16
33	Medical, precision, optical instruments, etc.	1	3	4	0
34/35	Motor vehicles and other transport equip.	57	8	65	11
36/37	Other manufacturing	21	6	28	3
40	Electricity, gas, steam and hot water supply	6	5	11	15
	TOTAL	919	175	1 094	840

Source: Water Accounts. Physical and monetary data connected to abstraction, use and discharge of water in the Swedish NAMEA – Statistiska centralbyrån, December 1999

It should be noted that the purchased services in the above table are largely underestimated: according to table 3.1-10 above the purchase of wastewater treatment services by NACE 10 to 40 industries is 758

millions SEK. Reason of the discrepancy could be that when answering to environmental protection survey enterprises do not consider their payments for collective wastewater services as environmental protection. Moreover these payments are difficult to isolate within the water bill.

Expenditure in agriculture

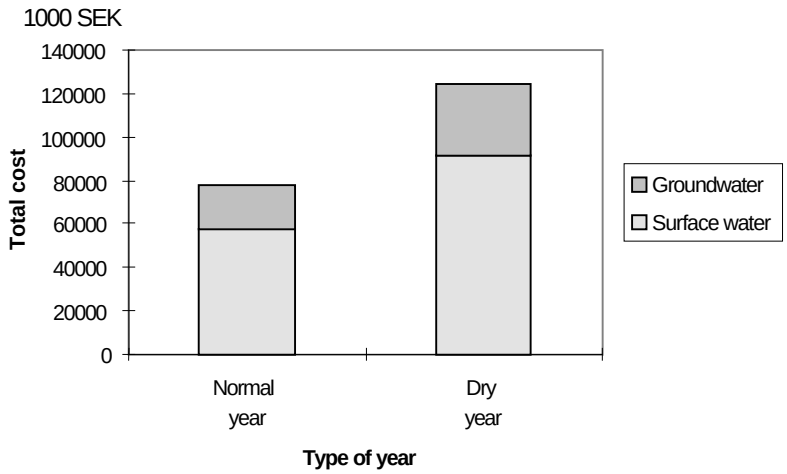
The information collected shows that the irrigation costs were as follows:

- For surface water, the fixed cost per hectare was 1 100 SEK and the variable cost was 262 SEK per hectare.
- For groundwater, 1 200 SEK per hectare for fixed cost and 252 SEK per hectare for the variable cost.

As the area which needed irrigation was estimated at 56 000 hectares in a normal year and at around 90 000 in a dry year and as the distribution between the types of origin of the water has been estimated at ¾ surface water and ¼ groundwater, the total costs for irrigation in Sweden were estimated at 78 million SEK for a normal year and to 125 million SEK for a dry year.

According to meteorological conditions, these expenditures give rise to a variation of 1 to 1.5.

Figure 3.1-4 Irrigation costs Sweden thousands SEK



Source: Water Accounts. Physical and monetary data connected to abstraction, use and discharge of water in the Swedish NAMEA – Statistiska centralbyrån, December 1999

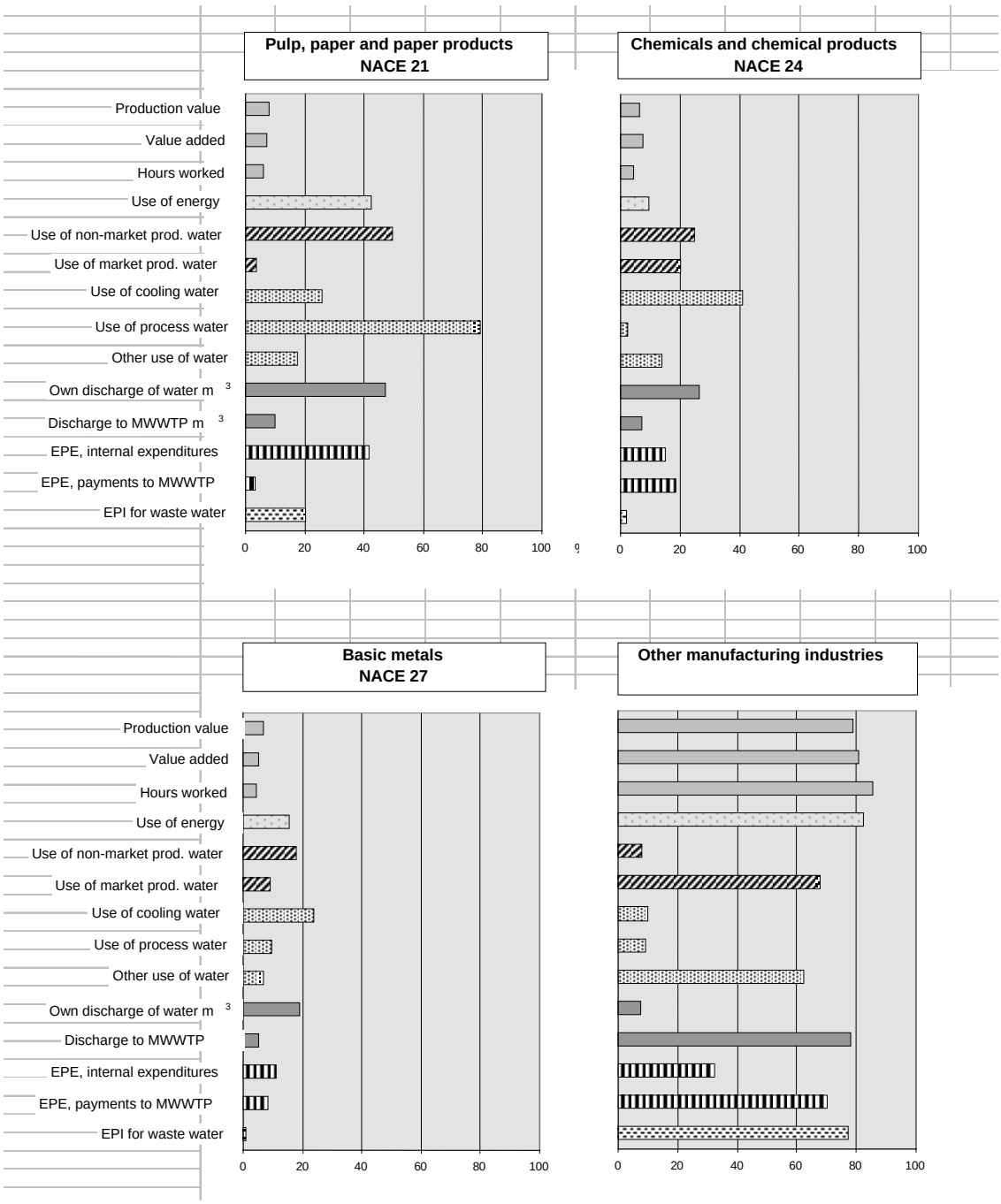
Environmental-economic profiles for some manufacturing industries

The Swedish report also gives an example of possible analyses when economic and environmental data are presented in a coherent framework.

The so-called 'environmental-economic profiles' show the shares that a specific sector makes in the manufacturing industries total in diverse economic and environmental data: production, value added, input factors such as hours worked, use of energy, use of water, discharge to water and environmental expenditures and investments related to wastewater treatment.

As can be seen from the four profiles selected hereafter, in proportion to its share in the Swedish economy (less than 10% of the output or of the value added of the manufacturing sector), the pulp and paper industry takes a larger share in water uses, in particular in the water used in industrial processes where its share attains 80%. It participates very little to the payments of the MWWTP services, but a great deal (40%) to the manufacturing industry expenditures as internal activities.

Figure 3.1-5 Environmental-economic profiles for some Swedish industries



Note: EPE = Environmental protection expenditure, EPI = Environmental protection investment.

Source: Water Accounts. Physical and monetary data connected to abstraction, use and discharge of water in the Swedish NAMEA – Statistiska centralbyrån, December 1999

3.1.6 Norway

Norway's work about the water economy was restricted to analysing the production accounts of the public wastewater sector. The following table summarises the major results from the annual survey on municipal wastewater treatment plants.

The results from the current annual survey do not provide enough detail to fill in the pilot tables. From the survey data it has not been possible to identify, for example, intermediate consumption, compensation of employees, subsidies or taxes on production. This data will be available from the new system of municipal

accounts. Another problem, which Statistics Norway had not been in a position to solve, is how to break down the income from fees between households and other users (schools, hospitals, enterprises, etc.).

Table 3.1-14 Costs and income from user fees in the municipal wastewater sector, Norway, billion NOK

Year	Overheads, running and maintenance costs	Capital costs	Total Costs	Income from user fees
1999	2.08	1.96	4.04	3.66
1998	1.93	1.60	3.53	3.46
1997	1.85	1.41	3.26	3.28
1996	1.78	1.47	3.25	3.09
1995	1.71	1.50	3.21	2.96
1994	1.60	1.43	3.03	2.75
1993	1.44	1.60	3.04	2.36

Source: Wastewater statistics, Statistics Norway

Some envisaged ways of allocating user fees had been the new dwelling register that is part of the 2001 population census (with the information of the dwelling's connection to the wastewater network) or the household budget survey. According to the national accounts, households paid 51.4% of the product 'municipal sewage fees' in 1997.

The information available for general government activities for environment-related activities shall be much better when the new COFOG classification of government expenditures by purpose is implemented.

3.1.7 Comparisons between countries

Comparison between countries was limited to prices and costs.

Table 3.1-15 Comparison of average prices per industry, Denmark, Spain and Sweden (euro/m^3)

Price in euro/m^3		Denmark 1997		Spain 1997		Sweden 1995	
		Water	Waste-water services	Water	Waste-water services	Water	Waste-water services
A, B	Agriculture, forestry, fisheries	0.55	1.68	0.21	0.06		
C	Mining and quarrying	0.87	1.54	0.19	0.04	0.57	0.93
DA	Food products, beverages and tobacco	0.60	1.51	0.35	0.14	0.55	0.81
DB+DC	Textiles and leather products	0.55	1.38	0.55	0.14	0.52	0.63
DD	Wood and wood products	0.64	1.84	0.26	0.11	0.51	0.73
DE	Pulp, paper, publishing and printing	0.97	1.57	0.39	0.10	0.56	0.45
DF	Coke, petroleum and nuclear fuel	0.53	1.71	0.23	0.13	0.40	0.60
DG	Chemicals and man-made fibres	0.76	1.24	0.30	0.12	0.54	2.78
DH	Rubber and plastic products	0.67	1.67	0.32	0.11	0.54	0.63
DI	Other non-metallic mineral products	0.68	1.74	0.29	0.09	0.55	0.82
DJ+DK+DL+DM	Metal products and machinery	0.73	1.60	0.28	0.10	0.55	0.86
DN	Manufacturing n.e.c.	0.94	1.68	0.27	0.09	0.62	0.86
40	Electricity, gas, steam, hot water supply	0.68	1.69	0.37	0.15	0.55	7.24
F-O	Construction and other service branches	0.84	1.57	0.29	0.09	0.90	1.31
	Unknown industries					0.55	7.08
	Total industries	0.71	1.55	0.28	0.10	0.71	1.17
	Households	0.80	1.47	0.30	0.12	0.54	0.79
	Unknown users					0.54	0.79
	Total	0.77	1.49	0.29	0.11	0.59	0.88

Note: This comparison should be interpreted with great care. The products are not necessarily equivalent. For instance, within distributed water, non-drinking water is supplied in Spain.

Table 3.1-16 Comparison of costs of water supply and wastewater treatment

	Unit	IRL(*) 1997	S 1995	F(*) 1997p	NO 1999	E(*) 1999
Water supply						
Current	Mio euro	156	442	6 839		
Capital	Mio euro	110	62	1 984		
Receipts	Mio euro	61	442	7 063		
Quantity	Mio m^3	279	936	4 621		
Unit current costs	euro per m^3	0.56	0.47	1.48		
Unit total costs	euro per m^3	0.95	0.54	1.91		
Unit current costs	euro/inhabitant	43	50	117		
Unit total costs	euro/inhabitant	73	57	151		
Recovery of current costs	percent	39%	100%	103%		
Recovery of total costs	percent	23%	88%	80%		
Wastewater services						
Current	Mio euro	69	641		250	
Capital	Mio euro	139	131		236	
Receipts	Mio euro	11	641		440	
Quantity	Mio m^3		866			
Unit current costs	euro per m^3		0.74			
Unit total costs	euro per m^3		0.89			
Unit current costs	euro/inhabitant		73		56	
Unit total costs	euro/inhabitant		87		109	
Recovery of current costs	percent	16.7%	100.0%		176.0%	
Recovery of total costs	percent	5.5%	83.1%		90.6%	
Total water-related services						
Current	Mio euro	225	1 083			1 350
Capital	Mio euro	249	193			587
Receipts	Mio euro	73	1 083			1 704
Unit current costs	euro/inhabitant	61	123			34
Unit total costs	euro/inhabitant	129	145			49
Recovery of current costs	percent	32.3%	100.0%			126.2%
Recovery of total costs	percent	15.3%	84.9%			87.9%

(*) including administration

3.1.8 Conclusion on the water economy accounts

Countries are obviously not at the same stage of information: while Denmark could produce a supply-use table on 128 industries, only a breakdown between households and industries is available in some other countries. Often, the uses of distributed water are used to break down the uses of wastewater services as well: distributed water is followed in economic national accounts, not wastewater services. Furthermore, prices often cover the two products together.

Prices must not be compared without taking into consideration the political context: for example, in Ireland the decision has been taken not to make households pay for their water. In Sweden, water municipal services must cover their costs (including consumption of fixed capital).

Ancillary expenditures could only be (partially) known with specific surveys.

It should be noted that in all countries, the exercise gave the opportunity to re-examine and sometimes revise national accounts data.

3.2 Volumes of water flows

This section presents the results of pilot applications as concerns the pilot tables 5 to 9. These tables cover the water flows in m^3: water entering the economic sphere, water within the economy and water discharged back to the environment.

The tables resulting from the test are given, as well as some indicators built on them. As in the previous section, no attempts are made at harmonisation. In fact, as can be seen from the diagram representations, reproduced from the reports of three countries, concepts and classifications applied differ as regards either water in nature (different components, different types of discharges) or water in the economy (number of steps considered, number of economic agents).

3.2.1 Belgium

Belgium supplied two types of tables: tables following the Eurostat format, with detailed information by industry and aggregated tables. For instance, Table 3.2-2, shown in percentage terms, makes more apparent the fact that the energy and water distribution industries were responsible for the major part of total wastewater discharges in 1998. About a quarter of wastewater discharges could be attributed to the manufacturing sector.

However as concerns wastewater discharged into the sewage system, more than 70% of the sewage originated from households[46].

Table 3.2-1 Water and wastewater flows by industry, Belgium 1998, 1 000 m^3

		Drinking and non-drinking water received	Wastewater discharged into sewage networks	Wastewater discharged into water bodies
A	Agriculture, hunting and forestry	470	0	35 038
B	Fishing	411	17	67
CA	Mining and quarrying of energy producing materials	1 285	0	0
CB	Mining and quarrying except energy producing materials	197	706	55 077
DA	Manufacture of food products; beverages and tobacco	10 608	12 554	37 047
DB	Manufacture of textiles and textile products	2 556	7 811	4 297
DC	Manufacture of leather and leather products	40	33	11
DD	Manufacture of wood and wood products	244	222	0
DE	Manufacture of pulp, papers; publishing and printing	1 949	746	44 247
DF	Manufacture of coke, refined petroleum and nuclear fuel	3 636	4	26 224
DG	Manufacture of chemicals and man-made fibres	22 169	8 674	169 994
DH	Manufacture of rubber and plastic products	1 432	1 515	219
DI	Manufacture of other non-metallic mineral products	2 382	369	1 521
DJ	Manufacture of basic metals and fabricated metal products	24 207	9 166	345 617
DK	Manufacture of machinery and equipment n.e.c.	603	177	82
DL	Manufacture of electrical and optical equipment	1 301	1 266	4 461
DM	Manufacture of transport equipment	1 609	2 388	3 172
DN	Manufacturing n.e.c.	5 197	411	402
40	Electricity, gas, steam and hot water supply	34 582	2 528	799 485
41	Collection, purification and distribution of water	60 772	30 589	602 154
F	Construction	2 078	48	0
G	Wholesale and retail trade; repairs	25 982	148	41
H	Hotels and restaurants	5 674	630	37
I	Transport, storage and communication	7 140	66	723
J	Financial intermediation	132	0	0
K	Real estate, renting and business activities	12 266	6	108
L	Public administration and defence; compulsory social security	27	0	191
M	Education	39	0	10
N	Health and social work	47	2 877	227
90*	Sewage removal and treatment	167	:	661 169
O*	Other community, social and personal services, excluding 90*	1 861	4 634	2 374
P	Private households with employed persons	1	0	0
Q	Extra-territorial organisations and bodies	1	0	0
Total flows by industries		231 062	87 584	2 793 995
Flows by households		329 298	206 622	118 087
Total flows		560 361	294 206	2 912 082

Source: The NAMEA water for Belgium, Federal Planning Bureau, February 2002

[46] This figure is probably overestimated, since the data for households also include some discharges by the services sector.

Table 3.2-2 Sectoral distribution of wastewater discharges, Belgium 1998, % of total volume discharged

	Primary sector	Manufacturing industries	Power & water distributors	Services	Households
Into water bodies	4.0	28.3	62.3	0.2	5.2
Into sewage system	0.2	15.4	11.3	2.9	70.2
Total	**3.6**	**26.8**	**56.4**	**0.5**	**12.8**

Source: The NAMEA water for Belgium, Federal Planning Bureau, February 2002

3.2.2 Denmark

Tables

The same level of detail (128 industries) retained in the Danish monetary supply-use tables is also available for the water abstraction and discharge. All these detailed tables could not be reproduced in this publication. Only some key results are presented.

80% of the water comes from and is rejected into the sea. It is mainly abstracted for cooling purposes by the production and distribution of electricity sector. 98% of the other abstraction concerns groundwater. Half of the water abstracted is used to make 'tap water' sold to households and industries. About a third is abstracted by agriculture, the rest directly abstracted by various industries and households.

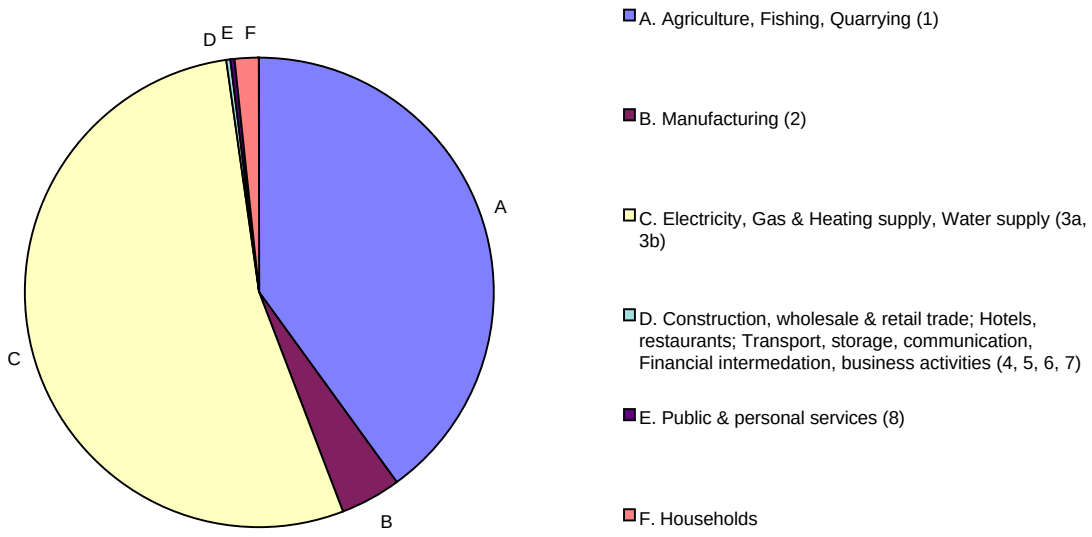
By construction, the total uses of water (direct abstraction plus use of tap water) are balanced by total 'discharges' for each industry. This 'discharge' concept includes not only discharge of wastewater but also elements of what is called 'water consumption' in pilot table 9. In the Danish data, 'discharge' is further broken down into 'water added to products', 'wastewater discharged to sewers' and 'other discharges'.

A very small quantity of water (0.07% of total 'discharges') is embodied in economic products ('added to products'), essentially by the food and beverages industry, the chemical industry and the manufacturing of construction materials industry. The breakdown of the discharges of wastewater by recipient water body could not be given for the flows transiting through sewers and the 'other discharges' (which may include evaporation).

Graphic analysis of the abstraction and use of water

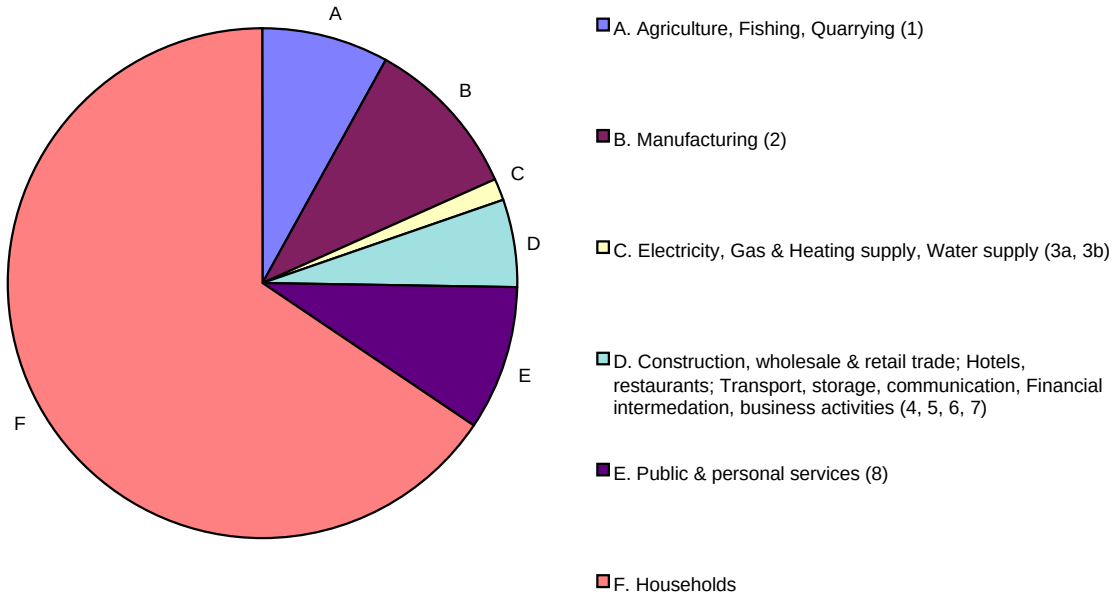
Different graphs were built in the report in order to better visualise the share of each economic actor in the abstraction and use of the different categories of water: groundwater and tap water. More than 50% of groundwater is extracted by the water supply industry. Households are the main users of tap water.

Figure 3.2-1 Extraction of groundwater by industries and households in Denmark in 1994



Source: Statistics Denmark – NAMEA with water extraction and use – April 1999

Figure 3.2-2 Use of tap water by industries and households in Denmark in 1994



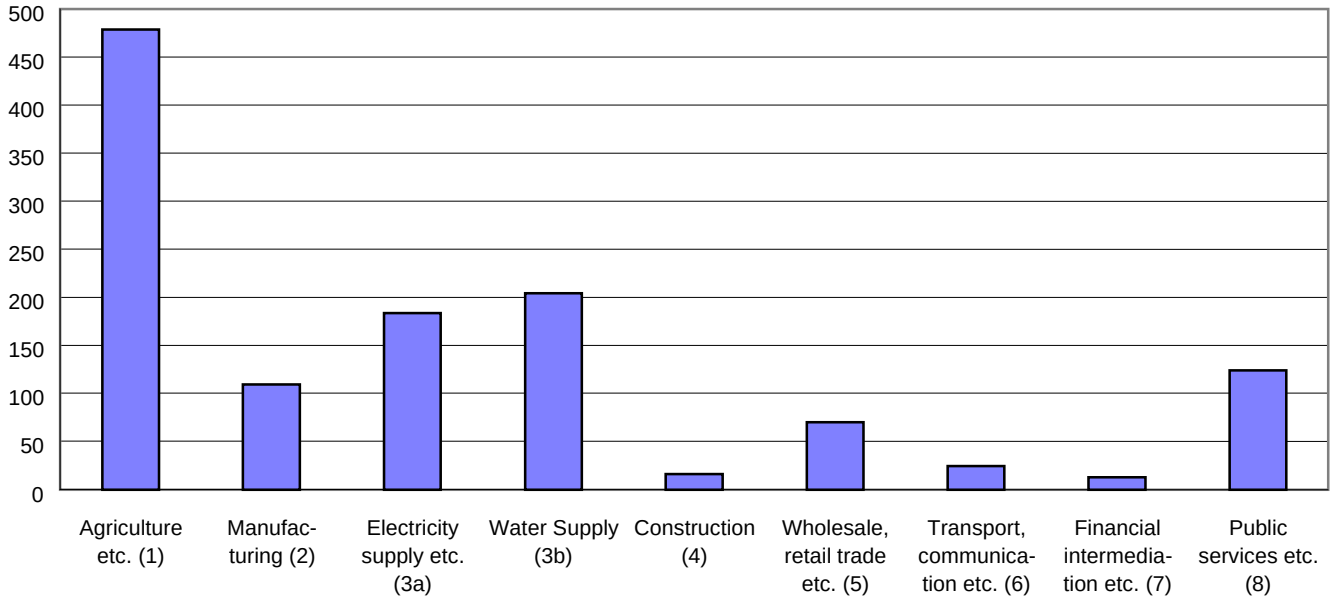
Source: Statistics Denmark – NAMEA with water extraction and use – April 1999

Water 'intensity'

Statistics Denmark introduced in its reports a concept of 'water intensity' linking the quantities of 'tap' water used to some economic characteristics of the industries such as the output and the number of employees.

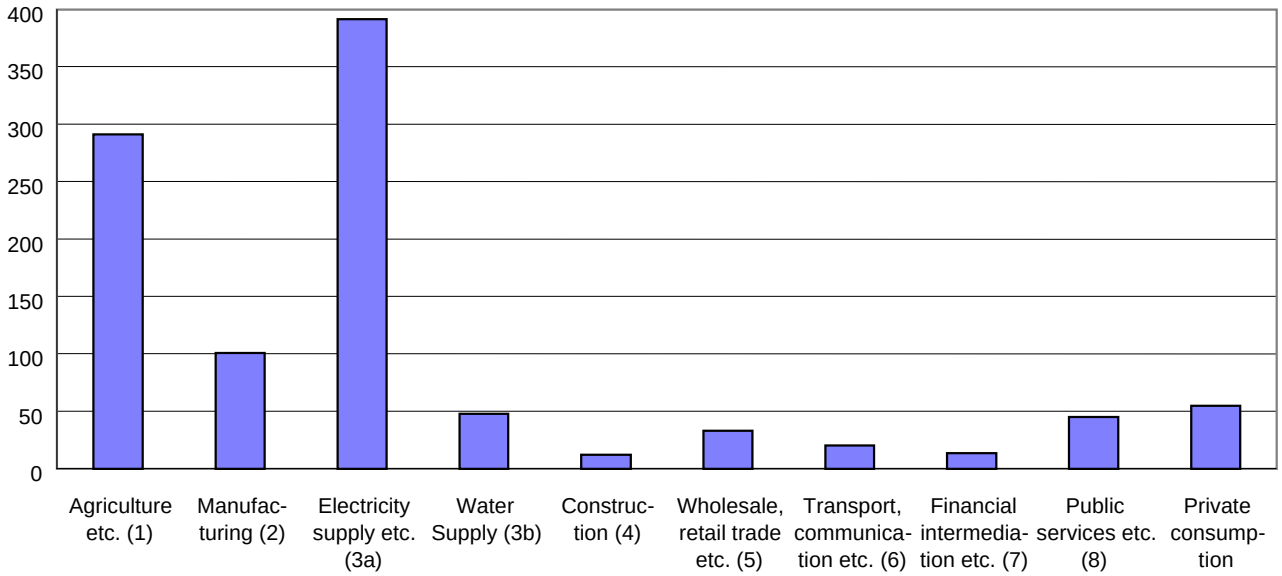
Agriculture is an intensive consumer of 'tap' water in relation to its output and it ranks second when the use of water is linked to the number of employees.

Figure 3.2-3 Water intensity in Denmark, 1994. Use of tap water related to output, m^3/million DKK



Source: Statistics Denmark – NAMEA with water extraction and use – April 1999

Figure 3.2-4 Water intensity in Denmark, 1994. Use of tap water in m^3 per employee



Note. The *private consumption* water intensity is a per capita consumption of the households

Source: Statistics Denmark – NAMEA with water extraction and use – April 1999

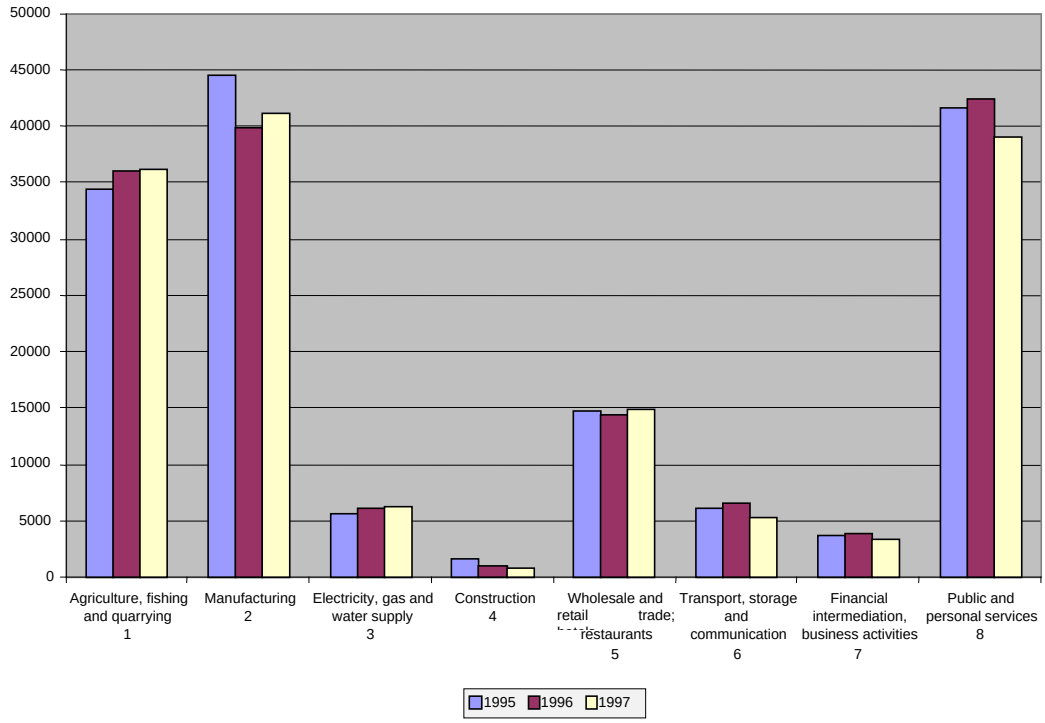
The indicator is limited to tap water only, but this presentation may be a good basis in the development of indicators linking economic and environmental information.

Time analysis of the physical flows of 'tap water' 1995-1997

As Denmark has been able to carry out its study for 3 years, an analysis of the time dimension was possible.

The total amount of water used increased from 1995 to 1996, then decreased from 1996 to 1997, with notable variations between the 1-digit NACE groups, as illustrated below.

Figure 3.2-5 Evolution of the use of water in Denmark, by industry (NACE 1-digit level)



Source: Statistics Denmark – 1997 water accounts related to NAMEA

3.2.3 Germany

Tables

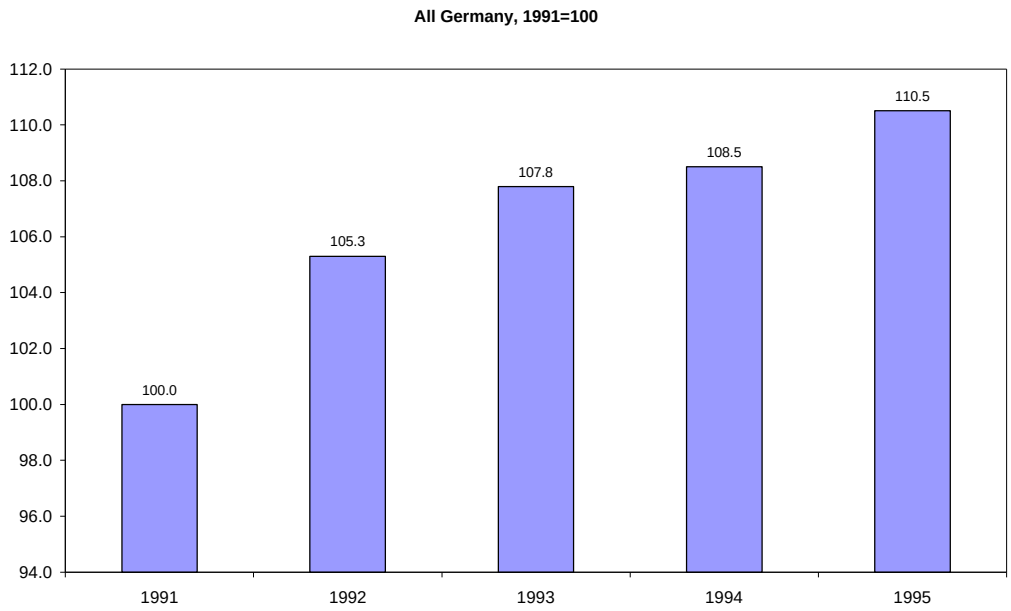
The German breakdown of activities is less detailed than the Danish one (21 activities), and the representation of the flows is different, and different from Eurostat's proposal, in particular in its 'discharges' part. As in the Danish presentation, incorporation of water in economic products has been considered, as well as a possible 'removal' of water from other products (e.g. by households in their activity of consumption). Other components are water 'lost' and water 'evaporated', notably during agricultural and electricity production activities. A distinction is made between water discharges after or without treatment.

The wastewater disposal system discharges much more water (9 962 Mio m^3) than the water supply abstracts (6 448 Mio m^3) due to the draining of much 'natural' water via the sewage network (such as urban rainwater run-off). This is the type of flows that pilot table 9 intended to capture.

The water 'productivity' indicator

'Water productivity' is, in its conception, very similar to the water 'intensity' indicator used by Denmark. It is measured in terms of gross domestic product (in real terms) per unit of water withdrawn from nature. This indicator has been calculated for the former territory of the Federal Republic from 1960 to 1991 and for all of Germany from 1991 to 1995. The graph below shows a strong increase of the productivity thus calculated from 1991 to 1995, indicating a rationalisation of the use of water.

Figure 3.2-6 Water productivity in Germany 1991 - 1995



Source: Water flow accounts as part of material and energy flow accounts in Germany – Statistisches Bundesamt – 2000

Table 3.2-3 Water flows broken down by branch (including households), Germany 1995, million m³

Code	Activity	Withdrawn from nature 1	Received from other branches 2	Used 3=1+2	Removed from materials 4	Incorporated into other materials 5	Transfer to wastewater disposal 6	Discharged by wastewater disposal 7	Discharged directly after treatment 8	Discharged directly without treatment 9	Lost 10	Evaporated 11	Infiltration and rain water 12
A, B	Agriculture, forestry, fisheries	764	152	916	0	290	31	0	0	0	0	596	0
CA	Mining and quarrying of energy producing materials	1 369	115	1 484	0	0	22	0	54	1 361	0	46	0
CB	Mining and quarrying except energy-producing materials	648	4	652	0	0	7	0	21	593	0	31	0
DA	Manufacture of food products, beverages and tobacco	316	218	534	0	39	240	0	57	168	0	30	0
DB	Manufacture of textiles and textile products	52	20	73	0	0	56	0	3	3	0	10	0
DC	Manufacture of leather and leather products	4	1	4	0	0	3	0	2	0	0	0	0
DD	Manufacture of wood and wood products	11	4	15	0	0	3	0	0	8	0	3	0
DE	Manufacture of pulp, paper, publishing and printing	379	70	449	0	0	104	0	226	101	0	18	0
DF	Manufacture of coke, petroleum and nuclear fuel	231	43	274	0	0	36	0	81	94	0	63	0
DG	Manufacture of chemicals and man-made fibres	2 723	435	3 158	0	0	223	0	513	2 374	0	48	0
DH	Manufacture of rubber and plastic products	77	21	98	0	0	23	0	7	60	0	8	0
DI	Manufacture of other non-metallic mineral products	147	53	200	0	0	33	0	11	102	0	54	0
DJ	Manufacture of basic metals and fabricated metal products	543	149	693	0	0	92	0	232	311	0	58	0
DK	Manufacture of machinery and equipment n.e.c.	31	27	59	0	0	29	0	1	23	0	5	0
DL	Manufacture of electrical and optical equipment	59	40	99	0	0	41	0	1	51	0	5	0
DM	Manufacture of transport equipment	67	31	98	0	0	32	0	10	45	0	11	0
DN	Manufacturing n.e.c.	4	6	11	0	0	6	0	0	2	0	2	0
40	Electricity, gas, steam and hot water supply	2 9715	332	30 046	0	0	59	0	54	29 232	711	701	0
41	Collection, purification and distribution of water	6 448	-5 613	835	0	0	124	0	0	0	0	0	0
90 part	Sewage disposal	5 273	0	5 273	0	0	-4 689	4 689	0	0	0	0	5 273
F-O	Construction and other service branches	0	618	618	0	0	594	0	0	0	0	24	0
	Total homogeneous branches	48 862	-3 274	45 588	0	329	-2 930	4 689	1 273	34 528	711	1 715	5 273
	Households	47	3 266	3 313	152	0	2 930	0	0	250	0	285	0
	Total	48 909	-8	48 901	152	329	0	4 689	1 273	34 778	711	2 000	5 273

Source: Water flow accounts as part of material and energy flow accounts in Germany – Statistisches Bundesamt – 2000

3.2.4 Greece

Tables

Greece, provided the following table on the use of distributed water by the industries.

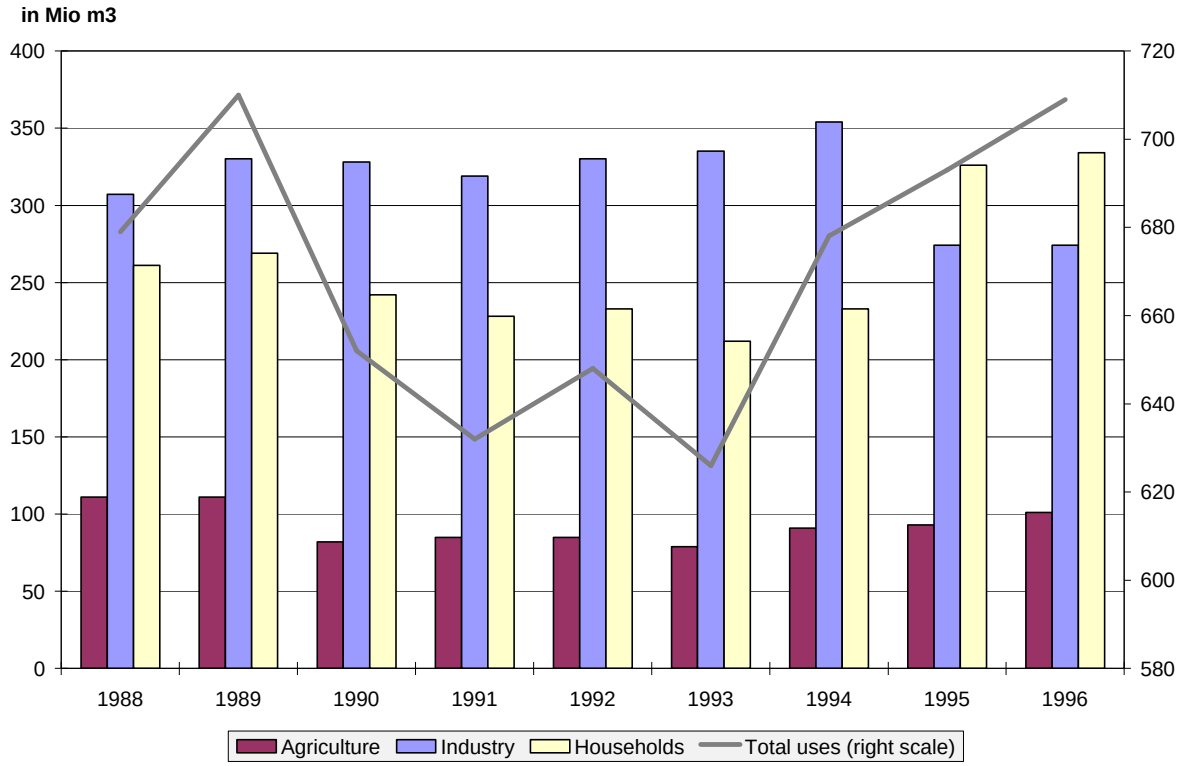
Table 3.2-4 Use table of distributed water, Greece 1988 - 1996, million m³

NACE code	1988	1989	1990	1991	1992	1993	1994	1995	1996
1 /2	111	111	82	85	85	79	91	93	101
5	0	0	0	0	0	0	0	0	0
10/12	0	0	0	0	0	0	0	0	0
13/14	0	0	0	0	0	0	0	0	0
15/16	8	8	11	8	8	8	8	6	7
17/19	26	19	12	18	28	23	23	21	22
20	1	0	0	0	1	1	1	0	0
21/22	5	5	4	4	5	5	5	5	6
23	10	16	13	14	12	9	11	10	9
24/25	10	12	8	7	7	6	7	6	6
26	5	5	4	4	4	3	3	2	3
27	4	6	3	3	4	2	3	3	3
28	0	1	0	0	1	0	0	0	0
29/37	9	8	6	5	7	6	5	4	4
40/41	1	1	1	1	1	1	1	1	1
45	10	9	16	21	14	6	6	4	2
50/52	22	25	26	26	19	22	24	21	22
55	58	63	66	62	72	83	90	79	80
60/64	23	24	26	25	18	19	19	17	19
65/67	8	7	8	9	11	11	14	12	32
70/74	3	4	4	4	4	4	4	3	2
75 & 90	46	49	54	44	49	59	64	39	22
80/85	46	50	50	47	51	53	50	29	24
91	0	1	1	1	1	0	0	0	0
92/95	12	17	15	16	13	14	16	12	10
Total industries	418	441	410	404	415	414	445	367	375
Households	261	269	242	228	233	212	233	326	334
Total uses	679	710	652	632	648	626	678	693	709

Source: Natural resources accounts and environmental input/output tables for Greece 1988-1998, National Technical University of Athens, 2000

This long time series enables to draw a chart to analyse the possible changes in the uses of water. The changes that thus come forward would be the basis for analysing the causes of the changes (e.g. climatic variations).

Figure 3.2-7 Use of distributed water by user category, Greece 1988 - 1996



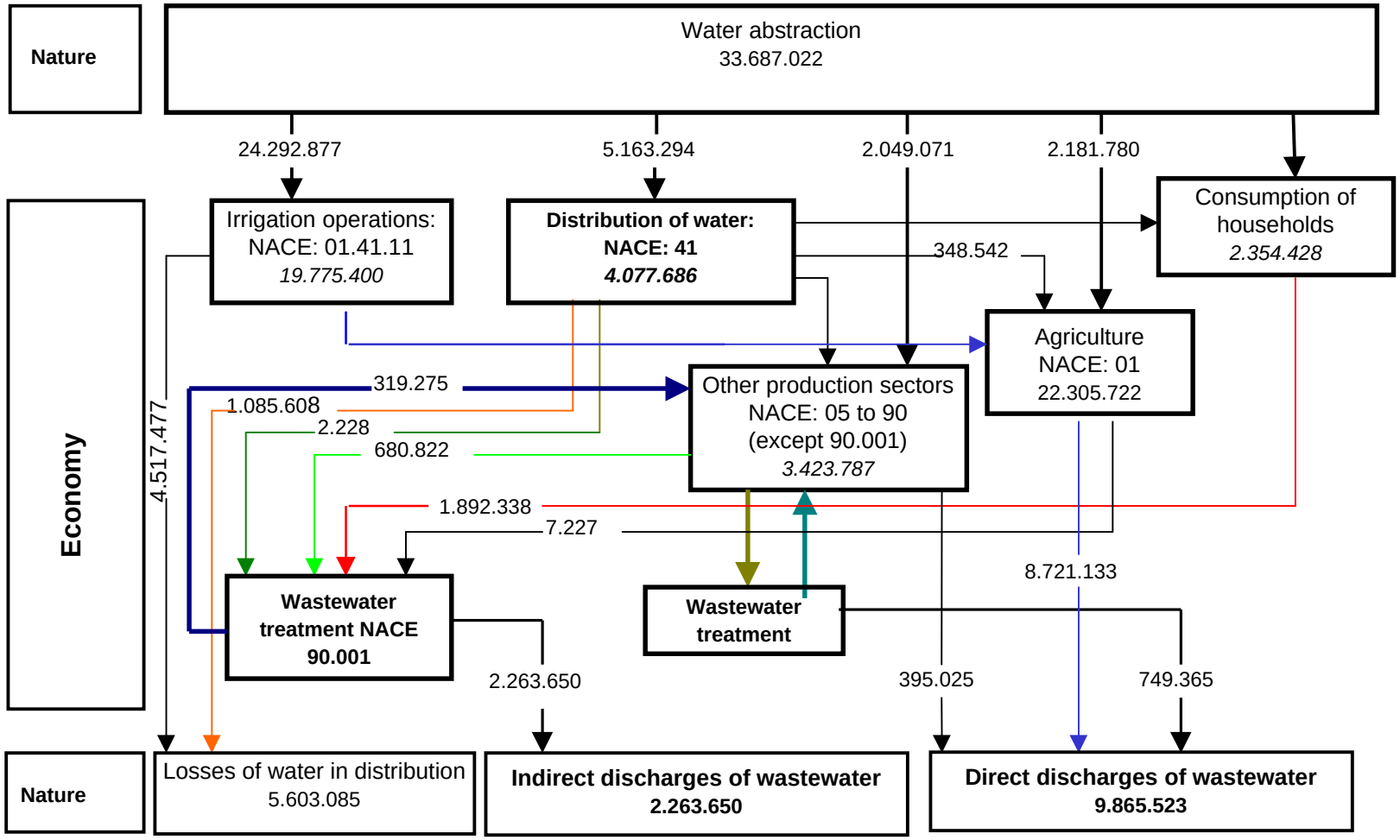
Source: Natural resources accounts and environmental input/output tables for Greece 1988-1998, National Technical University of Athens, 2000

3.2.5 Spain

Flow diagram

Spain translates the pilot tables 5 to 8 into a diagram, which shows in particular the importance of agriculture in water uses. It is responsible for 72% of abstractions. Balancing items, such as evapo-transpiration of crops and incorporation of water in products (in particular agricultural products) are not shown.

Scheme 3.2-1 Water flows in the economy and between economy and environment, Spain 1999, 1 000 m³



Source: Eurostat Working Paper n° 2/2001/B/6 – Water Satellite Accounts for Spain 1997-1999

3.2.6 The Netherlands

Tables

In the CBS NAMEA framework, a comprehensive point of view is adopted for water. The volumes of water flows exchanged between the economy and the environment (pilot table 7) and within the economy (pilot tables 5 & 6) are put in the same tables and flows of water in nature are recorded as well. The supply-use tables are complemented by an origin/destination part to deal with flows of water in nature. Water and wastewater are not distinguished as such. (Consumers refer to households in these tables.)

Table 3.2-5 Origin/supply of water, The Netherlands 1991, million m³

	Tap water	Groundwater	Surface water	Total
SUPPLY OF TAP WATER AND DISCHARGES BY PRODUCERS				
Water supply	1 278			1 278
Environmental cleansing and sanitary services			1 642	1 642
Water boards			100	100
Discharges by other economic activities			8 130	8 130
OTHER ORIGINS				
Water inflows from neighbouring counties and precipitation		5 800	84 623	90 423
Total	**1 278**	**5 800**	**94 495**	**101 573**

Source: Water accounts in the Dutch NAMEA: a 'NAMWA' for 1991 – CBS, May 1997

Table 3.2-6 Destination/use of water, The Netherlands 1991, million m³

	Tap water	Ground-water	Surface water	Total
USE BY CONSUMERS	704	-	-	704
USE BY PRODUCERS				
Agriculture, hunting, forestry, fishing[1]	100	130	200	430
Mining and quarrying	1	-	-	1
Manufacturing				
Food, beverages and tobacco industry	34	77	94	204
Textile, wearing apparel and leather industry	4	5	4	12
Wood and furniture industry	2	-	-	2
Paper, printing and publishing industry	13	32	58	102
Petroleum industry	27	0	3	30
Chemical industry	36	43	849	928
Rubber and plastic industry	2	15	2	19
Construction materials, earthenware and glass products	5	14	157	177
Basic metal industry	41	7	3	50
Metal products and machinery industry	22	5	2	29
Other manufacturing	27	7	3	37
Public utilities				
Electricity and gas	5	2	5 143	5 150
Water supply	1	842	435	1 278
Construction	5	-	-	5
Transport and storage	9	-	-	9
Environmental cleansing and sanitary services	12	-	1 642	1 654
Water boards	-	100	-	100
Other services	230	-	-	230
OTHER DESTINATIONS				
Water outflows to open sea and evapo-transpiration	-	4 621	85 902	90 523
NET CHANGES IN STOCK	-	-100	-	-100
Total	**1 278**	**5 800**	**94 495**	**101 573**

1: estimated

Source: Water accounts in the Dutch NAMEA: a 'NAMWA' for 1991 – CBS, May 1997

3.2.7 Sweden

Tables

Table 3.2-7 summarises the total abstractions, total discharges and economic flows (supply-use of distributed water) and Table 3.2-8 shows the origin of the abstractions and the destination of the private discharges. As discharges by wastewater treatment are not incorporated, this table does not balance.

A diagram of the flows of water was also included in the Swedish report (see scheme 1.2-5 in section 1.2). This scheme includes the abstractions and discharges by type of water as shown in Table 3.2-8 but also shows flows of seawater (8 500 Mio m^3) used by nuclear power plants for cooling (not presented in Table 3.2-8). This illustrates that, like in the Danish case, seawater is an important resource.

There are still some uncertainties about possible direct abstractions by services industries.

Contrary to some other countries, Sweden assumed that losses in the supply network are captured by the wastewater network in the form of urban run-offs.

Table 3.2-7 Volumes of water flows, Sweden 1995, 1 000 m³

NACE code	Activity	Water				Wastewater				Water balance
		Supply of marketed water	Use of marketed water	Self-supply of water	Total	Supply of wastewater treatment	Use of wastewater treatment	Private discharge	Total	
1	Agriculture			137 291	137 291					137 291
10/14	Mining and quarrying		1 312	42 594	43 906		1 157	45 306	46 463	-2 557
15/16	Food products, beverages, tobacco		25 917	48 112	74 029		25 154	43 178	68 332	5 697
17/19	Textiles, textile products, leather		2 459	9 220	11 679		3 080	8 337	11 417	262
20	Wood, products of wood, cork, straw, etc.		1 249	18 531	19 780		1 327	16 068	17 395	2 385
21	Pulp, paper and paper products		3 327	975 075	978 402		7 682	873 006	880 688	97 714
22	Publishing, printing and reproduction		2 466	64	2 530		2 282	62	2 344	186
23	Coke, refined petroleum and nuclear fuel		271	126	397		357	10	367	30
24	Chemicals and chemical products		18 891	492 881	511 772		5 352	488 792	494 144	17 628
25	Rubber and plastic products		995	16 782	17 777		1 193	16 391	17 584	193
26	Non-metallic mineral products		2 716	12 175	14 891		2 617	8 197	10 814	4 077
27	Basic metals		8 592	351 862	360 454		3 972	355 181	359 153	1 301
28	Fabricated metals, except machinery		4 164	12 126	16 290		4 379	11 749	16 128	162
29	Machinery and equipment n.e.c.		5 473	19 815	25 288		5 615	19 666	25 281	7
30	Office machinery and computers		406	67	473		381	61	442	31
31/32	Electrical machinery, radio, TV, etc.		3 385	5 045	8 430		4 136	4 225	8 361	69
33	Medical, precision, optical instruments, etc.		1 025	181	1 206		1 023	165	1 188	18
34/35	Motor vehicles and other transport eq.		6 446	10 130	16 576		7 644	8 687	16 331	245
36/37	Other manufacturing		695	360	1 055		623	266	889	166
	Not possible to disaggregate by sector		6 469	5 667	12 136		727	5 517	6 244	5 892
40	Electricity, gas, steam and hot water supply		6 681	113 551	120 232		725	116 888	117 613	2 619
41	Collection, purification, distribution of water	936 301	180 596		180 596		132 972	47 624	180 596	0
45/99	Other, excluding 90.01 and 70		86 522		86 522		86 522		86 522	0
90.01	Sewage disposal					1 360 000				0
70	Real estate		527 975	88 449	616 424		527 975	88 449	616 424	0
	Unspecified use		38 269		38 269		38 269		38 269	0
	Urban run-offs						494 836		494 836	-494 836
	TOTAL	936 301	936 301	2 360 104	3 296 405	1 360 000	1 360 000	2 157 825	3 517 825	-221 420

Source: Water Accounts. Physical and monetary data connected to abstraction, use and discharge of water in the Swedish NAMEA – Statistiska centralbyrån, December 1999

Table 3.2-8 Origin and destination of water, Sweden 1995, 1 000 m³

NACE code	Activity	Abstractions from			Private discharges to	
		Groundwater	Surface water	Sea water	Inland waters	Sea
1	Agriculture	66 418	70 873			
2	Forestry					
10/14	Mining and quarrying	15 229	24 845	2 521	42 767	2 539
15/16	Food products, beverages, tobacco	10 600	7 709	29 802	11 107	32 071
17/19	Textiles, textile products, leather	913	8 307		8 337	
20	Wood, products of wood, cork, straw, etc.	946	15 924	1 661	13 989	2 079
21	Pulp, paper and paper products	16	975 059		361 112	511 894
22	Publishing, printing and reproduction	3	42	19	41	21
23	Coke, refined petroleum and nuclear fuel	8	117		6	4
24	Chemicals and chemical products	2 968	180 639	309 274	159 999	328 793
25	Rubber and plastic products	450	11 286	5 045	5 201	11 190
26	Non-metallic mineral products	3 947	6 305	1 923	6 812	1 385
27	Basic metals	2 843	160 193	188 826	159 521	195 660
28	Fabricated metals, except machinery	721	11 366	38	9 928	1 821
29	Machinery and equipment n.e.c.	270	19 545		19 640	26
30	Office machinery and computers	42	24	2	59	2
31/32	Electrical machinery, radio, TV, etc.	1 303	1 990	1 753	2 108	2 117
33	Medical, precision, optical instruments, etc.	77	44	61	59	106
34/35	Motor vehicles and other transport eq.	238	9 885	7	8 484	203
36/37	Other manufacturing	111	238	11	220	46
	Not possible to disaggregate by sector	1 474	4 192	1	5 514	3
40	Electricity, gas, steam and hot water supply	897	68 480	44 174	67 360	49 528
41	Collection, purification, distribution of water	444 948	491 353			
45	Construction					
50/52	Wholesale and retail trade					
55	Hotels and restaurants					
60/64	Transport, storage and communication					
62	Financial intermediation					
71/74	Renting and business activities					
80/99	Other, excluding 90.01					
90.01	Sewage disposal					
75	Public administration					
70	Real estate	88 449				
	TOTAL	642 871	2 068 416	585 118	882 264	1 139 488

Source: Water Accounts. Physical and monetary data connected to abstraction, use and discharge of water in the Swedish NAMEA – Statistiska centralbyrån, December 1999

3.2.8 The United Kingdom

Tables

As explained in the methodological part, the source of the data being the Environment Agency, only a few details are available as concerns activities.

The concept of 'net uses' in Table 3.2-9 includes water incorporated in products, water evaporated, but also probably large unknown flows, since it is 1/4 of the total abstractions.

Table 3.2-9 Abstractions and returns by industry, England and Wales 1994, million m³

	Public + private water supply	Agriculture + irrigation	Hydro-electricity generation	Other energy generation	Industry (non-energy)	Minerals	Other, un-attributed	Total
Abstractions								
Lakes/rivers	4 300	1 400	2 400	500	700	0	100	9 400
Groundwater	1 900	200	0	0	200	100	0	2 500
Coastal	0	0	0	7 200	600	0	0	7 800
Total	6 200	1 600	2 400	7 700	1 600	100	100	19 700
Returns								
Lakes/rivers	3 000	1 500	2 400	500	700	100	100	8 200
Groundwater	0	0	0	0	0	0	0	0
Coastal	1 300	0	0	7 200	400	0	0	9 000
Total	4 400	1 500	2 400	7 700	1 100	100	100	17 200
Net uses								
Lakes/rivers	1 300	-100	0	0	100	0	0	1 100
Groundwater	1 900	200	0	0	200	100	0	2 500
Coastal	-1 300	0	0	0	200	0	0	-1 200
Total	1 800	100	0	0	500	0	0	2 500

Notes: The industry classification is that of the Environment Agency. Coastal abstractions relate to tidal waters.

Source: United Kingdom Environmental Accounts 1998

3.2.9 Comparisons between countries

Water uses

Five countries (Denmark, Germany, Spain, The Netherlands and Sweden) could provide broadly comparable information on direct abstraction as well as on use of distributed water by industry (see Tables 3.2-10). Adding direct abstraction and the use of distributed water indicates the total use of water by industry (leaks and losses in the distribution network are allocated to the water supply industry).

In order to remove the scale effect, these flows have been divided by the number of inhabitants as regards the use by households and by the value added as regards industries in Tables 3.2-11 and 3.2-12. These tables show large differences in the average water uses. Some differences are easily explained, such as the higher water use in agriculture in Spain due to climatic conditions and the recourse to irrigation, others would need more research.

Incorporation of water in products

Strangely, it is not the same industries that incorporate water into other products in the Danish and the German pilot studies. For Germany, the major incorporating industry is agriculture, followed by food and beverages manufacturing. No flow is recorded for chemical and construction materials industries, as in Denmark. In Denmark, no incorporation is considered for agriculture.

Water incorporated as a percentage of total water use is small but 10 times higher in Germany than in Denmark (0.7% against 0.07%).

Table 3.2-10 Uses of fresh water by user category in 5 countries, million m^3

NACE code		Germany 1995			The Netherlands 1991			Denmark 1997			Sweden 1995			Spain 1997		
		Direct abstraction	Exchange with other industries	Total uses	Direct abstraction	Exchange with other industries	Total uses	Direct abstraction	Exchange with other industries	Total uses	Direct abstraction	Exchange with other industries	Total uses	Direct abstraction	Exchange with other industries	Total uses
A, B	Agriculture, forestry, fisheries	764	152	916	330	100	430	393	36	429	137	0	137	23 214	340	23 554
C	Mining and quarrying	2 017	119	2 136	0	1	1	5	0	5	40	1	41	133	16	150
DA	Food products, beverages, tobacco	316	218	534	170	34	204	26	23	49	18	26	44	112	56	167
DB/DC	Textiles and leather products	56	21	77	8	4	12	8	2	10	9	2	12	103	11	115
DD	Wood and wood products	11	4	15	0	2	2	2	1	2	17	1	18	21	3	24
DE	Pulp, paper, publishing and printing	379	70	449	89	13	102	5	1	6	975	6	981	229	12	241
DF	Coke, petroleum and nuclear fuel	231	43	274	3	27	30	1	1	1	0	0	0	15	33	47
DG	Chemicals and man-made fibres	2 723	435	3 158	892	36	928	6	8	14	184	19	202	385	76	461
DH	Rubber and plastic products	77	21	98	16	2	19	0	1	1	12	1	13	21	50	71
DI	Non-metallic mineral products	147	53	200	172	5	177	8	1	10	10	3	13	12	23	35
DJ/DM	Metal products and machinery	700	247	947	17	63	80	2	4	6	209	29	238	192	71	264
DN	Manufacturing n.e.c.	4	6	10	10	27	37	1	0	1	0	1	1	59	9	68
40	Electricity, gas, steam, hot water	29 715	332	30 047	5 145	5	5 150	5	6	12	69	7	76	0	41	41
41	Water supply	6 448	-5 613	835	1 277	-1 278	-1	470	-412	57	936	-756	181	4 393	-3 697	696
part 90	Sewage disposal	5 273	0	5 273	0	12	12	0	1	1	0	0	0	0	160	160
F-O	Construction and other services	0	618	618	0	244	244	2	63	65	0	87	87	116	678	794
	Unknown industry	0	0	0	0	0	0	0	0	0	6	6	12	0	0	0
	Total industries	48 861	-3 274	45 587	8 130	-705	7 426	934	-266	669	2 623	-566	2 057	29 005	-2 118	26 888
	Households	47	3 266	3 313	0	704	704	18	266	283	88	528	616	0	2 118	2 118
	Unknown user	0	0	0	0	0	0	0	0	0	0	38	38	0	0	0
	Total	48 908	-8	48 900	8 130	-1	8 130	952	0	952	2 711	0	2 711	29 005	0	29 005

Table 3.2-11 Water uses by households in 5 countries

Country	Year	m^3 per inhabitant per year	litre per inhabitant per day	of which, directly abstracted
Germany	1995	40,6	111	1,4%
The Netherlands	1991	46,7	128	0,0%
Denmark	1997	53,6	147	6,3%
Sweden	1995	69,8	191	14,3%
Spain	1997	53,9	148	0,0%

Table 3.2-12 Water uses by industry in 4 countries, litres of water used per euro of value added

NACE code		Denmark 1997	Germany 1995	Spain 1995/97*	Sweden 1995
A, B	Agriculture, forestry, fisheries	98	41	2 302	39
C	Mining and quarrying	3	207	112	89
DA/DB/DC/DD/DI	Food, textiles, leather, wood, minerals	11	11	23	15
DE	Pulp, paper, publishing, printing	2	15	68	199
DF	Coke, petroleum, nuclear fuel	24	114	42	0
DG/DH	Chemicals, rubber, plastics	4	53	90	59
DJ/DK/DM/DN	Metal products, machinery, transport	1	4	19	12
E	Electricity, gas and water	21	818	112	59
F-O	Construction and services	1	5	6	1
	Total industries	5	26	116	18

* Water uses relate to year 97, economic data to 1995

3.2.10 Appropriateness of the breakdowns

3.2.10.1 Description of water in nature

In order to maintain coherence with environment statistics, the pilot tables only include the three types of water bodies listed in the OECD/Eurostat questionnaire: groundwater, surface water and other water.

When testing the accounting framework, a number of countries moved away from this list. For instance, in its description of the emissions of nitrogen, Ireland used the following breakdown of 'recipient' bodies: rivers, estuaries, bays and 'coastal'. The United Kingdom also used the 'coastal' concept in its presentation of abstractions and discharges, but this term related to tidal waters (Table 3.2-9). Seawater was added by Denmark and Sweden (Table 3.2-8). Germany identified springs and bank filtrates within fresh water resources.

3.2.10.2 Water uses

A limited number of water-related products were proposed for testing, products that were supposed to be of interest in all EU Member States. The products and activities retained in this first step correspond to activities implying a displacement of water (therefore excluding *in-situ* activities) into controlled networks in order to use it (therefore excluding activities undertaken against unwanted water).

A use can be defined as any economic action which:

- makes water temporarily disappear from the water sources, e.g. is evaporated or incorporated in a product (consumption);
- or makes physical characteristics of water change (e.g. temperature, when water is used for cooling);
- or adds biological or chemical elements to it (pollution).

Within this limited framework, the type of use has been considered an important characteristic of water flows in several Member States and it may be worth investigating why they found it important to make this supplementary breakdown.

The type of use was actually introduced by Member States for different reasons. Sometimes, it was used as a proxy for a group of activities because data, generally coming from the Environment Agency, was available according to the use and not according to an industry classification. Other times, it was a complement to an already detailed breakdown by activities and seemed connected to the wish of introducing in the accounts the type of transformation water faces during its 'economic' phase.

Examples by Denmark and Sweden can be found below.

In Denmark, 5 classifications of uses are to be found, in relation to the type of user.

Table 3.2-13 Water use by purpose in non-manufacturing activities, Denmark 1994, 1 000 m³

Type of user	Type of water / Type of use	Sea water	Surface water	Tap water	Ground-water	Recycled water
Agriculture (NACE 01)	watering		10 200		254 992	
	animal breeding			21 938	16 259	
	sanitary purpose			1 439	1 065	
	other purposes			9 089		
Electricity (NACE 40.1)	Production processes	196	791	1 329	1 293	409
	Environment installations			647	616	639
	Cooling	5 253 900				
	Heat supply system			1 989	391	
	Other			490		
Heating (NACE 40.3)	Production processes			3		
	Environment installations					
	Cooling					
	Heat supply system			885		
	Other			21		
Water distribution (NACE 41)	Tap water		2 240		432 160	
	Production processes				11 837	
	Losses		200		43 000	
	Protection drillings				4 494	
	Other			440		
Households	Personal hygiene			102 636	5 616	
	Toilets			76 977	4 212	
	Washing of clothes			37 063	2 028	
	Cleaning, doing dishes			28 510	1 560	
	Cooking, drinking			19 957	1 092	
	Other			19 957	1 092	

Source: Statistics Denmark – NAMEA with water extraction and use – April 1999

Table 3.2-14 Use by purpose in the manufacturing industries, Denmark 1994, 1 000 m³

	Industry	Rinsing of raw materials	Cleaning	Cooling	Used in production	Added to products	Other use	Total
140009	Extr. of gravel, clay, etc.	2 199	547	550	556	548	1 101	5 502
151000	Production etc. of meat...	862	4 022	818	7 045	127	2 615	15 489
152000	Processing etc. of fish...	515	3 924	1 633	12 120	206	4 456	22 854
153000	Processing etc. of fruit...	341	455	424	695	117	29	2 061
154000	Manf. of vegetable and...	0	28	2 534	568	76	1	3 209
155000	Manf. of dairy products	158	4 410	2 189	1 324	267	205	8 553
156009	Manf. of starch, chocolate...	69	2 291	2 324	5 829	140	2 282	12 935
158109	Manf. of bread, cakes...	0	230	1	0	212	4	448
158120	Bakers' shops	0	83	0	0	96	32	212
158300	Manufacture of sugar	835	112	3 967	54	8	3 040	8 016
159000	Manf. of beverages	2 632	1 194	9 783	2 603	854	653	17 719
160000	Manufacture of tobacco...	2	14	9	0	1	66	93
170000	Manf. of textiles...	2 328	144	143	599	35	112	3 361
180000	Manf. of wearing apparel...	0	4	0	8	0	45	57
190000	Manf. of leather...	0	0	84	1	0	5	90
200000	Manf. of wood and ...	73	42	753	444	60	275	1 646
210000	Manf. of pulp, paper and...	3	65	3 522	1 664	314	883	6 452
221200	Publishing of newspapers	2	2	2	10	0	70	86
221309	Publishing activities, excl...	35	74	19	19	0	112	260
222009	Printing activities etc.	248	173	22	139	3	150	735
230000	Manf. of refined petroleum prod...	320	19	477	1	23	301	1 140
241109	Manf. of industrial gases and...	60	22	9 302	347	10	36	9 777
241209	Manf. of dyes, pigments and...	297	107	45 876	1 713	48	175	48 216
241500	Manufacture of fertilizers etc.	48	17	7 363	275	8	28	7 738
241617	Manf. of plastics and...	0	7	72	0	3	1 829	1 910
242000	Manufacture of pesticides and...	16	6	2 507	94	3	10	2 635
243000	Manf. of paints, printing ink and...	0	35	8	0	46	26	116
244000	Manf. of pharmaceuticals etc.	1 939	1 107	2 438	414	446	208	6 552
245070	Manf. of detergents and other...	231	168	692	596	75	3 527	5 289
251122	Manf. of rubber products and...	83	40	810	202	1	513	1 650
252300	Manf. of builders' ware of plastic	3	1	2	9	0	10	26
252400	Manufacture of other plastic...	10	6	52	42	0	58	168
261126	Manf. of glass and ceramic goods...	50	4	193	18	1	155	421
263053	Manf. of cement, bricks...	0	114	620	1 453	8	1 108	3 302
266080	Manf. of concrete, cement...	885	168	702	253	254	573	2 835
271000	Manf. of basic ferrous metals	1	1	1 367	0	0	74	1 442
272030	First processing of iron and steel	0	7	24	195	0	32	258
274000	Manf. of basic non-ferrous metals	35	6	5	33	0	5	84
275000	Casting of metal products	0	1	1	1	0	1	4
281009	Manf. of construct. materials of...	332	96	34	183	0	303	948
286009	Manf. of hand tools...	39	32	254	155	0	139	618
291000	Manf. af marine engines...	34	39	299	160	0	161	694
292000	Manf. of other general purpose...	28	31	95	156	0	231	541
293000	Manf. of agricultural and foresty...	32	32	2	38	0	61	165
294009	Manf. of machinery for industries...	18	30	35	56	1	145	284
297000	Manf. of domestic appliances...	5	6	43	39	0	40	133
300000	Manf. of office machinery and...	0	0	0	0	0	0	1
310000	Manf. of other electrical...	7	39	42	54	0	66	208
320000	Manf. of radio and communicat...	36	8	23	245	0	131	444
330000	Manf. of medical and optical...	2	5	36	5	0	70	118
340000	Manufacture of motor vehicles...	152	40	38	21	0	112	363
351000	Building and repairing of ships...	37	28	3	0	0	218	286
352050	Manf. of transport equipment...	12	3	15	9	0	9	49
361000	Manf. of furniture	71	53	28	70	0	171	393
362060	Manf. of toys, gold and silver...	3	16	23	3	4	78	127
	Total manufacturing	**15 088**	**20 112**	**102 257**	**40 518**	**3 996**	**26 742**	**208 712**

Source: Statistics Denmark – NAMEA with water extraction and use – April 1999

In Sweden, only four categories of uses have been distinguished, with extra detail for agriculture and household uses.

Table 3.2-15 Use of water by purpose, Sweden 1995, 1 000 m³

NACE code	Activity	Cooling water in production of electricity	Other cooling water	Production processes	Other uses
1	Agriculture				137 291
2	Forestry				
10/14	Mining and quarrying		271	41 659	1 977
15/16	Food products, beverages, tobacco		43 522	27 516	2 991
17/19	Textiles, textile products, leather	53	3 773	7 303	551
20	Wood, products of wood, cork, straw, etc.		669	18 256	855
21	Pulp, paper and paper products	24 615	279 730	665 309	8 748
22	Publishing, printing and reproduction		190	715	1 625
23	Coke, refined petroleum and nuclear fuel		260	87	48
24	Chemicals and chemical products	996	482 419	21 305	7 051
25	Rubber and plastic products		15 267	1 844	666
26	Non-metallic mineral products		7 796	5 492	1 602
27	Basic metals	20 916	257 659	78 422	3 457
28	Fabricated metals, except machinery	40	11 251	2 782	2 216
29	Machinery and equipment n.e.c.		19 013	2 947	3 328
30	Office machinery and computers		223	69	181
31/32	Electrical machinery, radio, TV, etc.		3 473	3 593	1 364
33	Medical, precision, optical instr., etc.		443	195	568
34/35	Motor vehicles and other transport eq.		9 452	4 162	2 962
36/37	Other manufacturing		137	480	438
	Not possible to disaggregate by sector				12 136
40	Electricity, gas, steam, hot water supply	105 880	4 866	6 057	3 429
41	Collection, purification, distrib. of water				180 596
45	Construction				86 522
50/52	Wholesale and retail trade				
55	Hotels and restaurants				
60/64	Transport, storage and communication				
62	Financial intermediation				
71/74	Renting and business activities				
80/99	Other, excluding 90.01				
90.01	Sewage disposal				
75	Public administration				
70	Real estate				616 424
	Unspecified use				38 269
	TOTAL	**152 500**	**1 140 414**	**888 193**	**1 115 295**

Source: Water Accounts. Physical and monetary data connected to abstraction, use and discharge of water in the Swedish NAMEA – Statistiska centralbyrån, December 1999

Agriculture

Table 3.2-16 Use of water in agriculture, Sweden 1985

	million m^3	percent
Irrigation	94	69
Livestock	43	31
Total	137	100

Source: Water Accounts. Physical and monetary data connected to abstraction, use and discharge of water in the Swedish NAMEA – Statistiska centralbyrån, December 1999

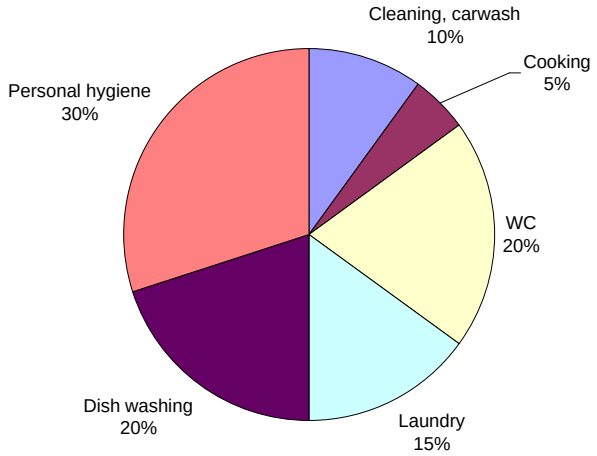
Households

In Sweden, expenditure for water used by households are counted in the national accounts as intermediate consumption in the real estate sector (NACE 70), i.e. it is part of the expenditure for housing. In the environmental accounts for water, the physical data for use of water by households are, in the same way as in the national accounts, linked to the real estate sector.

The use of water by households amounts to 616 million m^3, which means the average use of water in Sweden amounts to 189 litres per person and day.

Some estimates are available on the use of water for different purposes, which shows that 30 percent is used for personal hygiene and 20 percent for dishwashing.

Figure 3.2-8 Use of water in households by purpose in Sweden, mid 90s



Source: Website http://www.svenskamiljonatet.se

This rather frequent introduction of the type of use by Member States probably lies in the assumption that the environmental impacts of the economic actions involving water largely depend on the type of use. It raises questions regarding the usefulness of introducing in the accounts such a breakdown by uses, and what uses should be considered.

3.2.11 Conclusion on water volume flow accounts

The suggestions made by the Member States which tested the tables on water flows raise a number of questions:

- The detail of the activity nomenclature: when the Member States had to refer to their Environment Protection Agency to obtain data, the Agency generally supplied data with a different nomenclature, often process-based, separating the major type of use met in a certain class of activity/process.
- This type of use has been described by several Member States.
- Some Member States introduced other types of water flows: water incorporated in products, water removed from products, water evaporated, water infiltrated in the networks.
- The nomenclature regarding the water sources did not seem to satisfy the compilers of the accounts and a number of countries judged important the introduction of other categories such as coastal resources (Ireland and the United Kingdom) or sea water (Nordic countries) in order to make the scheme comprehensive.

Different indicators were built up, combining economic and environmental data: water productivity, water intensity.

3.3 Flows of pollutants

Regarding the flows of pollutants, the pilot tables proposed for testing have been presented in section 2.2. The testing countries clearly moved away from this framework, either for reasons of data availability, or because they focussed on one specific methodological aspect (e.g. test of the quality of the supplied data). Therefore, it has been quite difficult to show comparable information. But this lack of comparability does not prevent interesting conclusions from being drawn as will be demonstrated in this section 3.3.

As in the previous sections, national presentations have not been systematically harmonised, as a study of the divergences also provides lessons for the future implementation of the water accounts.

3.3.1 Belgium

The results on volumes of water flows (section 3.2.1) showed that more than half of total wastewater discharges in Belgium in 1998 were due to the power and water distribution industries, but these industries had very low shares in the total pollution.

Table 3.3-1 Sectoral distribution of water pollution in Belgium in 1998, in percent of total discharges

	Primary sector	Manufacturing industries	Power & water distributors	Services	Households
BOD	16.2	19.5	0.0	1.4	62.9
COD	7.0	25.6	0.1	1.6	65.7
Suspended solids	0.8	8.5	0.1	1.1	89.6
As	0.0	99.0	0.0	0.0	1.0
Cd	0.0	98.5	0.0	0.2	1.2
Hg	0.0	99.7	0.0	0.0	0.2
Cu	0.3	97.6	0.0	0.0	2.1
Cr	0.5	99.4	0.0	0.0	0.1
Ni	2.4	97.3	0.0	0.0	0.3
Pb	6.3	92.9	0.0	0.0	0.8
Zn	0.8	98.8	0.0	0.0	0.4
Phosphorus	24.0	11.9	0.0	0.9	63.2
Nitrogen	54.2	9.0	0.1	0.5	36.2

Source: The NAMEA water for Belgium, Federal Planning Bureau, February 2002

Environmental data have been combined with economic data in order to distinguish the sectors that are important water polluters because of the kind of activity they perform from those that are important polluters because of their economic size. In order to make this distinction, indicators have been calculated, notably a value added ratio[47]:

$$\text{value added ratio}_{ij} = \frac{\text{share of sector } i \text{ in total discharge of water pollution form } j}{\text{share of sector } i \text{ in total value added}}$$

When the ratio is higher than 1, it means that the relative contribution to pollution is higher than the relative contribution to GDP.

The primary sector (agriculture and mining industries) contributed much more to the pollution of the Belgian waters than it contributed to the national value added as regards nitrogen and phosphorus, as well as BOD and COD. Manufacturing industries contributed more to the pollution of water with any form of pollutant than they contributed to value added, except for nitrogen. The power and water distribution industries and the service industries contribute more to value added than to any form of water pollution.

[47] A similar ratio has also been built for employment.

Table 3.3-2 Value added ratios of industry groups by pollutant, Belgium 1998

	Primary sector	Manufacturing industries	Power & water distributors	Services
BOD	25.60	2.71	0.02	0.05
COD	11.94	3.84	0.08	0.06
Suspended solids	4.27	4.19	0.35	0.13
As	0.01	5.14	0.01	0.00
Cd	0.01	5.13	0.00	0.00
Hg	0.00	5.14	0.00	0.00
Cu	0.15	5.12	0.00	0.00
Cr	0.30	5.11	0.00	0.00
Ni	1.41	5.01	0.00	0.00
Pb	3.76	4.81	0.00	0.00
Zn	0.45	5.10	0.00	0.00
Phosphorus	38.30	1.66	0.04	0.03
Nitrogen	50.00	0.72	0.07	0.01

Source: The NAMEA water for Belgium, Federal Planning Bureau, February 2002

An apparent contradiction has also been raised by the Belgian study: once the different tables about the pollutants are completed, the amount of pollutants subtracted by wastewater treatment plants can be calculated indirectly by deducting the discharges into the water bodies by the wastewater treatment sector from the total discharges into the sewage system. For nitrogen, arsenic, zinc and nickel, in one of the three regions, the resulting estimate of pollution subtracted by water treatment plants was negative. This would imply that wastewater treatment adds pollution to water instead of subtracting it. Reasons for the negative results may be weaknesses in data sources or incomplete coverage of the origins of pollution. For example, illicit discharges or urban run-off (which may be a potentially large source for Zinc from roofs) would have to be taken into account also to obtain a more complete picture.

Table 3.3-3 An estimate for water pollutants subtracted by NACE 90, Belgium 1998, kg

BOD	27 923 649
COD	53 258 676
Suspended solids	23 554 875
Heavy metals	
As	-438
Cd	81
Hg	5
Cu	297 861
Cr	231 638
Ni	45 598
Pb	33 827
Zn	431 726
Phosphorus (total)	527 594
Nitrogen (total)	-693 118

3.3.2 Germany

Germany tried to cover practically all aspects of the proposed framework, and no particular focus was put on the emission of pollutants. The tables provided are those proposed by Eurostat (pilot tables 10 to 12), but, with the immediately available statistics, only a limited number of pollutants and no industrial detail could be supplied. Notably, no breakdown by industry of the pollutants collected from industries by sewage operators could be supplied.

Table 3.3-4 Pollutants discharged by economic activities into the sewage network, Germany 1991, 1 000 tonnes

	BOD_5	COD	Nitrogen	Phosphorus
Sewage operators	-	-	-	-
Other industries	829	1 949	131	18
Households	1 505	3 011	276	63
TOTAL	**2 334**	**4 960**	**407**	**81**

Source: Entwicklung von Physischen Wasserflußrechnungen für Deutschland – Statistisches Bundesamt, August 1998

Table 3.3-5 Pollutants discharged to water bodies by economic activities, Germany 1991, 1 000 tonnes

	BOD_5	COD	Nitrogen	Phosphorus
Sewage operators	233	783	196	20
Other industries	89	337	91	6
Households	172	345	32	7
TOTAL	**494**	**1 465**	**318**	**33**

Source: Entwicklung von Physischen Wasserflußrechnungen für Deutschland – Statistisches Bundesamt, August 1998

Table 3.3-6 Pollutants subtracted by economic activities, Germany 1991, 1 000 tonnes

	BOD_5	COD	Nitrogen	Phosphorus
Sewage operators	2 102	4 177	211	61
Other industries	-	-	-	-
Households	-	-	-	-
TOTAL	2 102	4 177	211	61

Source: Entwicklung von Physischen Wasserflußrechnungen für Deutschland – Statistisches Bundesamt, August 1998

In Table 3.3-6, no data are provided for 'households' and 'other industries' (mainly mining and manufacturing industries) because a 'net' concept of emission is applied: if pollution is absorbed by a sewage treatment plant belonging to the firm, it is an internal process and this pollution is not counted either in the pollution emitted by the firm. It would be useful to have also the 'gross' emissions (prior to internal treatment), for comparison with environmental protection expenditure accounts, where the expenditure corresponding to internal treatment will be recorded.

3.3.3 France

One main objective was to test the reliability of the data obtained by using the NOPOLU model, as well as the practicability of a correspondence table between the Water Agencies' industrial process-oriented nomenclature (TEF) and NACE. These tests were organised at the Loire-Bretagne region level. Table 3.3-8 shows the results of testing various methods. The aggregated results are not very different according to the different sources of data or procedures. The shares of the main aggregated branches of industrial activities are also rather equivalent, whatever data or calculation method is used. The use of the correspondence table between the process-oriented nomenclature and NACE and the actual classification of individual sites seem to give the same results, at least for the simplified matrices.

Based on these encouraging results, an extension of the NOPOLU model to the national level was carried out later on after the end of the pilot study.

In spite a common collection framework, some differences were observed between the Water Agencies:

- the selection criteria for industrial sites,
- the codification process,
- the quality of data concerning the connection of industrial sites to WWTP.

Nevertheless, a preliminary national physical account for wastewater emissions was issued, as follows.

Table 3.3-7 Pollutants discharged into water bodies by economic activities, France 1997

	Suspended solids kg/day	TOC[48] kg/day	Tox[49] kg equitox/day	N kg/day	P kg/day
Agriculture	20 028	11 011		2 586	774
Industry	13 992 892	5 046 008	54 613 497	318 768	86 241
Food and beverages	8 205 721	3 297 353	80 991	197 877	39 533
Consumption goods	170 291	258 658	812 822	15 702	4 183
Vehicles					
Equipment					
Intermediate goods	4 829 825	1 429 689	50 903 099	95 086	42 031
Energy	787 055	60 309	2 087 584	10102	494
Construction					
Trade, Services, Administration	215 967	347 450	23 201	20 097	4 368
TOTAL	14 228 887	5 404 469	54 636 698	341 451	91 383

Source: IFEN, Synthesis file based on 1997 fees received by the 6 water agencies

This table is not consistent with Eurostat's proposal in the sense that it is a combination of two tables: pollutants discharged to the sewage network are re-attributed to their original source. This allocation is of course oriented by the polluter-pays principle: whether the industrial site discharges its wastewater directly to the water bodies or into the sewage networks, its polluting load is identified and taxed.

[48] TOC = total organic carbon

[49] Tox = toxic substances (notably heavy metals). In order to aggregate these substances, they are expressed in kg equitox. The kg equitox is a measurement unit that evaluates the capacity of a substance to inhibit the biological functions of a living thing.

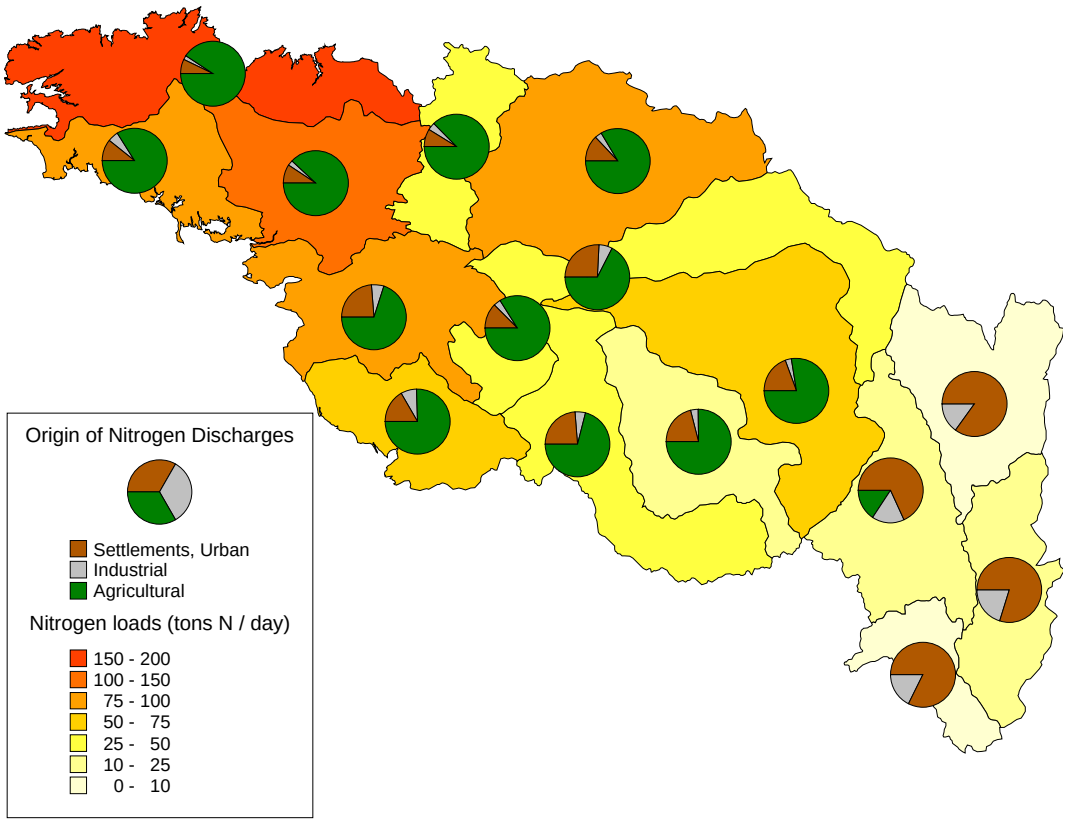
Table 3.3-8 France: Pollutants discharged by economic activities in the Loire-Bretagne basin 1997, comparison of 4 procedures

Origin of discharges	Suspended solids kg/day				TOC kg/day				Tox kg equitox/day		N kg/day				P kg/day			
	TEF	Individ-ual data	Nopolu/ TEF	Nopolu/ NACE	TEF	Individ-ual data	Nopolu/ TEF	Nopolu/ NACE	TEF	Individ-ual data	TEF	Individual data	Nopolu/ TEF	Nopolu/ NACE	TEF	Individ-ual data	Nopolu/ TEF	Nopolu/ NACE
Households				**54 066**				**38 522**						**8 786**				**2 406**
Agriculture	59	67	16	515	756	775	33	2 657	0	0	256	263	38	1 470 858	45	37	6	51 098
Industry	59 202	59 794	52 051	47 354	99 017	99 294	89 112	92 823	1 231	1208	13 867	13 482	12 858	12 979	3 422	3 286	2 565	2 974
Food &beverages	18 834	17 484	17 556	16 630	50 556	50 490	51 026	48 627	4	3	8 271	7 694	7 385	6 639	2 051	1 993	1 978	1 903
Consump. goods	4 131	4 612	4 502	3 537	6 786	7 450	6 846	6 611	44	79	637	791	794	1 025	203	100	100	101
Vehicles				547				1 098						35				55
Equipment	7 954	1 391	383	2850	10 735	552	48	2 622	890	117	559	85	15	168	899	122	102	207
Interm. goods	19 103	25 673	20 068	21 345	29 875	39 258	30 147	32 638	293	942	4 077	2 184	4 347	4 764	242	1 030	360	673
Energy	9 180	10 633	9 543	2 445	1 065	1 274	1 045	1 223	0	67	323	2 728	317	347	27	40	25	34
Construction				21				12						1				0
Trade & Services	7 871	6 076	6 255	5 125	7 521	7 105	7 126	7 550	0	2	831	691	706	651	230	238	239	212
Administration		3 299	4 299	6 641		2 165	2 659	4 747		0		554	619	960		156	173	258
Not allocated				2 863				4 603						281				237
Sewage/waste				84 213				70 836						41 135				3 883
Total production	**67 132**	**69 235**	**58 322**	**146 732**	**107 293**	**109 340**	**96 271**	**183 228**	**1 231**	**1 210**	**14 954**	**14 990**	**13 602**	**1 526 864**	**3 697**	**3 717**	**2 810**	**58 663**
TOTAL				**200 797**				**221 750**						**1 535 650**				**61 069**

Source: Environmental accounts in France – NAMEA pilot study for France Phase III – IFEN, October 2000 using Loire-Bretagne Water Agency data

Due to the detailed geographical level of the data utilised (NUTS 3), a mapping of the discharges was undertaken. For each of the pollutants followed, maps such as the one shown below could be drawn.

Map 3.3-1 France: Location, level and origin of nitrogen discharges in Loire-Bretagne

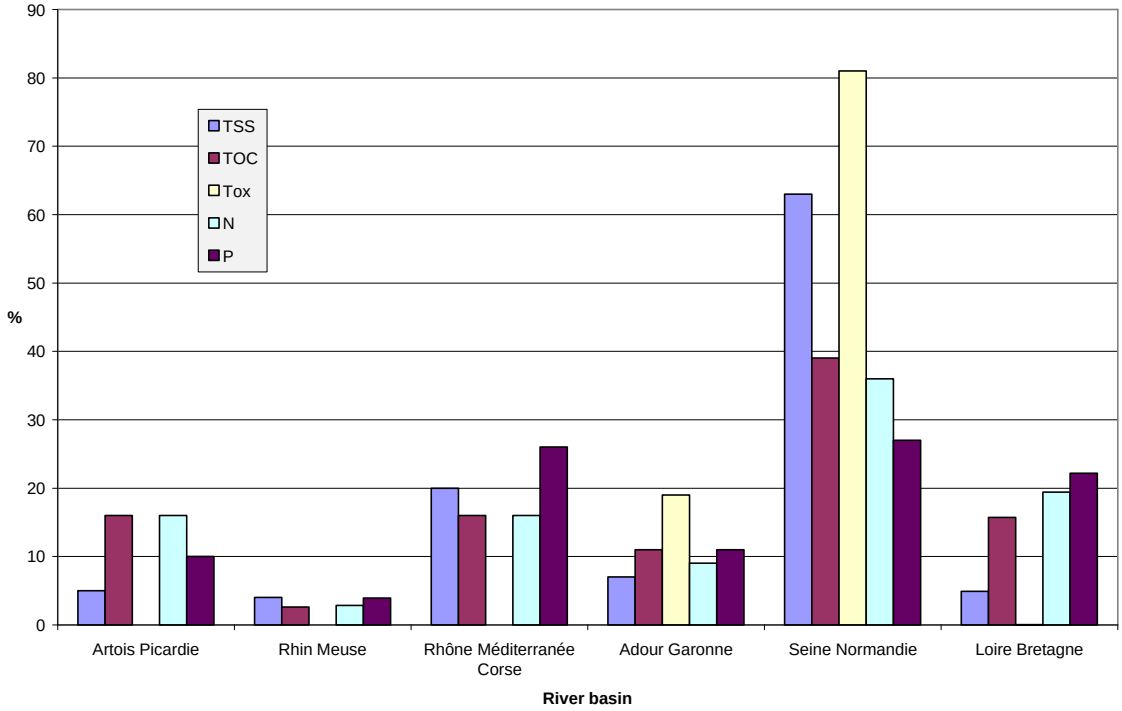


Source: Presentation of Ifen results – RBDE meeting, 14 march 2001

The locations of the main discharges are easily identified by the background colour. The pie charts add information on the kind of source which pollutes most.

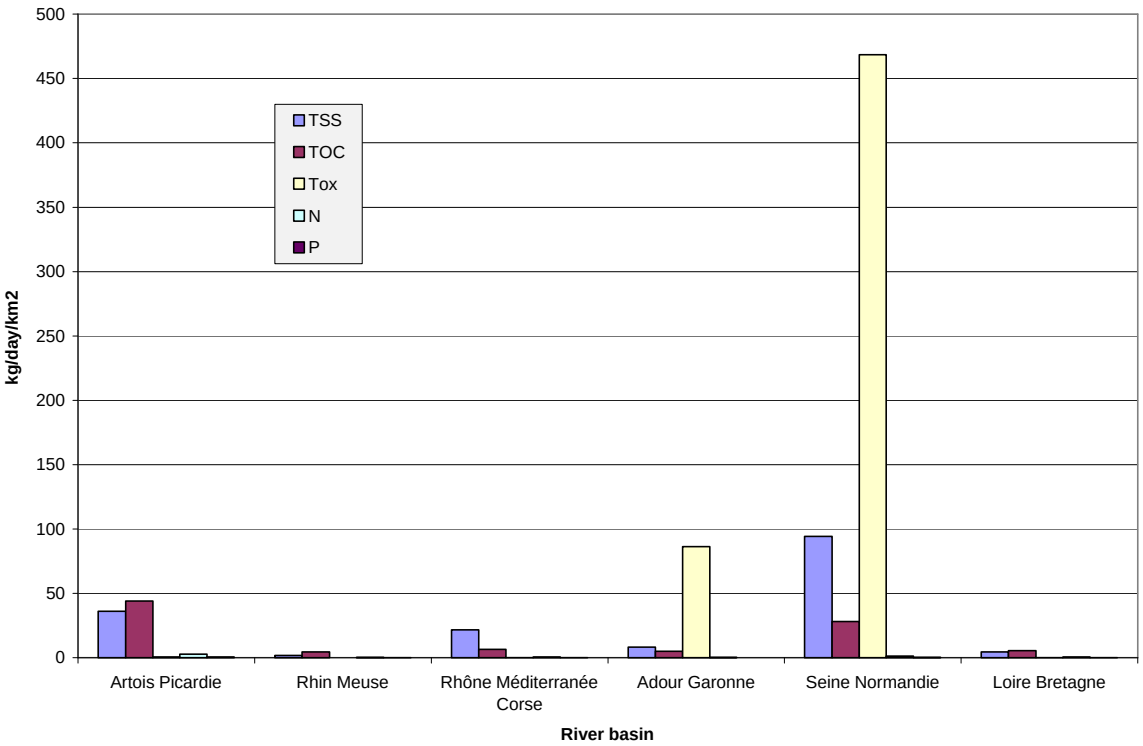
Other types of regional graphic analyses have been explored at the national level: breakdown of the discharges by river basins, comparison of emissions by river basin (see examples on the next page).

Figure 3.3-1 Share of each river basin in national emissions, France 1997



Source: Presentation of Ifen results – RBDE meeting, 14 March 2001

Figure 3.3-2 Emission by river basin weighted by the surface of the basin, France 1997



Note for this graph: Tox is expressed in kg equitox.

Source: Presentation of Ifen results – RBDE meeting, 14 March 2001

3.3.4 Ireland

Two tentative evaluations have been undertaken by Ireland, on the basis of (1) coefficients found in the literature applied to economic data, and (2) of the regional registers of licences to pollute granted to enterprises (complemented by other sources).

First evaluation (1994 data)

Table 3.3-9 Discharges to water, Ireland 1994

Sector	NACE – CLIO R25 code	BOD in tonnes	N in tonnes	P in tonnes	Other in tonnes
Agriculture. Forestry. fishing	01	10 000	148 500	3 445	136 464 (ammonia)
Chemical products	17	3 650	1 460	73	
Food. beverages. tobacco	36	17 340	1 825	438	
Textiles. clothes & footwear	42	180			
Total industry (direct discharge)		**21 170**	**3 285**	**511**	**To be estimated**
Transport	61/3/5				Metals. oil. salt
Municipal works	86	36 000	8 500	2 400	
Total services		**36 000**	**8 500**	**2 400**	
Residential *					
Total *accounted for* discharges**		**67 170**	**160 285**	**6 356**	

* Emissions by septic tanks could be: 24 455 tonnes BOD, 3 600 tonnes N and 0 tonnes P. These uncertain figures have not been accounted for.

** Supplementary discharges could emanate from private septic tanks (see above) and agriculture: maybe 650 000 tonnes BOD, 226 388 tonnes N and 1 tonne P more.

Source: Compilation of Satellite Environments Accounts – ESRI, September 1998

Second evaluation (1996 and 1998/1999 data)

The second evaluation, based on the submissions to OSPAR confirmed the importance of agriculture in the pollutants loads to water bodies. According to this source, agriculture is responsible for 80% of nitrogen and nearly 70% of phosphorus discharges.

A breakdown by region (three large river basins), by type of water bodies and by type of source (diffuse/point) was possible.

Table 3.3-10 Estimated net annual loads discharged to rivers and coastal waters, Ireland 1996, tonnes

		Nitrogen	Phosphorus	BOD
Diffuse Sources	**Agriculture**	**102 996**	**4 590**	**-**
	East	17 144	770	-
	South	33 226	1 402	-
	West	52 626	2 418	-
	Forestry	**407**	**25**	**-**
	East	72	4	-
	South	140	9	-
	West	195	12	-
	Background run-off	**5 364**	**358**	**-**
	East	779	52	-
	South	1 331	89	-
	West	3 254	217	-
	Rural/Residential	**3 105**	**310**	**2 858**
	East	577	58	531
	South	838	84	771
	West	1 689	169	1 555
Point Sources	**IPC Industry Direct**	**573**	**231**	**1 274**
	East	288	5	108
	South	167	210	802
	West	117	16	364
	Non-IPC Industry Direct	**1 483**	**422**	**5 624**
	East	54	24	396
	South	94	26	395
	West	1 335	373	4 833
	IPC Industry to Sewer	**1 173**	**277**	**3 248**
	East	321	101	896
	South	728	143	1 955
	West	124	33	397
	Non-IPC Industry to Sewer	**1 314**	**310**	**2 629**
	East	701	163	1 239
	South	202	52	650
	West	411	95	740
	Urban/Residential	**6 015**	**1 704**	**26 220**
	East	3 486	987	14 158
	South	1 315	380	6 793
	West	1 214	337	5 269
Total	**All diffuse + point sources**	**122 430**	**8 227**	**41 852**
	East	23 424	2 164	17 328
	South	38 043	2 393	11 366
	West	60 964	3 670	13 158

The estimates themselves relate to net nutrient loads reaching coastal waters and include factors for retention of nutrients where the river basin incorporates lakes.
Estimates of BOD discharges are to water's edge and no reference is made to the receiving medium. No estimates are made for diffuse sources of BOD discharges, except residential sources, as sufficient data were not available.

Source: Satellite Environmental Accounts for Ireland 1996 – ESRI, May 2000

Table 3.3-11 compares the two evaluations, which are in certain cases radically different.

Table 3.3-11 Comparison of sources, Ireland, loads in tonnes per year

	BOD			Nitrogen			Phosphorus		
	1994	1996	1998/99	1994	1996	1998/99	1994	1996	1998/99
Agriculture					102 996	102 996		4 590	4 590
Forestry					407	2 606		25	217
Peat lands	10 000 + 650 000			148 500 + 226 388			3 445 + 1		
Fresh aquaculture			791			116			74
Marine aquaculture			4 422			1 609			253
Industry total		12 775	9 664			3 616			1 021
Unsewered	21 170	6 898	2 784	3 285	2 056	1 133	511	653	406
Unsewered non IPC		5 624	1 054		1 483	404		422	109
Unsewered IPC		1 274	1 730		573	730		231	297
Sewered		5 877	6 880		2 487	2 486		587	615
Sewered non IPC		2 629	3 253		1 314	1 384		310	340
Sewered IPC		3 248	3 627		1 173	1 099		277	275
Urban residential incl. Commercial		26 220	40 958		6 015	7 255		1 704	2 088
Total sewered (industry + urban residential)	36 000	32 097	47 838	8 500	8 502	9 738	2 400	2 291	2 703
Rural households	24 455	2 858	1 429	3 600	3 105	2 980	0	310	310

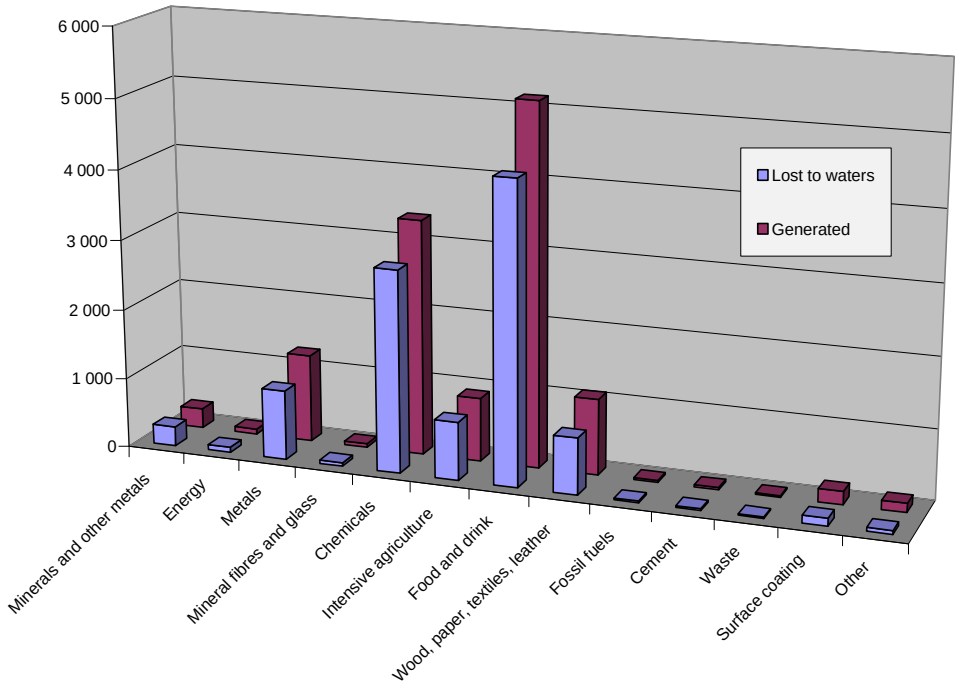
Source: Compilation of Satellite Environments Accounts – ESRI, September 1998. Satellite Environmental Accounts for Ireland 1996, ESRI, May 2000. Environmental accounts: time series + eco-taxes – ESRI, February 2001

The estimation work involved disaggregating the 'industry' category into NACE sectors, using the classification by industrial process.

Main economic indicators were put in front of the emissions of main pollutants in a NAMEA-type matrix.

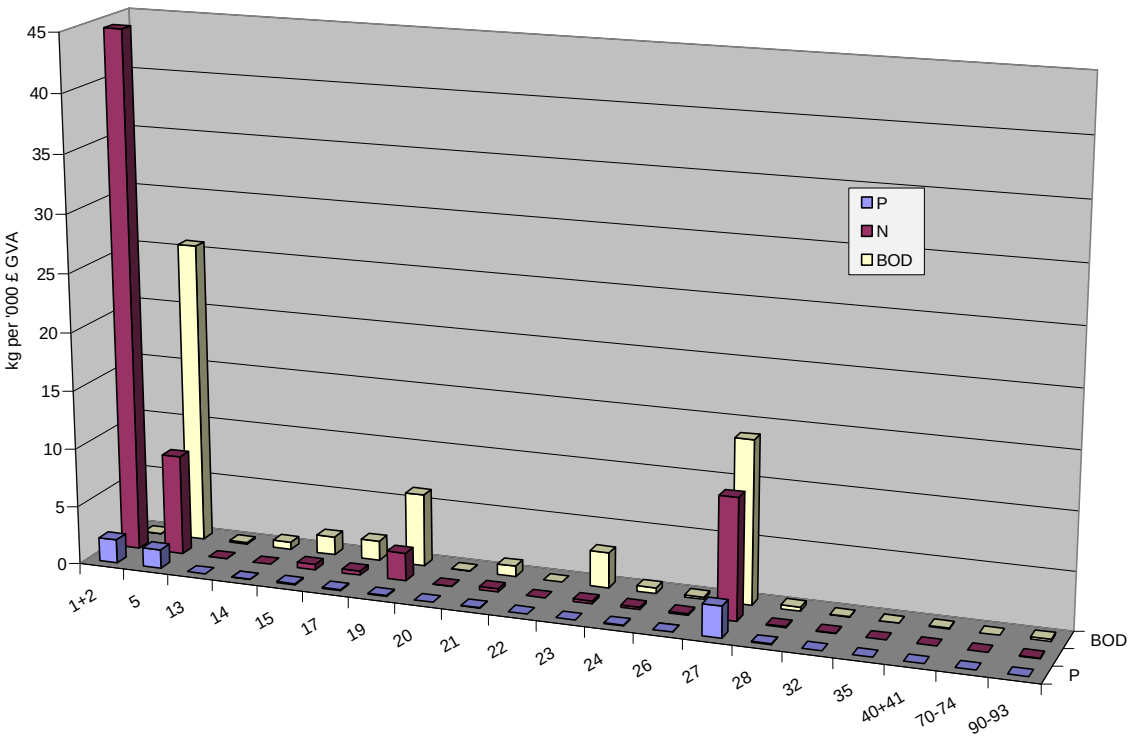
Ireland also built up analytical graphs, some of them being reproduced hereafter. Industrial branches are compared as regards their total pollution load of BOD in Figure 3.3-3 or as regards their pollution load in proportion to their economic importance measured in terms of gross value added (GVA) in Figure 3.3-4 or in terms of employment (not presented). The picture changes as the most BOD emitting industry is the food and drink industry, whereas per unit of GVA it is the fabrication of basic metals. (Note that agriculture is not present in Figure 3.3-3, as the source is restricted to industry).

Figure 3.3-3 Emissions of BOD by EPA sector, Ireland, 1998/99 data, tonnes/year



Source: Environmental accounts: time series + eco-taxes – ESRI, February 2001

Figure 3.3-4 Loads by NACE activity, Ireland, 1998/99 data, kg per 1000 IEP of GVA



Source: Environmental accounts: time series + eco-taxes – ESRI, February 2001

3.3.5 The Netherlands

The Netherlands produced quite a detailed emission account (11 pollutants x 21 industries). However, according to the pilot study, " …*due to incompleteness and limited reliability, the quality of emission figures on heavy metals is rather poor. The total domestic emission of heavy metals seems rather underestimated, at least for arsenic, but presumably also for other heavy metals: in the first instance, the total accumulation of arsenic in the Netherlands showed a negative result. As it is very unlikely that the total annual outflow of arsenic in the Netherlands is higher than its inflow, the emission from diffuse sources was grossed up*… "

In the more recent emission register publications, the coverage of heavy metals has been improved.

The table below " …*shows that a considerable amount of all heavy metals are emitted by diffuse, or indirect sources. By far the greatest amount, however, is 'imported' from abroad through the rivers, the Rhine, from Germany, and the Meuse, from France and Belgium* …"

It should be remarked that the Dutch version of the tables about flows of pollutants introduces 'activities' which have not been considered in the pilot tables:

- Water boards: this activity (part of general government) does not intervene in the emission topic, but has been kept here for reasons of consistency with the monetary account;
- Waste dumping sites: these are noticeably responsible for some emission to water of dangerous substances and are therefore shown separately.
- Rest of the World: this is clearly an addition towards a second step of the accounts: integration of state accounts. The Netherlands measures the concentration of pollutants in water bodies (rivers) at entry to national territory and at exit (open sea) and attributes the incoming and outgoing flows to the Rest of the World. This method also allows 'diffuse sources' to be estimated by difference.

Table 3.3-13 presents the Dutch equivalent of Eurostat's proposal concerning the table about pollutants subtracted by economic activities. The balance is broken down into Rest of the World (pollution exported) and 'Environmental themes' (pollution accumulated on the territory). The method of analysis of eutrophication potential and other environmental themes has been presented in section 1.2.

Table 3.3-12 Origin of water pollutants, The Netherlands 1991

ORIGIN OF SUBSTANCES	P	N	Organic pollution(1)	Heavy metals							
				Cadmium	Mercury	Arsenic	Chromium	Copper	Lead	Nickel	Zinc
	1 000 tonnes		*1 000 i.e.*	*kg*			*tonnes*				
EMISSION BY CONSUMERS											
Other consumption	13	67	15 068	1 327	665	2 981	27	135	75	24	323
EMISSION BY PRODUCERS											
Agriculture, hunting, forestry, fishing[1]	134	1 005	62	3 000	-	-	-	120	68	-	640
Mining and quarrying			6								
Manufacturing											
Food, beverages and tobacco industry	6	24	2 133	4	3	108	1	4	-	1	9
Textile, wearing apparel and leather industry	1	-	257	-	-	5	1	2	-	-	2
Wood and furniture industry	-	-	28	-	-	-	-	-	-	-	-
Paper, printing and publishing industry	1	4	283	4	4	-	-	1	-	-	1
Petroleum industry	-	-	-	-	-	-	-	-	1	-	2
Chemical industry	4	3	929	2 235	317	1 925	11	7	8	10	41
Rubber and plastic industry	-	-	5	2	-	-	-	-	-	-	-
Construction materials, earthenware and glass	-	-	12	4				-	-	-	-
Basic metal industry	-	1	117	124	33	72	1	-	1	-	6
Metal products and machinery industry	-	1	222	34	-	41	4	6	1	3	10
Other manufacturing	-	-	180								
Public utilities											
Electricity and gas	-	-	10	-	-	-	-	-	-	-	-
Water supply	-	-	22	-	-	-	-	-	-	-	-
Construction	-	-	209	-	-	-	-	-	-	-	-
Transport and storage	-	-	170	-	-	-	-	-	-	-	-
Environmental cleansing and sanitary services	19	53	5 010	847	316	2176	17	61	43	27	147
Water boards	-	-	-	-	-	-	-	-	-	-	-
Other services	7	7	3 545								
OTHER DOMESTIC ORIGIN											
Waste dumping sites	.	.	.	17	1	32	.	.	.	.	.
Diffuse sources	-	-	5 520	748	374	19669	14	75	42	14	181
FROM THE REST OF THE WORLD	19	315	.	14 600	4 980	9 2433	294	474	325	282	2 300
TOTAL	204	1 480	33 788	22 946	6 693	11 9442	368	884	564	360	3 662

(1) The organic pollution is quantified as the number of inhabitant equivalents (i.e.), where one i.e. equals 54 grams of Biological Oxygen Demand (BOD).

Source: Water accounts in the Dutch NAMEA: a 'NAMWA' for 1991 – CBS, May 1997

Table 3.3-13 Destination of water pollutants, The Netherlands 1991

DESTINATION OF SUBSTANCES	P	N	Organic pollution(1)	Heavy metals							
				Cadmium	Mercury	Arsenic	Chromium	Copper	Lead	Nickel	Zinc
	1 000 tonnes		*1 000 i.e.*	*kg*			*tonnes*				
ABSORPTION BY PRODUCERS											
Environmental cleansing and sanitary services	22	106	26521	2000	1000	4400	42	203	109	39	482
TO THE REST OF THE WORLD	18	314	847	6632	2572	115042	225	326	185	254	873
CONTRIBUTION TO ENVIRONMENTAL THEMES											
Eutrophication	164	1060									
Wastewater			6420								
Dispersion of heavy metals				14314	3121	-	101	355	270	67	2307
TOTAL	204	1480	33788	22946	6693	119442	368	884	564	360	3662

(1) The organic pollution is quantified as the number of inhabitant equivalents (i.e.), where one i.e. equals 54 grams of Biological Oxygen Demand (BOD).

Source: Water accounts in the Dutch NAMEA: a 'NAMWA' for 1991 – CBS, May 1997

3.3.6 Austria

The results of the pilot study carried out in Austria show, industry by industry, at NACE-2 digits level[50] the diverse emissions for 14 pollutants (tables on following pages). The emission data are complemented by the main corresponding economic indicators (added value, output and number of employees) to build a NAMEA.

This high level of detail should however be reconsidered in the light of the methodology: the same emission coefficient (per employee) has been applied to the majority of services activities.

On this basis, a graphic summary is made by pollutant: graphs show the industries mainly responsible for the emission of a particular pollutant (see examples on following pages). The main results displayed are:

- About 75 % of the COD and 65 % of the BOD_5 emissions originate from households and the manufacture of pulp, paper and paper products.
- Roughly 90 % of nitrogen and ammonium-nitrogen emissions come from agriculture, forestry and private households.
- 90 % of the phosphorus emissions are caused by agriculture, households, manufacture of basic metals and forestry – with the latter two contributing only 7 % each to the total emissions.
- AOX emissions are mostly caused by the pulp and paper industry and the chemical industry, whilst households are responsible for 12 %.
- Heavy metal emissions originate from several branches. 72 % of the total copper emissions stem from households, partly due to human excretion.

Contrary to some other countries which recorded emissions at the step of discharge to the water bodies, Austria recorded emissions at the point of the *original* source industries or households. As explained in section 2.3.4, part of these 'gross' emissions (namely the discharges to the sewage network) are later treated by the sewage treatment plants before final discharge to the water bodies. In the Austrian presentation, sewage treatment plants do not emit pollutants, except for any (very low) emissions due to their own activity. The emissions by NACE 90 that are shown are the emissions by other units, e.g. by waste treatment units. In some case, the 'gross' emissions had to be estimated by applying a coefficient to net emissions.

In interpreting the following tables and figures, attention should be paid to the non-comparability of the results with countries which record net emissions.

According to the authors, the quality of the results depends upon the reliability of the data provided by the individual plants and on the degree of representativeness of responding plants in their industrial activity. For a number of industries, emissions should be viewed as rough estimates only.

Another problem has been the poor coverage of heavy metals, especially mercury, chromium and nickel. Only rough estimates were possible in a few cases. Moreover, for many substances, including a large number of the hazardous substances listed in EC Directive 76/464/EEC, almost no information was available.

Finally, and this is not specific to the Austrian methodology, it was remarked that the emissions are allocated to the *producing industry* and this raises the question of responsibility: for example, emissions from paper production are exclusively attributed to the pulp and paper industry and not to large paper consumers such as publishing or public administration.

[50] A 3-digit level is also available for some food, beverages and tobacco manufacturing industries.

Table 3.3-14 Austrian water NAMEA for 1994

Share in GDP	Gross production	Employees	NACE code	Description	Wastewater discharged	COD	BOD_5	TOC	N	NH_4-N	P	AOX
Mio ATS current prices					m^3/a	t/a	t/a	t/a	t/a	t/a	t/a	kg/a
50 446	77 526	179 368	01	Agriculture, hunting and related service activities	2 391 573	215	60	81	36 800	23 673	1 345	64.6
included in 01			02	Forestry, logging and related service activities	included in 01				9 882	6 357	198	
included in 01			05	Fishing, fish hatcheries and fish farms; incidental services	365 000 000		500	250	100	64	10	
655	1 208	955	10	Mining of coal and lignite; extraction of peat	6 242	1	0	0	0	0	0	0.2
3 077	11 419	2 370	11	Extraction of crude petroleum and natural gas; incidental services	31 600	3	0	1	1	0	0	0.9
not applicable			12	Mining of uranium and thorium ores	not applicable							
194	310	412	13	Mining of metal ores	3 840	0	0	0	0	0	0	0.1
4 332	8 145	4 742	14	Other mining and quarrying	4 976 967	1	0	0	0	0	0	0.3
55 458	173 634	94 254	15	Manufacture of food products and beverages	28 428 628	5 893	2 027	1 964	367	236	60	1 229.5
15 064	17 760	1 245	16	Manufacture of tobacco products	not publishable							
15 598	38 069	31 820	17	Manufacture of textiles	7 737 846	1 391	281	558	116	75	8	494.8
5 669	12 936	20 843	18	Manufacture of wearing apparel; dressing and dyeing of fur	573 996	82	14	31	1	0	1	4.4
3 193	9 404	9 176	19	Leather; manufacture of luggage, handbags, saddlery and footwear	1 235 224	408	18	147	144	3	1	229.2
23 475	60 428	53 584	20	Manufacture of wood, products of wood, cork, straw, etc.	5 168 229	427	164	160	12	12	0	63.9
15 739	47 023	19 118	21	Manufacture of pulp, paper and paper products	134 372 111	37 013	6 469	13 863	41	24	19	68 200.0
19 654	44 481	30 361	22	Publishing, printing and reproduction of recorded media	404 813	36	6	14	7	4	1	10.9
17 258	39 516	3 307	23	Manufacture of coke, refined petroleum products and nuclear fuel	8 519 130	285	47	107	12	12	4	212.9
30 772	81 562	36 947	24	Manufacture of chemicals and chemical products	68 940 040	5 970	572	860	2 300	1 480	0	60 000.0
13 508	29 563	22 459	25	Manufacture of rubber and plastic products	299 453	27	4	10	5	3	1	8.1
32 143	69 363	40 416	26	Manufacture of other non-metallic mineral products	7 378 681	331	125	124	24	22	9	1 119.3
22 725	69 344	35 070	27	Manufacture of basic metals	228 443 250	4 051	1 407	1 071	818	526	222	161.9
36 991	78 555	67 122	28	Manufacture of fabricated metals, except machinery and equipment	2 311 809	124	47	47	26	23	1	263.2
51 239	120 861	82 188	29	Manufacture of machinery and equipment n.e.c.	695 892	37	10	14	6	4	1	174.3
56	109	185	30	Manufacture of office machinery and computers	15 333	1	0	1	0	0	0	0.4
29 289	61 676	45 109	31	Manufacture of electrical machinery and apparatus n.e.c.	1 426 416	42	10	14	12	8	1	34.4
16 828	46 146	23 405	32	Manufacture of radio, TV and communication equipment	3 275 339	234	102	74	28	17	2	92.5
8 559	15 882	17 438	33	Manufacture of medical, precision, optical instruments, watches, etc.	84 721	6	1	2	1	0	0	2.4
19 556	59 568	24 466	34	Manufacture of motor vehicles, trailers and semi-trailers	549 664	28	6	12	5	3	1	12.6
2 965	6 431	5 130	35	Manufacture of other transport equipment	68 400	6	1	2	1	1	0	1.8
19 866	41 950	46 109	36	Manufacture of furniture; manufacturing n.e.c.	185 912	15	4	6	3	2	0	46.1
included in other activities			37	Recycling	included in other activities							
56 520	120 905	33 874	40	Electricity, gas, steam and hot water supply	451 653	41	7	15	13	10	1	12.2
3 697	5 772	2 521	41	Collection, purification and distribution of water	74 173	4	1	2	1	0	0	0.9

Table continued overleaf

Austrian water NAMEA for 1994 (continued)

Share in GDP	Gross production	Employees	NACE code	Description	Wastewater discharged	COD	BOD_5	TOC	N	NH_4-N	P	AOX
Mio ATS current prices					m^3/a	t/a	t/a	t/a	t/a	t/a	t/a	kg/a
165 295	309 334	301 444	45	Construction	4 019 253	362	60	136	66	43	8	108.5
46 756	74 096	81 776	50	Sale and repair of motor vehicles and motorcycles; retail sale of fuel	1 090 347	98	16	37	18	12	2	29.4
146 676	218 284	189 081	51	Wholesale trade and commission trade	2 521 080	227	38	85	42	27	5	68.1
93 700	135 394	255 690	52	Retail trade; repair of personal and household goods	3 409 200	307	51	115	56	36	6	92.0
90 498	155 712	196 171	55	Hotels and restaurants	25 202 835	2 268	378	851	416	268	47	907.3
62 214	97 683	145 078	60	Land transport; transport via pipelines	1 934 373	174	29	65	32	21	4	52.2
621	2 170	1 264	61	Water transport	93 503	8	1	3	2	1	0	2.5
6 477	17 768	4 007	62	Air transport	53 427	5	1	2	1	1	0	1.4
22 798	124 673	26 743	63	Supporting and auxiliary transport activities; travel agencies	356 573	32	5	12	6	4	1	9.6
54 912	62 506	53 711	64	Post and telecommunications	716 147	64	11	24	12	8	1	19.3
113 914	145 901	78 746	65	Financial intermediation, except insurance and pension funding	1 049 947	94	16	35	17	11	2	28.3
42 282	57 969	34 145	66	Insurance and pension funding, except compulsory social security	455 267	41	7	15	8	5	1	12.3
4 345	6 152	4 131	67	Activities auxiliary to financial intermediation	55 080	5	1	2	1	1	0	1.5
163 067	229 829	46 872	70	Real estate activities	624 960	56	9	21	10	7	1	16.9
14 091	18 243	4 684	71	Renting of equipment without operator and of personal goods	62 453	6	1	2	1	1	0	1.7
8 252	13 037	7 655	72	Computer and related activities	102 067	9	2	3	2	1	0	2.8
798	1 790	3 928	73	Research and development	52 373	5	1	2	1	1	0	1.4
82 755	129 026	96 519	74	Other business activities	1 286 920	116	19	43	21	14	2	34.7
No data available			75	Public administration and defence; compulsory social security	mostly included in ‘public services’							
3 089	3 993	8 820	80	Education	117 600	11	2	4	2	1	0	3.2
41 779	51 187	59 580	85	Health and social work	794 400	71	12	27	13	8	1	21.4
12 778	20 235	7 002	90	Sewage and refuse disposal, sanitation and similar activities	2 030 346	6 108	1 432	2 288	429	276	2	9 836.6
No data available			91	Activities of membership organizations n.e.c.	No data available							
30 105	44 680	32 894	92	Recreational, cultural and sporting activities	438 587	39	7	15	7	5	1	11.8
11 799	16 980	64 577	93	Other service activities	802 477	86	12	17	1	1	0	63.6
4 813	4 813	4 738	95	Private households with employed persons	63 173	6	1	2	1	1	0	1.7
			99	Extra-territorial organizations and bodies	60 147	5	1	2	1	1	0	1.6
				Households[1)]	538 843 018	48 496	8 083	18 186	8 891	5 719	1 010	19 398.3
303 574	520 374	611 883		Public services	8 158 440	734	122	275	135	87	15	220.3
45 520	70 684	119 720		Non-profit private services	included in ‘public services’							
2 147 434	**3 882 059**	**3 374 853**		**Total**	**1 467 444 929**	**116 109**	**22 201**	**41 700**	**60 915**	**39 115**	**2 996**	**163 391**

Table continued overleaf

Austrian water NAMEA for 1994 (continued)

Share in GDP	Gross production	Employees	NACE code	Description	Wastewater discharged	Zn	Cu	Cd	Pb	Cr	Ni	Hg
Mio ATS current prices					m³/a	kg/a	kg/a	kg/a	kg/a	kg/a	kg/a	kg/a
50 446	77 526	179 368	01	Agriculture, hunting and related service activities	2 391 573	70.2	73.5	1.0	2.3	0.0	0.0	0.0
included in 01			02	Forestry, logging and related service activities	included in 01							
included in 01			05	Fishing, fish hatcheries and fish farms; incidental services	365 000 000	included in 01						
655	1 208	955	10	Mining of coal and lignite; extraction of peat	6 242	0.2	0.2	0.0	0.0	0.0	0.0	0.0
3 077	11 419	2 370	11	Extraction of crude petroleum and natural gas; incidental services	31 600	0.3	0.1	0.0	0.0	0.0	0.0	0.0
not applicable			12	Mining of uranium and thorium ores	not applicable							
194	310	412	13	Mining of metal ores	3 840	0.1	0.1	0.0	0.0	0.0	0.0	0.0
4 332	8 145	4 742	14	Other mining and quarrying	4 976 967	0.4	0.4	0.0	0.0	0.0	0.0	0.0
55 458	173 634	94 254	15	Manufacture of food products and beverages	28 428 628	279.0	299.0	1.0	1.8	16.0	57.2	0.1
15 064	17 760	1 245	16	Manufacture of tobacco products	not publishable							
15 598	38 069	31 820	17	Manufacture of textiles	7 737 846	562.8	432.3	102.8	158.1	599.7	137.3	0.0
5 669	12 936	20 843	18	Manufacture of wearing apparel; dressing and dyeing of fur	573 996	26.9	42.2	0.4	0.7	5.2	17.1	0.0
3 193	9 404	9 176	19	Leather; manufacture of luggage, handbags, saddlery and footwear	1 235 224	1.5	2.4	0.9	0.6	494.8	4.0	0.0
23 475	60 428	53 584	20	Manufacture of wood, products of wood, cork, straw, etc.	5 168 229	3.0	2.0	0.3	0.4	0.0	0.2	0.0
15 739	47 023	19 118	21	Manufacture of pulp, paper and paper products	134 372 111	40.3	28.9	41.7	0.2	0.0	88.2	0.0
19 654	44 481	30 361	22	Publishing, printing and reproduction of recorded media	404 813	4.2	1.8	0.0	0.1	0.0	0.0	0.0
17 258	39 516	3 307	23	Manufacture of coke, refined petroleum products and nuclear fuel	8 519 130	0.7	1 062.2	0.0	1 061.5	0.0	1 061.5	40.4
30 772	81 562	36 947	24	Manufacture of chemicals and chemical products	68 940 040	2 552.7	138.2	24.0	35.0	15.7	217.2	33.0
13 508	29 563	22 459	25	Manufacture of rubber and plastic products	299 453	3.1	1.3	0.0	0.1	0.0	0.0	0.0
32 143	69 363	40 416	26	Manufacture of other non-metallic mineral products	7 378 681	3 976.2	233.5	206.7	4 505.7	1 098.5	231.4	0.0
22 725	69 344	35 070	27	Manufacture of basic metals	228 443 250	14 229.3	441.5	18.8	2 477.2	1 228.7	1 353.4	2.6
36 991	78 555	67 122	28	Manufacture of fabricated metals, except machinery and equipment	2 311 809	319.8	211.2	8.3	22.1	120.4	422.5	0.2
51 239	120 861	82 188	29	Manufacture of machinery and equipment n.e.c.	695 892	57.2	29.0	9.5	36.4	45.4	63.9	0.7
56	109	185	30	Manufacture of office machinery and computers	15 333	0.2	0.1	0.0	0.0	0.0	0.0	0.0
29 289	61 676	45 109	31	Manufacture of electrical machinery and apparatus n.e.c.	1 426 416	286.4	1 180.8	2.8	82.5	43.6	59.6	0.1
16 828	46 146	23 405	32	Manufacture of radio, tv and communication equipment	3 275 339	259.4	1 048.4	4.7	110.6	9.5	124.2	0.3
8 559	15 882	17 438	33	Manufacture of medical, precision, optical instruments, watches, etc.	84 721	1.9	15.7	0.1	1.0	0.8	1.0	0.0
19 556	59 568	24 466	34	Manufacture of motor vehicles, trailers and semi-trailers	549 664	38.7	35.5	1.6	5.5	8.4	125.3	0.0
2 965	6 431	5 130	35	Manufacture of other transport equipment	68 400	0.7	0.3	0.0	0.0	0.0	0.0	0.0
19 866	41 950	46 109	36	Manufacture of furniture; manufacturing n.e.c.	185 912	40.4	25.2	4.6	22.5	2.8	103.6	0.4
included in other activities			37	Recycling	included in other activities							
56 520	120 905	33 874	40	Electricity, gas, steam and hot water supply	451 653	4.7	2.0	0.0	0.1	0.0	0.0	0.0
3 697	5 772	2 521	41	Collection, purification and distribution of water	74 173	0.3	0.1	0.0	0.0	0.0	0.0	0.0

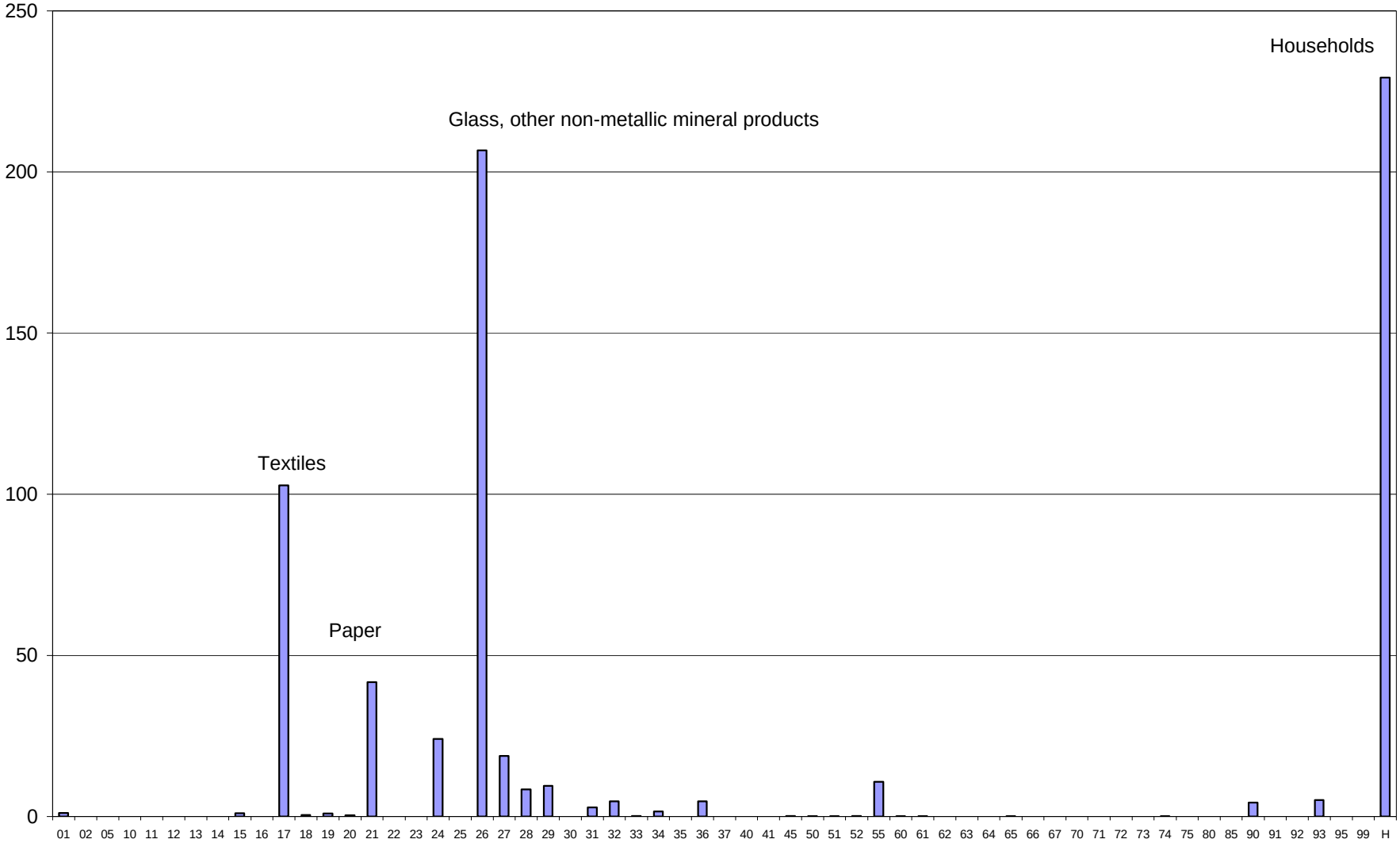
Table continued overleaf

Austrian water NAMEA for 1994 (end)

Share in GDP	Gross production	Employees	NACE code	Description	Wastewater discharged	Zn	Cu	Cd	Pb	Cr	Ni	Hg
Mio ATS current prices					m^3/a	kg/a	kg/a	kg/a	kg/a	kg/a	kg/a	kg/a
165 295	309 334	301 444	45	Construction	4 019 253	41.4	17.6	0.2	1.2	0.0	0.0	0.0
46 756	74 096	81 776	50	Sale and repair of motor vehicles and motorcycles; retail sale of fuel	1 090 347	11.2	4.8	0.0	0.3	0.0	0.0	0.0
146 676	218 284	189 081	51	Wholesale trade and commission trade	2 521 080	26.0	11.1	0.1	0.7	0.0	0.0	0.0
93 700	135 394	255 690	52	Retail trade; repair of personal and household goods	3 409 200	35.1	15.0	0.1	1.0	0.0	0.0	0.0
90 498	155 712	196 171	55	Hotels and restaurants	25 202 835	740.2	774.4	10.7	23.8	0.0	0.0	0.0
62 214	97 683	145 078	60	Land transport; transport via pipelines	1 934 373	19.9	8.5	0.1	0.6	0.0	0.0	0.0
621	2 170	1 264	61	Water transport	93 503	2.7	2.9	0.0	0.1	0.0	0.0	0.0
6 477	17 768	4 007	62	Air transport	53 427	1.6	1.6	0.0	0.1	0.0	0.0	0.0
22 798	124 673	26 743	63	Supporting and auxiliary transport activities; travel agencies	356 573	3.7	1.6	0.0	0.1	0.0	0.0	0.0
54 912	62 506	53 711	64	Post and telecommunications	716 147	7.4	3.1	0.0	0.2	0.0	0.0	0.0
113 914	145 901	78 746	65	Financial intermediation, except insurance and pension funding	1 049 947	10.8	4.6	0.0	0.3	0.0	0.0	0.0
42 282	57 969	34 145	66	Insurance and pension funding, except compulsory social security	455 267	4.7	2.0	0.0	0.1	0.0	0.0	0.0
4 345	6 152	4 131	67	Activities auxiliary to financial intermediation	55 080	0.6	0.2	0.0	0.0	0.0	0.0	0.0
163 067	229 829	46 872	70	Real estate activities	624 960	6.4	2.7	0.0	0.2	0.0	0.0	0.0
14 091	18 243	4 684	71	Renting of equipment without operator and of personal goods	62 453	0.6	0.3	0.0	0.0	0.0	0.0	0.0
8 252	13 037	7 655	72	Computer and related activities	102 067	1.1	0.4	0.0	0.0	0.0	0.0	0.0
798	1 790	3 928	73	Research and development	52 373	0.5	0.2	0.0	0.0	0.0	0.0	0.0
82 755	129 026	96 519	74	Other business activities	1 286 920	13.3	5.6	0.1	0.4	0.0	0.0	0.0
No data available			75	Public administration and defence; compulsory social security	mostly included in 'public services'							
3 089	3 993	8 820	80	Education	117 600	1.2	0.5	0.0	0.0	0.0	0.0	0.0
41 779	51 187	59 580	85	Health and social work	794 400	8.2	3.5	0.0	0.2	0.0	0.0	0.0
12 778	20 235	7 002	90	Sewage and refuse disposal, sanitation and similar activities	2 030 346	1 614.4	55.8	4.3	22.0	2.2	264.1	1.9
No data available			91	Activities of membership organizations n.e.c.	No data available							
30 105	44 680	32 894	92	Recreational, cultural and sporting activities	438 587	4.5	1.9	0.0	0.1	0.0	0.0	0.0
11 799	16 980	64 577	93	Other service activities	802 477	119.0	104.7	5.1	1.0	0.6	1.2	0.0
4 813	4 813	4 738	95	Private households with employed persons	63 173	0.7	0.3	0.0	0.0	0.0	0.0	0.0
			99	Extra-territorial organizations and bodies	60 147	0.6	0.3	0.0	0.0	0.0	0.0	0.0
				Households	538 843 018	15 824.7	16 556.5	229.3	509.7	0.0	0.0	0.0
303 574	520 374	611 883		Public services	8 158 440	84.0	35.8	0.4	2.4	0.0	0.0	0.0
45 520	70 684	119 720		Non-profit private services	included in 'public services'							
2 147 434	3 882 059	3 374 853		**Total**	1 467 444 929	41 345	22 924	680	9 089	3 692	4 333	80

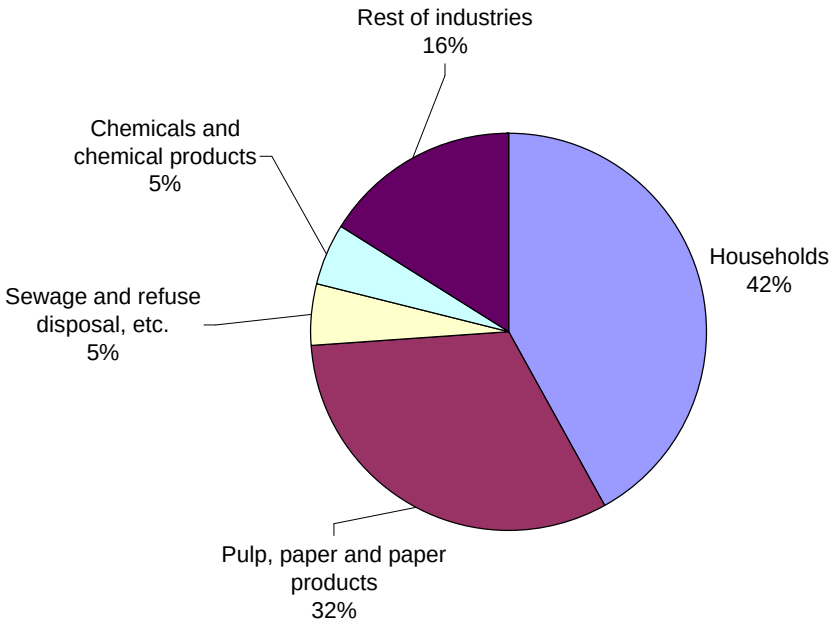
Source: NAMEA – Wasser – ÖSTAT – November 1998

Figure 3.3-5 Annual emission of cadmium by economic activity, Austria mid 90s, kg



Source: NAMEA – Wasser – ÖSTAT – November 1998

Figure 3.3-6 Austria: share of the different economic activities in annual emissions of COD



Source: NAMEA – Wasser – ÖSTAT – November 1998

3.3.7 Portugal

Portugal could only follow the pollutant content of the water flows in the public sewage system (about 64% of the population enjoy such a system). The pollutant content was measured first in the flow collected by the sewage system operators (pollutants discharged by economic activities into the sewers, but not broken down by industry), and secondly in the flow discharged by the operators into the water bodies.

Table 3.3-15 Pollutants content of wastewater at different steps of processing, tonnes per year

	Biological Oxygen Demand (BOD)	Chemical Oxygen Demand (COD)	Total suspended solids	Phosphorus (Total)
1- Pollutants content of flows discharged to the public sewage system	132 800	265 600	199 168	6 656
2- Pollutants subtracted by the public sewage system	61 300	122 700	108 600	200
3- Pollutants content of flows discharged to the water bodies by the public sewage system	71 500	142 900	90 568	6 456

Source: Source: Water accounts project 1998 – Final report to Eurostat – June 2002

3.3.8 Finland

The results supplied by Finland gave much detail in terms of activities, but only 3 types of pollutants were reviewed. BOD pollution is expressed in inhabitant equivalent.

Table 3.3-16 Discharges of wastewater, nitrogen and phosphorus, Finland 1995

		P	N	Wastewater
		1 000 tonnes		1 000 i.e.
CONSUMPTION				
	Private	2.63	15.19	1 426 126
	Public			
PRODUCTION				
1	Agriculture	3.24	31.88	37 037
2	Forestry and logging	0.20	1.20	1 111
05+015	Fishing and hunting	0.15	1.18	1 296
10	Mining of coal and lignite; extraction of peat	0.02	0.15	430
13	Mining of metal ores	0.00	0.01	593
14	Other mining and quarrying	0.03	0.95	1 450
15	Manufacture of food products	0.01	0.06	5 185
159/16	Manufacture of beverages and tobacco products	0.01	0.04	4 645
17	Manufacture of textiles	0.00	0.00	56
18	Manufacture of wearing apparel	0.00	0.00	0
19	Manufacture of leather and leather products	0.00	0.02	593
20	Manufacture of wood and wood products	0.00	0.02	3 645
21	Manufacture of pulp. paper and paper products	0.32	3.16	56
22	Publishing. printing	0.11	0.63	593
23	Manufacture of coke. refined petroleum products and nuclear fuel	0.00	0.11	22 315
241	Manufacture of chemicals	0.01	0.13	454 120
242/47	Manufacture of chemical products	0.01	0.03	95 454
25	Manufacture of rubber and plastic products	0.01	0.22	62 278
261	Manufacture of glass and glass products	0.01	0.06	698
262/68	Other manufacture of non-metallic mineral products	0.04	0.20	1815
27	Manufacture of basic metals	0.00	0.42	19
28	Manufacture of fabricated metal products	0.00	0.05	1 296
29	Manufacture of machinery and equipment n.e.c.	0.22	1.23	122 385
30	Manufacture of electrical and optical equipment	0.02	0.14	14 390
31	Manufacture of electrical machinery and apparatus	0.05	0.30	30 087
32	Manufacture of radio. television and communications equipment and apparatus	0.11	0.74	73 256
33	Manufacture of medical. precision and optical instruments. watches and clocks	0.02	0.15	14 390
34	Manufacture of motor vehicles. trailers and semi-trailers	0.02	0.12	11 950
35	Manufacture of other transport equipment	0.06	0.35	34 195
36	Manufacturing of furniture; manufacturing n.e.c.	0.05	0.23	23 016
37	Recycling	..	..	..
40	Electricity. gas and steam	0.00	0.02	222
41	Water supply	0.00	0.02	1 963
45	Construction. civil engineering	0.02	0.11	4 009
50/52	Wholesale and retail trade	0.18	1.01	100 252
55	Hotels and restaurants	0.04	0.25	25 027
60	Land transport	0.01	0.05	5 279
61	Water transport	0.00	0.01	1 473
62	Air transport	0.00	0.01	1 228
63	Supporting and auxiliary transport activities	0.01	0.04	4 419
64	Post and telecommunications	0.01	0.06	5 732
65/67	Financial intermediation	0.02	0.11	10 876
70/74	Real estate. renting and business activities	0.04	0.22	21 536
75	Public administration	0.04	0.23	22 399
80	Education services	0.06	0.34	33 598
85	Health and social work services	0.23	1.32	130 659
90/99	Other community. social and personal services	0.07	0.37	37 040
TOTAL		8.08	63.14	2 850 191

Source: Finnish NAMEA 1985-1995 – Statistics Finland, November 1999

Some information was also given on the absorption of pollutants by economic activities: for 'communities' connected to public wastewater networks and treatment plants (households, small industry and services), the reduction in phosphorus emissions in 1995 was 84 %, in nitrogen 29 % and in BOD 85 %.

3.3.9 Sweden

The two kinds of discharge (into the sewage network, and to water bodies) have been put in one table, since a breakdown by industry of the discharge of pollutants into the sewage network has not been possible. The pollutant content is only known for the discharge to water bodies.

Information on cooling water and whether the water is discharged to inland waters or to the sea is also available from the pilot work (see Table 3.2-8 in section 3.2.7 above). Urban run-offs join the sewage network and have been estimated.

Relatively small amounts of wastewater from the manufacturing industry are treated by the MWWTPs. The dominating industry in this respect is the food industry, whose wastewater may contain quite large amounts of organic matter (BOD_7). For industry in general, the volumes of direct discharges are much larger than the discharges into the sewage network.

Two original presentations in the Swedish table may be underlined:

- A row for mining leakage has been included, although not taken into account in the total. This data refers to expert assessments of the leakage from mining deposits in northern Sweden.
- Pollution by households not connected to the sewage network has apparently also been attributed to 'real estate' activity.

Table 3.3-17 Pollutants discharged to sewage network and water bodies by economic activities, Sweden 1995, tonnes

NACE code	Description	Wastewater discharged to sewage system	Wastewater discharged to water bodies	COD_{Cr}	BOD_7	N	P	As	Hg	Cd	Pb	Cu	Zn	Cr	Ni
01	Agriculture														
02	Forestry														
10/14	Mining and quarrying	1 157	45 306								1	1	14		
	Mining and quarrying, leakage							*0*	*0*	*0,7*	*2,8*	*21*	*357*	*0*	*0*
15/16	Food products, beverages, tobacco	25 154	43 178												
17/19	Textiles, textile products, leather	3 080	8 337												
20	Wood, products of wood, cork, straw, etc.	1 327	16 068												
21	Pulp, paper and paper products	7 682	873 006	328 922	95 803	3 844	419			1	3	8	89	4	5
22	Publishing, printing and reproduction of recorded media	2 282	62												
23	Coke, refined petroleum products and nuclear fuel	357	10	1 000		100									
24	Chemicals and chemical products	5 352	488 792	10 000		800							49		
25	Rubber and plastic products	1 193	16 391												
26	Non-metallic mineral products	2 617	8 197												
27	Basic metals	3 972	355 181	400		1 500		1			3	3	9	3	2
28	Fabricated metals, except machinery and equipment	4 379	11 749												
29	Machinery and equipment n.e.c.	5 615	19 666												
30	Office machinery and computers	381	61												
31/32	Electrical machinery, radio, TV, communication	4 136	4 225												
33	Medical, precision, optical instruments, watches, etc.	1 023	165												
34/35	Motor vehicles and other transport equipment	7 644	8 687												
36/37	Other manufacturing	623	266												
	Not possible to disaggregate by sector	727	5 517												
40	Electricity, gas, steam and hot water supply	725	116 888												
41	Collection, purification and distribution of water	132 972	47 624												
45	Construction														
50/52	Wholesale and retail trade														
55	Hotels and restaurants														
60/64	Transport, storage and communication														
62	Financial intermediation	86 522													
71/74	Renting and business activities														
80/99	Other, excluding 90.01														
90.01	Sewage disposal		1 360 000	66 840	13 060	25 940	470		1		2	17	52	3	8
75	Public administration														
70	Real estate	527 975	88 449												
	Unspecified use	38 269													
Urban run-off		494 836													
TOTAL		1 360 000	3 517 825	407 162	108 863	32 184	889	1	1	1	10	29	219	11	15

Source: Water Accounts. Physical and monetary data connected to abstraction, use and discharge of water in the Swedish NAMEA – Statistiska centralbyrån, December 1999

As in Finland, data are also given on the subtraction of pollutants by NACE 90 sector, in the form of efficiency ratios of MWWTPs. It has been assumed that incoming quantities in 1995 were equal to those of 1998 as measured by preliminary results from the 1998 survey.

Table 3.3-18 Efficiency of MWWTPs, Sweden 1995

	In (1 000 tonnes)	Out (1 000 tonnes)	Efficiency (%)
P total	7.2	0.47	93
BOD	207	13	94
N total	40	25.9	35

Source: Water Accounts. Physical and monetary data connected to abstraction, use and discharge of water in the Swedish NAMEA – Statistiska centralbyrån, December 1999

3.3.10 The United Kingdom

The United Kingdom's objective was to test the possibilities of estimating a load per employee (L/E) for 12 kinds of pollutants[51]. The results in terms of data about emissions are given in the two following pages. NACE-2 or 3 digit data were used for this presentation. The study confirmed the view that, for a specific pollutant, only a few sectors are responsible for the bulk of discharges:

- food production for COD and ammonia,
- metal production and iron and steel sectors for most heavy metal loads,
- chemical industry for arsenic and mercury.

However, most of the study dealt with the reliability of the coefficients obtained. Notably with their stability according to:

- time: it had not been statistically possible to tell whether the discharges were stable over time or not
- company size: a slight tendency for the coefficient to decrease with increasing company size was observed in some cases
- region: a statistically significant variation between regions was also noticed, but seems due to differences in consenting, monitoring or other operational practices by the water companies, rather than to real differences between regions.

Some examples of the results of these tests are given on the following pages.

Another comparison which has been made was the consented level of emission against the actual (or estimated) level. The consented levels are generally much higher than actual total loads (Table 3.3-20), but there are exceptions (for instance, an actual load of 3 752% of the BOD consents for 'other businesses' in Yorkshire).

[51] Emissions of Nitrate, Phosphate and Lindane, concerning only a few industries have not been taken up in this summary.

Table 3.3-19 Overall median load/employee for five regions in the UK (from individual company load/employee), kg/employee/year

NACE	Sector	COD	BOD	Ammonia	Cadmium	Chromium	Copper	Lead	Nickel	Mercury	Zinc	Arsenic
01	Agriculture	214.1										
10	Mine Coal	11.0										
14	Mine Other	12.6									0.168	
15	Food products	201.8	634.5	1.714	0.00010	0.003	0.017	0.003	0.004		0.029	
17	Textiles	415.4	223.3	1.556	0.00288	0.129		0.024	0.026		0.350	
18	Apparel	14.7										
19	Leather	123.2		119.659		2.056	0.079	0.059	0.003		0.027	
20	Wood products	1.2										
21	Paper	16.1	712.4	0.403	0.00001	0.000	0.031	0.000	0.000		0.003	
23	Petroleum	39.3	24.3	0.618				0.006			0.086	
2411/2	Dyes & Gas	728.5	389.7	66.050	0.00315	0.643	0.446	0.024	0.003	0.00089	0.106	
2413	Inorganic Chemistry	75.3	70.8	6.150	0.00333	0.010	0.026	0.013	0.034		0.027	
2414	Organic Chemistry	691.5	1 040.8	6.552	0.00357	0.021	0.146	0.080	0.046	0.04007	0.202	0.04015
2416	Plastics	96.5	0.2	4.488		0.055	0.098	0.088	0.098	0.08774	0.062	0.08774
242	Agro Chemical	19.8										
243	Paint etc.	10.0	12.9		0.00015	0.005	0.005	0.013	0.004	0.00004	0.037	
244	Pharmaceutical Chemistry	32.8	4.0			0.004	0.005	0.003			0.004	
245	Soap etc	56.6		0.015							0.011	
246	Chemical products	99.1	419.2	1.339	0.00051	0.013	0.156	0.006	0.005	0.00011	0.009	
247	Man made fibre	82.2										
251	Rubber products	1.5			0.00008	0.003		0.000	0.008		0.208	
252	Plastic products	3.2			0.00058	0.051		0.003	0.021		0.015	
261	Glass products	8.7	105.3		0.00047	0.004	0.071	0.083	0.009		0.035	
262/3	Ceramic goods	2.3			0.00027	0.006	0.009	0.014	0.005		0.063	
266/7/8	Concrete etc	16.3	50.3			1.017		2.000			1.420	

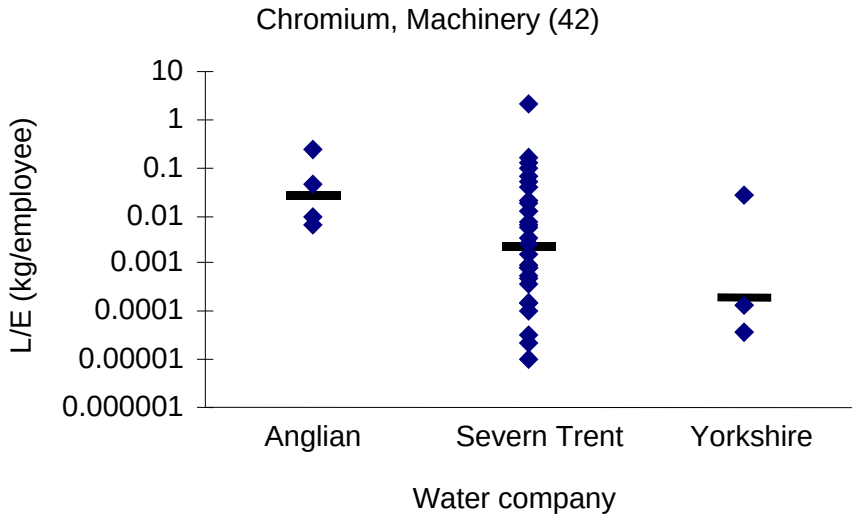
Table continued overleaf

Overall median load/employee for five regions in the UK (from individual company load/employee), kg/employee/year – *Continued*

NACE	Sector	COD	BOD	Ammonia	Cadmium	Chromium	Copper	Lead	Nickel	Mercury	Zinc	Arsenic
271/2/3	Iron Steel	10.7			0.00040	0.029	0.039	0.013	0.036		0.063	
274	Non ferrous metal	0.8	0.1	0.139	0.00026	0.002	0.125	0.003	0.008	0.06612	0.019	0.10245
2742	Aluminium	5.7				0.032	0.036	0.010	0.039		0.026	
275	Cast Metal	7.6			0.00686	0.002		0.010	0.005		0.142	
28	Metal products	9.6	7.9	1.128	0.00176	0.070	0.169	0.009	0.050	0.00145	0.149	
29	Machinery	2.3		104.014	0.00006	0.003	0.004	0.001	0.005		0.022	
30	Office machinery	1.7				0.000		0.001	0.037		0.001	
31	Electric machinery	1.9	0.0		0.00006	0.013	0.005	0.001	0.008	0.00001	0.023	0.01163
32	TV & communication	20.4	0.2		0.00469	0.010	1.176	0.079	0.018		0.030	
33	Precision	1.6				0.000		0.041	0.001		0.001	
34	Motor Vehicles	1.3	0.1		0.00004	0.001	0.004	0.001	0.001	0.00239	0.010	0.00569
35	Other Transport Equip	2.2			0.00004	0.002	0.004	0.000	0.001		0.005	
361/5	Furniture Toys	3.2	0.0		0.00050	0.005	0.016	0.006	0.028	0.01550	0.039	0.01550
366	Miscellaneous	49.0		6.997	0.00064	0.006	0.009	0.010	0.008	0.00017	0.134	
401	Electricity (all)	0.4										
41	Water distribution	12.6										
502	Garages	8.4						0.012	0.002		0.330	
51	Wholesale	293.2	788.1									
60211	Buses	4.4										
6024	HGV etc	3.0							0.690		2.739	
73	R&D	6.0					0.027	0.027	0.027			
74	Other Business	32.6	22 005.4		0.00022	0.002	0.029	0.013	0.003		0.076	
75	Public Administration	643.7		1 708.213								
85	Health Veterinary	6.9										
90	Sewage etc	76.2	3.5	70.705	0.09319	0.181	0.023	0.055	0.327	0.41000	0.750	0.38884
93	Other services	333.5		0.281	0.00009	0.002		0.002	0.002		0.017	

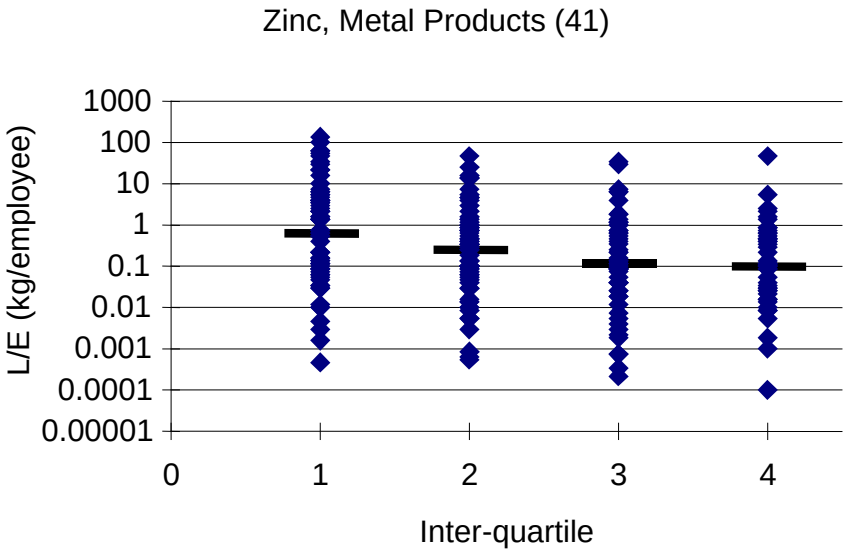
Source: Emissions coefficients for pollutants discharged to sewers. Final report to Eurostat – ONS, July 2000

Figure 3.3-7 United Kingdom: example of variation of a load coefficient by region



Source: Emissions coefficients for pollutants discharged to sewers. Final report to Eurostat – ONS, July 2000

Figure 3.3-8 United Kingdom: example of variation of a load coefficient by company size



Source: Emissions coefficients for pollutants discharged to sewers. Final report to Eurostat – ONS, July 2000

Table 3.3-20 Total actual load (from matched firms) as a percentage of total consented loads (Yorkshire's results only – industries with other consents than COD)

NACE	Sector	COD	BOD	Ammonia	Cadmium	Chromium	Copper	Lead	Nickel	Mercury	Zinc	Arsenic	Lindane
01	Agriculture	3											1
15	Food products	72	326			3	67	6	4				
17	Textiles	28	402	91	0	42	0		0	0	172		3
19	Leather	64				125	1				1		
21	Paper	77	1 145			0	40		0		6		
23	Petroleum	17									4		
2411/2	Dyes & Gas	41	1 825	102	9	37	16	5	2	86	5	0	
2416	Plastics	60				1	5	0	9		35		
243	Paint etc	40			9	2	1	4	1	2 377	6		
244	Pharmaceutical Chemistry	37				10	55	4	3		1		
246	Chemistry Products	16		11									
247	Man made fibre	18					7	46			5		
251	Rubber products	24									25		
252	Plastic products	65		159		3	183	0	5		150		
261	Glass products	13			14			10			10		
262/3	Ceramic goods	53				3	2	2	2		0		
271/2/3	Iron Steel	7			47	21	20	17	11		26		
2742	Aluminium	229				23	12	4	13		3		
275	Cast Metal	18			1	1	3	7	5		5		
28	Metal products	18		62	6	55	27	5	13	23	21		1
29	Machinery	40			14	4	5	5	25		18		
31	Electrical Machinery	4			2	2	3	4	2		0		
32	TV & communication	14				8	118	5	10		30		
34	Motor Vehicles	37				70	5		2		25		
35	Other transport equipment	4				5	1		16		2		
361/5	Furniture Toys	14		0	7	5	17	1	17		2		
502	Garages	22									9		
74	Other Business	23	3 752	17		0	0		0		0		
90	Sewage etc	6	0	11	0	0	1	1	1	0	0	0	

Source: Emissions coefficients for pollutants discharged to sewers. Final report to Eurostat – ONS, July 2000

The conclusion of the ONS study was that resulting coefficients (loads of different pollutants per employee) have to be interpreted cautiously for a number of reasons:

- It has been difficult to merge different databases on the basis of the name and address of firms.
- The calculated emission coefficients were generally extremely variable within an industrial sector as well as between sectors.
- The estimates of proportion of sectors consented remain uncertain.
- Differences in consenting practices in the regions result in discrepancies in the contributing sectors, which most likely do not mirror real regional differences in the nature of discharges.

Finally, using such coefficients to estimate loads of pollutants in the wastewater is considered to have an important drawback, even if the coefficients were sufficiently robust. Total loads calculated by using loads per employee only vary if the number of employees changes. An updating of the coefficients is needed to relate changes due to shifts in process technology or production activities.

To summarise, using emissions coefficients for estimating the loads of pollutants discharged to sewers by different industrial sectors was not considered sufficiently robust for inclusion in the national water accounts. However, the water companies are moving towards a more sophisticated integrated data system, and are in some cases starting to apply SIC codes. The report estimates that in a not too distant future, the generation of appropriate data sets may become a relatively trivial task.

3.3.11 Norway

Heavy metals

Using the INKOSYS database Statistics Norway drew up emissions accounts for 19 types of toxic substances (heavy metals) for the years 1995, 1996 and 1997. According to these accounts, the emissions seem heavily dependent on the types of processes and technologies used by the enterprises. They primarily come from the following NACE divisions:

- NACE 13 (Mining of metal ores),
- NACE 21 (Manufacture of pulp, paper and paper products),
- NACE 24 (Manufacture of chemicals and chemical products),
- NACE 27 (Manufacture of basic metals).

In addition to the INKOSYS database, estimates of heavy metals in the sludge from the municipal wastewater treatment plants have also been used. Comparing the amounts removed from the water in the form of sludge to the amounts released by enterprises Statistics Norway concluded that there is a need to better identify the sources of emissions. For some substances, for example copper, twice as much is removed in the sludge from the wastewater treatment plants than is released by the enterprises requiring a discharge licence. This would indicate that there are other major emissions sources of copper that are connected to the municipal wastewater system that need to be identified[52]. Similarly, for chromium and mercury the amounts reported in the sludge are several times higher than the amounts reported as emissions from the enterprises that have discharge licences.

This conclusion should even be reinforced, considering that, although no data are available as regards the content of heavy metals in the effluent released into water bodies after treatment, the removal rate of these substances is most probably less than 100%.

[52] Households are the major source for copper, according to the Austrian study.

Table 3.3-21 Emissions to water of heavy metals from enterprises having discharge licences, Norway 1997, kg

NACE	Ag Silver	Al Aluminium	As[1] Arsenic	Au Gold	Ba Barium	Cd[1,2] Cadmium	Co Cobalt	Tot Cr[1] chromium	Cu[1,2] Copper	Fe Iron	Hg[1,2] Mercury	Mn Manganese	Mo Molybdenum	Ni[1] Nickel	Pb[1,2] Lead	Sn Tin	Ti Titanium	V Vanadium	Zn[1] Zinc
13						2.4			128					5 294					
14																			
15									613					198					
17			17			1.9	7.3	65	201		0.3			11	23	15			494
18								42											
19								82											
20																			
21		0.9			4.6	1.9		0.4	5 852	433	0.0	772		8	8				76
22									4					0.0					
23										39				11	0.0		44	39	0.0
24						23		11	560	329 111	12	2 520		4 244	230		280 300	594	3 272
25																			
26					0.01	0.00					0.0				0.0				
27		8 891	130			938	200	232	2 018	824	7	989	120	1 496	3 917		24	6.0	43 176
28	3.512	3 750		1.122		0.2	2.8	60	51	1 165		17		169	19	206			150
29																			
31									2	9			1.0	1.1	4.4	0.9			3.6
35																			
40						0.02					0.1				0.3				
60																			
74																			
75																			
90			0.2		32	0.7			1 505	251	0.3	2 541	0.6	176		0.3		4.6	2 983
INKOSYS total	**3.512**	**12 642**	**147**	**1.122**	**36**	**968**	**210**	**492**	**10 934**	**331 832**	**19**	**6 838**	**122**	**11 608**	**4 201**	**222**	**280 368**	**644**	**50 155**
For memory: Sewage sludge content						76		1 600	22 100		101			900	1 960				28 900

Source: Norwegian Economic and Environment Accounts (NOREEA Phase 2) Project – Statistics Norway, October 2000

[1]Heavy metals reported in the OECD/Eurostat joint questionnaire, Inland waters (Table 7)

[2]Toxic substances which are to be substantially reduced by 2010 according to White Paper n°58 (1996-1997) to the Norwegian Parliament.

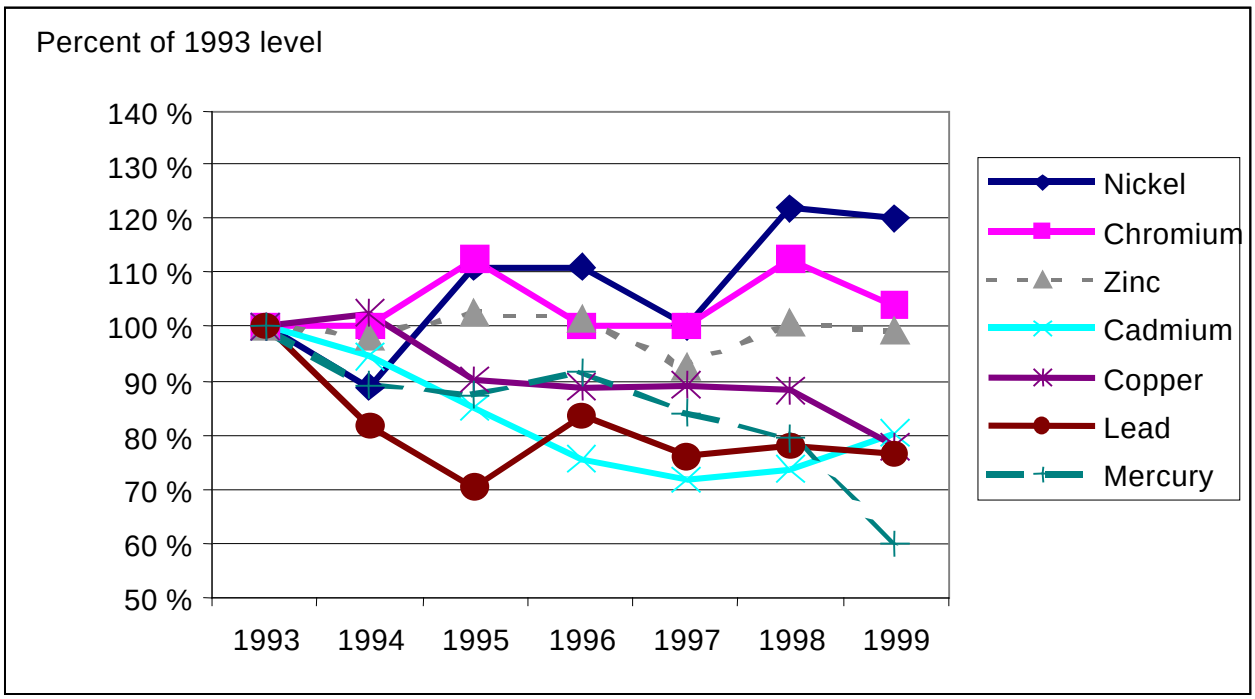
Light grey shading are values that are substantially different from the values reported in Table 7 of the OECD/Eurostat joint questionnaire on Inland waters.

Values shaded in dark grey highlight data needing additional checking due to inconsistencies between years.

Statistics Norway also elaborated a time series for the seven types of toxic substances that are reported for municipal sludge (shown below).

The report by Statistics Norway states that: *" …From this figure it appears that the amounts of mercury found in sludge are being drastically reduced but the emissions from industrial sources show a mixed picture for the time period 1995 to 1997. Drawing conclusions about trends is difficult from these two sets of data. Further work is needed before overall trends can be identified with confidence... "*

Figure 3.3-9 Heavy metals in sludge from municipal wastewater treatment plants, Norway 1993 - 1999



Source: Statistics Norway, Wastewater statistics 1999. (http://www.ssb.no/emner/01/04/20/avlut/)

Nitrogen and phosphorus

Discharges of nitrogen and phosphorus by industries have been reported separately by Norway, over the years 1995 to 1997. The results are reproduced below, which show large variations over time.

Total emissions by industry are rather close to emissions calculated by the TEOTIL model for industry. The TEOTIL model also gives an estimate of total emissions, including 'natural' emissions:

Table 3.3-22 Emissions of phosphorus and nitrogen to coastal areas, Norway 1996, tonnes

	Phosphorus	Nitrogen
Agriculture, hunting and forestry	663	21 988
Municipal wastewater	1 479	19 370
Industry	241	3 908
Natural run-off from pristine areas	1 246	55 016
Total	3 629	100 282
INKOSYS data (mining and manufacturing industry)	*283*	*3 623*

Source: Bratli 1998, calculated using the TEOTIL model, cited by Norwegian Economic and Environment Accounts (NOREEA Phase 2) Project – Statistics Norway, October 2000

Table 3.3-23 Emissions of phosphorus and nitrogen from enterprises reporting to the INKOSYS administrative register, Norway 1995-1997, tonnes

NACE	Description	Phosphorus			Nitrogen		
		1995	1996	1997	1995	1996	1997
13	Mining of metal ores.	0.8	0.0		2.2	1.2	1.2
14	Other mining and quarrying.						
15	Manufacture of food products and beverages.	50.1	128.8	54.0	403.4	432.3	432.5
17	Manufacture of textiles.	6.8	8.3	9.1	0.4	1.1	
18	Manufacture of wearing apparel; fur.		0.0				
19	Leather; manufacture of luggage, saddlery, footwear etc.	0.1	0.1	0.1	91.8	26.0	20.0
20	Manuf. of wood and products of wood and cork, etc.	1.6	1.4	1.8	9.2	5.5	11.1
21	Manufacture of pulp paper and paper products.	94.1	95.1	83.0	888.9	820.6	628.9
22	Publishing printing and reproduction of recorded media.		0.0				
23	Manufacture of coke, petroleum products, nuclear fuel.	2.2	2.1	3.6	2.2	0.5	0.4
24	Manufacture of chemicals and chemical products.	27.7	35.7	52.7	1 690.4	2 329.8	2 496.2
25	Manufacture of rubber and plastic products.	8.5	7.1	10.0			
26	Manufacture of other non-metallic mineral products.		0.3	0.1	0.3	0.3	0.1
27	Manufacture of basic metals.	1.7	1.2	1.3	43.0		710.4
28	Manufacture of fabricated metal products	0.9	1.7	374.0	4.4	4.2	2.5
29	Manufacture of machinery and equipment n.e.c.	..	0.2	..	..	1.5	..
31	Manufacture of radio, TV and communication equipment						
35	Manufacture of other transport equipment	0.2	0.2	0.0	0.0	0.0	0.0
40	Electricity, gas, steam and hot water supply						
60	Land transport, transport via pipelines						
74	Other business activities						
75	Public administration						
90	Sewage and refuse disposal, sanitation, etc.						3.6
Total		**194.8**	**282.7**	**589.8**	**3 136.2**	**3 623.1**	**4 307.0**

Source: Norwegian Economic and Environment Accounts (NOREEA Phase 2) Project – Statistics Norway, October 2000

The conclusion of Statistics Norway on the issue of water accounts is that, once the important issue of data quality is solved, there is a need for a more complete mapping of the flows in order to cope with the double counting problem (pollutants discharged to the sewage network, then, to the water bodies). This will require better information regarding enterprises' connection to the municipal wastewater system, information which could be derived from the register of the buildings which is being established as part of the population and housing census for 2001.

However, Statistics Norway also stressed that NAMEA has some limits for substances that dissolve in water. In this case, it becomes difficult to determine the actual source of the emissions. Modelling the flows and the possible retention of the pollutants is necessary to avoid double counting. In the NAMEA framework, only 'economic' emissions should be included. For Norway, as regards nitrogen and phosphorus, this means than only about half of the total amount that is emitted to the coastal waters will be included, due to the large amounts that come from the run-off from pristine nature areas.

Furthermore, in some cases emissions of nitrogen can be positive for the recipient area. It is therefore felt that some additional conceptual work is needed, especially for nitrogen and phosphorus. What should be included in a NAMEA still needs clarification. Finally Statistics Norway argues that wastewater produced by individuals is not in relation with the volume of production and that, maybe, all wastewater connected to 'individual' needs should be classified as coming from ‘households’, whether individuals are at work or at home.

3.3.12 Comparisons between countries

As stated at the beginning of this chapter, it has not been possible to undertake systematic comparisons. Since comparisons between total emissions of pollutants into water do not make much sense, given the size differences between the countries as well as their differences in industrial structure, only ratio comparisons have been attempted below (discharge per employee, as calculated by Ireland, Austria and the United Kingdom).

However, when these ratios were not presented in the pilot studies reports, or if all data necessary for their calculation were not in the report, no trial has been made to calculate these ratios for other countries with the help of external statistics, because the consistency of the series was not guaranteed.

Faced with results that diverge too much, a number of questions may be asked, in particular, about:

- the concept applied (emission before/after treatment within the industrial site, before/after treatment by MWWTP),
- the coverage (e.g. inclusion of leaches by agriculture or not),
- the representativeness of the samples which had been monitored,
- the importance of the differences in industrial processes (especially within a NACE division),
- the methodology of measurement of the emission (frequency, instruments, highest level *vis-à-vis* average, etc.).

Results show that concepts and methods need to be further clarified and made more comparable.

Table 3.3-24 Comparison of countries – COD and BOD loads, kg per employee per year

NACE code	Description	COD		BOD		
		A	UK	IRL	A	UK
1/2/5	Agriculture, forestry, fishing and related service activities*	1,2	214,1	38,9	3,1	
10	Mining of coal and lignite; extraction of peat	0,6	11,0	0,0	0,1	
11	Extraction of crude petroleum and natural gas; incidental services	1,2		0,0	0,2	
13	Mining of metal ores	0,8		6,7	0,1	
14	Other mining and quarrying	0,2	12,6	64,3	0,0	
15	Manufacture of food products and beverages	62,5	201,8	83,5	21,5	634,5
17	Manufacture of textiles	43,7	415,4	22,2	8,8	223,3
18	Manufacture of wearing apparel; dressing and dyeing of fur	3,9	14,7	0,0	0,7	
19	Leather; manufacture of luggage, handbags, saddlery and footwear	44,4	123,2	55,0	2,0	
20	Manufacture of wood, products of wood, cork, straw, etc.	8,0	1,2	0,6	3,1	
21	Manufacture of pulp, paper and paper products	1 936,0	16,1	45,9	338,3	712,4
22	Publishing, printing and reproduction of recorded media	1,2		0,9	0,2	
23	Manufacture of coke, refined petroleum products and nuclear fuel	86,1	39,3	90,0	14,1	24,3
24	Manufacture of chemicals and chemical products	161,6		112,9	15,5	
25	Manufacture of rubber and plastic products	1,2		0,0	0,2	
26	Manufacture of other non-metallic mineral products	8,2		5,2	3,1	
27	Manufacture of basic metals	115,5		296,1	40,1	
28	Manufacture of fabricated metals, except machinery and equipment	1,9	9,6	5,2	0,7	7,9
29	Manufacture of machinery and equipment n.e.c.	0,4	2,3	0,0	0,1	
30	Manufacture of office machinery and computers	7,5	1,7	0,0	1,2	
31	Manufacture of electrical machinery and apparatus n.e.c.	0,9	1,9	0,0	0,2	0,0
32	Manufacture of radio, tv and communication equipment	10,0	20,4	1,8	4,4	0,2
33	Manufacture of medical, precision, optical instruments, watches, etc.	0,4	1,6	0,0	0,1	
34	Manufacture of motor vehicles, trailers and semi-trailers	1,2	1,3	0,0	0,2	0,1
35	Manufacture of other transport equipment	1,2	2,2	0,2	0,2	
36	Manufacture of furniture; manufacturing n.e.c.	0,3		0,0	0,1	
41	Collection, purification and distribution of water	1,8	12,6		0,2	
45	Construction	1,2		0,0	0,2	
51	Wholesale trade and commission trade	1,2	293,2		0,2	788,1
73	Research and development	1,2	6,0		0,2	
74	Other business activities	1,2	32,6		0,2	22 005
75	Public administration and defence; compulsory social security**	1,0	643,7	0,0	0,2	
80	Education	1,2		0,0	0,2	
85	Health and social work	1,2	6,9		0,2	
90	Sewage and refuse disposal, sanitation and similar activities	872,3	76,2		204,6	3,5
93	Other service activities	1,3	333,5		0,2	
	Total	**34,4**		**10,0**	**6,6**	

* Agriculture only for UK

** Including non profit private institutions for A

Table 3.3-25 Comparison of countries – N and P loads, kg per employee per year

NACE code	Description	N		P	
		IRL	A	IRL	A
1/2/5	Agriculture, forestry, fishing and related service activities*	795.067	0.261	38.037	0.009
10	Mining of coal and lignite; extraction of peat	0.000	0.000	0.000	0.000
11	Extraction of crude petroleum and natural gas; incidental services	0.000	0.000	0.000	0.000
13	Mining of metal ores	1.111	0.000	0.000	0.000
14	Other mining and quarrying	0.000	0.000	0.952	0.000
15	Manufacture of food products and beverages	23.988	0.004	5.817	0.001
17	Manufacture of textiles	4.857	0.004	1.333	0.000
18	Manufacture of wearing apparel; dressing and dyeing of fur	0.000	0.000	0.000	0.000
19	Leather; manufacture of luggage, handbags, saddlery and footwear	21.250	0.016	0.625	0.000
20	Manufacture of wood, products of wood, cork, straw, etc.	0.149	0.000	0.000	0.000
21	Manufacture of pulp, paper and paper products	14.615	0.002	2.051	0.001
22	Publishing, printing and reproduction of recorded media	0.000	0.000	0.000	0.000
23	Manufacture of coke, refined petroleum products and nuclear fuel	6.667	0.004	0.000	0.001
24	Manufacture of chemicals and chemical products	44.788	0.062	16.988	0.000
25	Manufacture of rubber and plastic products	0.000	0.000	0.000	0.000
26	Manufacture of other non-metallic mineral products	4.631	0.001	0.201	0.000
27	Manufacture of basic metals	220.000	0.023	56.842	0.006
28	Manufacture of fabricated metals, except machinery and equipment	1.176	0.000	0.860	0.000
29	Manufacture of machinery and equipment n.e.c.	0.000	0.000	0.000	0.000
30	Manufacture of office machinery and computers	0.000	0.001	0.000	0.000
31	Manufacture of electrical machinery and apparatus n.e.c.	0.000	0.000	0.000	0.000
32	Manufacture of radio, TV and communication equipment	1.714	0.001	0.333	0.000
33	Manufacture of medical, precision, optical instruments, watches, etc.	0.000	0.000	0.000	0.000
34	Manufacture of motor vehicles, trailers and semi-trailers	0.000	0.000	0.000	0.000
35	Manufacture of other transport equipment	0.000	0.000	0.000	0.000
36	Manufacture of furniture; manufacturing n.e.c.	0.000	0.000	0.000	0.000
45	Construction	0.000	0.000	0.000	0.000
50	Sale and repair of motor vehicles and motorcycles; retail sale of fuel		0.000	0.000	0.000
51	Wholesale trade and commission trade		0.000	0.000	0.000
52	Retail trade; repair of personal and household goods		0.000	0.000	0.000
55	Hotels and restaurants		0.002	0.000	0.000
60	Land transport; transport via pipelines		0.000	0.000	0.000
75	Public administration and defence; compulsory social security**	0.000	0.000	0.000	0.000
80	Education	0.000	0.000	0.000	0.000
	Total	**74.242**	**0.018**	**4.118**	**0.001**

* Agriculture only for United Kingdom

** Including non-profit private institutions for Austria

3.3.13 Conclusion on flows of pollutants

This issue attracted the largest number of countries, indicating the importance of the pollution aspect for most European countries. However it is worth noting that 'Southern' country, more concerned about resource availability in terms of quantity, only marginally participated in it.

As can be seen throughout this section, various adapted versions of the tables initially proposed have finally been obtained from the countries participating in the test. The adaptation concerned the list of the pollutants studied, the level of detail of the economic activities classification, but also the covered field.

It must be underlined that, in spite of the development of water statistics, the delimitation of the different steps followed by the discharge of wastewater is not very fixed, and the countries used different terms for net/gross emissions with different meanings.

Furthermore, in a number of countries, pollution brought by wastewater which is firstly discharged into common sewage networks could not be allocated to the different sources (pilot table 10). The proposed pilot table on the efficiency of wastewater treatment plants (pilot table 12) was only occasionally filled in.

Some minor questions have also been implicitly asked, which need a common answer:

- What to do with urban run-off collected by the sewage networks?
- How to treat leakage from mining sites, from dumping sites and other diffuse emissions?
- In which unit to express organic pollution (kg of BOD or inhabitant-equivalent)?
- Is aggregation possible (k-equitox, environmental themes)?

Some countries have been confronted – as with the air pollution issue – with using a classification of enterprises by industrial process, and had to build correspondence tables between process-based classification used by Environmental Agencies or similar bodies and the NACE Rev.1 or national economic classifications.

Those countries possessing sufficiently detailed data or long time series to give an opinion about the quality of the data, put forward diverging conclusions: on the one hand, data seem too subject to variability over time (UK, N), according to region (UK), to be reliable. On the other hand, aggregated data do not seem to suffer much from such variability (F).

In their conclusions, some countries stressed that the indicators chosen cannot easily be linked to the state of water due to the existence of natural filtration, time lag between the pressure and the impact on water bodies, etc. Measuring loads in kg without taking into account the concentration sometimes hindered building information as proposed in the pilot tables, as pollution was only recorded in concentration terms.

On the contrary, some other countries went further in the analysis and proposed indicators or other analytical instruments: share of each source in the discharge of one kind of pollutant, global contribution to environmental themes, etc.

As a general conclusion nearly all countries insisted on the fact that the results were very preliminary and that developments were needed to improve the quality of data. Some are already planned: introduction of renewed registers of enterprises, modernisation of municipalities' control of records, etc.

4 Uncovered issues

As stated in the introduction, for some issues related to water accounts no immediate solution could be found at the first meetings of the Task Force organised by Eurostat. Introducing time and space concerns, describing water in nature in a consistent framework, measuring water quality in order to assess the sustainability of the use of water and agreeing on a concept of 'economically available' water were the main problems outstanding. This chapter reviews the underlying questions and tries to take stock of some experiments carried out here and there, but in a less systematic way than for the 13 pilot tables proposed as a start for drawing up the accounts.

4.1 Space and time dimensions

The possible uses of water both at present and in the future are naturally influenced by the impacts of the pressure exerted by economic activities upon the water system. As regards the time and geographical dimension, the level of aggregation of the proposed NAMEA-type framework is too high to form the basis for a full description of how the water system is influenced by economic activities. These issues are of course not exclusively related to water accounts, but are particularly important in this domain.

Environmental problems within the water system are often local or regional phenomena or are restricted to certain periods of the year. The pressures causing these problems are best described in a system which takes into account the locality, notably because river basins are rather independent. The system should also consider the period (season) in which the pressure is applied.

Furthermore, it is not possible to assume that (a change in) the state of the environment is directly a result of the pressure exerted upon it. The impact of emissions to water mainly depends on concentration. The impact of one unit pollutant released might be distinctly different from another due to different circumstances at the release. Similarly, an abstraction of 1 m^3 of fresh water does not bear the same consequences if it is abstracted from a resource with a low or quick renewal speed.

The Task Force has investigated the possibilities for including these issues in the water accounts framework. The overall conclusion was that an annual and national framework could not cover directly all aspects of time and space without attributing weights to emissions and abstractions in relation with the season or location they occur, thus involving subjective assessments that may be considered to fall outside an accounting framework.

However it is possible, as a further step, to consider drawing up accounts for regions (if possible hydrological regions) and quarters. When applied to flows of water, this would allow investigating the background for local or periodical scarcity of water.

Some Member States already experimented the building of partial water accounts at the regional level. None of them tried to build quarterly accounts, at least within this exercise.

4.1.1 Spain

The INE was able to collect most data and elaborate pilot tables at the level of the different Spanish administrative regions. These regions correspond to the European NUTS 2 level.

Two tables are given below as examples. They concern the supply of water-related products in monetary units (pilot table 1) and the uses of the same products in thousand m^3 (pilot table 6).

An additional step would be the transition from administrative regions with hydrological basins.

Table 4.1-1 Supply of water-related products in Spanish regions, 1999, million ESP at market prices

Product of NACE activity	01	41	90	75	Total	%
Andalucía	32 097	47 604	24 809		104 510	18.4%
Aragón	1 958	7 048	4 061		13 067	1.8%
Asturias	0	4 603	2 357		6 960	1.1%
Islas Baleares	0	9 684	5 671		15 355	2.4%
Islas Canarias	1 761	38 204	2 160		42 125	9.1%
Cantabria	0	4 128	1 380		5 508	1.0%
Castilla León	2 048	17 052	2 545		21 645	4.4%
Castilla La Mancha	4 163	8 999	2 150		15 312	3.1%
Cataluña	1 412	90 311	20 255		111 978	19.6%
Comunidad Valenciana	7 855	35 612	7 459		50 926	9.9%
Extremadura	1 588	6 719	1 422		9 729	2.0%
Galicia	48	20 854	3 362		24 264	4.6%
Comunidad de Madrid	243	53 260	9 953	9 563	73 019	12.3%
Región de Murcia	5 435	10 706	2 559		18 700	3.6%
C. Foral de Navarra	441	4 376	2 588		7 405	1.2%
País Vasco	151	20 834	15 193		36 178	4.5%
La Rioja	579	2 340	1 212		4 131	0.7%
Ceuta y Melilla	0	949	432		1 381	0.2%
España	**59 779**	**383 283**	**109 568**	**9 563**	**562 193**	**100.0%**

Source: Eurostat Working Paper n° 2/2001/B/6 – Water Satellite Accounts for Spain, 1997-1999

Table 4.1-2 Use of water-related products* in Spanish regions, 1999, thousand m³

	Intermediate consumption			Total	Households	Total uses	%
	Agriculture	Industry	Services				
Andalucía	5 459 974	59 356	161 486	5 680 816	396 060	6 076 876	18.0%
Aragón	2 883 472	16 549	26 242	2 926 263	65 793	2 992 056	2.0%
Asturias	17 050	11 507	18 723	47 280	49 971	97 251	1.0%
Islas Baleares	12 340	616	15 927	28 883	37 489	66 372	2.2%
Islas Canarias	157 980	24 611	33 260	215 851	92 552	308 403	9.0%
Cantabria	7 342	4 449	15 700	27 491	36 178	63 669	0.9%
Castilla León	2 258 967	8 455	63 327	2 330 749	140 554	2 471 303	4.3%
Castilla La Mancha	1 975 533	8 767	40 172	2 024 472	93 882	2 118 354	3.0%
Cataluña	2 004 793	128 600	155 950	2 289 343	428 185	2 717 528	20.7%
Comunidad Valenciana	2 467 348	19 882	87 665	2 574 895	247 417	2 822 312	9.8%
Extremadura	1 572 800	3 046	17 569	1 593 415	55 014	1 648 429	1.9%
Galicia	35 374	20 451	60 094	115 919	148 286	264 205	4.7%
Comunidad de Madrid	149 857	57 382	118 046	325 285	337 987	663 272	12.1%
Región de Murcia	405 639	22 055	17 159	444 853	59 139	503 992	3.6%
C. Foral de Navarra	440 332	9 871	13 028	463 231	29 881	493 112	1.1%
País Vasco	24 391	59 258	44 160	127 809	111 290	239 099	4.7%
La Rioja	264 098	5 906	9 599	279 603	17 322	296 925	0.7%
Ceuta y Melilla	405	0	2 095	2 500	7 428	9 928	0.2%
España	**20 137 695**	**460 761**	**900 202**	**21 498 658**	**2 354 428**	**23 853 086**	**100.0%**

(*) except for wastewater treatment

Source: Eurostat Working Paper n° 2/2001/B/6 – Water Satellite Accounts for Spain, 1997-1999

4.1.2 Denmark

In Denmark many data are available at the county level (NUTS 3). In fact, the method used by Denmark Statistics to draw the water accounts essentially relied on local data: geo-codes served as a matching item for the merging of different files and database. However, it is clear that such a method necessitates harmonised data in all the geographical entities.

The table below, adapted from pilot table 7, shows the information on the abstraction of water by the main categories of users.

Table 4.1-3 Groundwater abstraction by counties, GEUS categories (uses), Denmark 1997

Name of county	Public suppliers	Private suppliers	BBR-supply	Institutions	Industries	Watering	Other extraction	Protection	Individual drillings	Total
Total	**318 840**	**144 572**	**11 542**	**766**	**67 672**	**368 682**	**6 339**	**6 174**	**11 400**	**935 988**
Fr.berg og Kbh. Kommune	1 808	0	0	2	66	0	0	0	0	1 876
København	46 472	712	92	0	404	408	0	4 897	0	52 985
Frederiksborg	29 741	11 408	383	28	395	1 185	0	665	1 000	44 805
Roskilde	38 190	0	259	0	2 766	714	2 026	0	500	44 455
Vestsjælland	21 785	14 361	472	0	1 100	1 400	1 500	0	0	40 618
Storstrøm	20 929	0	706	0	2 373	1 452	0	0	0	25 460
Bornholm	4 408	0	227	0	120	0	0	0	400	5 155
Fyn	22 395	18 454	942	17	1 986	5 730	64	463	3 500	53 551
Sønderjylland	10 491	12 462	1 067	0	5 250	52 600	0	0	6 000	87 870
Ribe	12 932	9 711	842	221	4 035	91 706	115	149	0	119 710
Vejle	19 246	13 074	1 140	0	3 480	45 240	870	0	0	83 050
Ringkøbing	18 112	12 005	1 327	61	10 455	113 560	0	0	0	155 520
Århus	33 833	20 065	1 084	88	5 257	9 581	353	0	0	70 262
Viborg	13 108	11 017	1 253	349	4 547	13 027	1 411	0	0	44 712
Nordjylland	25 390	21 303	1 749	0	9 698	32 079	0	0	0	90 219

Source: Geological Survey (GEUS); written reports and electronic reporting to GEUS from the counties

4.1.3 Ireland

A pilot survey was organised in Ireland in order to assess the feasibility of obtaining information on economic aspects at a river basin level, as required by the Water Framework Directive. Initially all local authorities in the Irish Republic were surveyed, but a low response rate led the authors to concentrate on one region in particular, the area approximately covering the Greater Dublin region. Four local authorities managed this area:

- Dublin Corporation
- Fingal County Council
- South Dublin County Council
- Dun Laoghaire-Rathdown County Council

Although on the basis of different schemes of information and with the help of various work assumptions, costs and receipts could be identified in the four sub-regions as well as approximate quantities. Consequently, notional costs per unit of water services and notional subsidy to consumers could be tentatively estimated (considering only current costs). A supplementary difficulty of this exercise consisted in avoiding double accounting when building the total, since water can be exchanged between the different counties.

The following tables show what could be produced from the information collected from one local authority, and the result of aggregation to the Greater Dublin region:

Table 4.1-4 Dublin Corporation – Water supply and uses – 1998/99

	Water input m^3/year	Water input used locally m^3/year	Current costs (IEP)	Current costs per m^3	Total revenue from sales (IEP)	% Cost recovery	Implicit subsidy (IEP/m^3)
Households	64 884 000	64 884 000	11 407 643	0.18	-	0%	0.18
Industries	43 256 000	43 256 000	7 605 095	0.18	9 983 152	131%	-0.05
Exported to other County Councils	44 000 000	-	3 482 186	0.08	5 205 714	149%	-0.04
Exported to other areas	16 060 000	-	1 270 998	0.08	1 900 085	149%	-0.04
Total	168 200 000	108 140 000	23 765 922	0.14	17 088 951	72%	0.04

Source: Environmental accounts: time series + eco-taxes – ESRI, February 2001

Table 4.1-5 Greater Dublin – Water supply and wastewater services (tentative figures 1998/99).

		Volume in m^3/year	Current costs (IEP)	Current cost per m^3	Total revenue (IEP)	% Cost recovery	Implicit subsidy (IEP/m^3)
Water supply		170 352 000	34 201 138	0.20	13 550 147	59%	0.12
Of which:	Households	113 308 264	22 325 247	0.20	-	0%	0.20
	Industries	57 043 736	11 875 891	0.21	13 550 147	168%	-0.03
Wastewater services		128 564 029	17 577 273	0.14	5 080 000	29%	0.10

Source: Environmental accounts: time series + eco-taxes – ESRI, February 2001

Finally, an interesting comparison between prices from one area to the other could be made. There are two points to note on this topic: the prices are based on the volumes of delivered water: due to leakage and use by the system, prices charged are higher than the 'per-unit' production cost shown in the previous tables. Secondly the prices are broadly similar indicating, according to ESRI, that water is in some way a 'tradable' good.

Table 4.1-6 Examples of local water charges in Ireland (Greater Dublin) in IEP/m^3

		1995	1996	1997	1998	1999	2000	2001
Dublin Corporation	Commercial	0.433	0.447	0.469	0.493	0.517	0.543	-
Fingal County Council (CC)	-	-	-	-	0.41	0.43	0.45	-
South Dublin County Council	-	-	-	-	0.435	0.455	0.475	-
Dun Laoghaire-Rathdown CC	-	-	-	-	0.41	0.45	0.50	-
Cork Corporation	Commercial	0.41	0.42	0.44	0.46	0.48	0.50	0.53
Cork County Council (South)	Industry	-	-	-	0.396	0.411	0.429	0.462
	Commerce	-	-	-	0.363	0.374	0.385	0.396
Cork County Council (North)	-	-	-	0.407	0.451	0.495	0.506	-
Cork County Council (West)	-	-	-	-	0.389	0.418	0.462	0.495

Source: Environmental accounts: time series + eco-taxes – ESRI, February 2001

4.2 Water quality accounts

4.2.1 Exercise suggested by Eurostat

In the Eurostat set of tables, only one table tried to introduce the 'quality' aspect: Pilot table 8 referred to the 4 quality classes defined in the Drinking Water Directive[53].

Table 4.2-1 Quality classes of surface water in view of human consumption

			Classes and proposed standards		
	Parameters	**Unit**	**A1**	**A2**	**A3**
1	Coloration (after simple filtration)	mg/l Pt scale	20 (*)	100 (*)	200 (*)
2	Temperature	°C	25 (*)	25 (*)	25 (*)
3	Nitrates	mg/l NO3	50 (*)	50 (*)	50 (*)
4	Fluorides	mg/l F		1.5	
5	Dissolved iron	mg/l Fe	0.3	2	
6	Copper	mg/l Cu	0.05 (*)		
7	Zinc	mg/l Zn	3	5	5
8	Arsenic	mg/l As	0.05	0.05	0.1
9	Cadmium	mg/l Cd	0.005	0.005	0.005
10	Total chromium	mg/l Cr	0.05	0.05	0.05
11	Lead	mg/l Pb	0.05	0.05	0.05
12	Selenium	mg/l Se	0.01	0.01	0.01
13	Mercury	mg/l Hg	0.001	0.001	0.001
14	Barium	mg/l Ba	0.01	1	1
15	Cyanide	mg/l CN	0.05	0.05	0.05
16	Sulphates	mg/l SO4	250	250 (*)	250 (*)
17	Phenols[1]	mg/l C6H5OH	0.001	0.005	0.1
18	Dissolved[2] or emulsified hydrocarbons	mg/l	0.05	0.2	1
19	Polycyclic aromatic hydrocarbons	mg/l	0.0002	0.0002	0.001
20	Total pesticides (parathion, BHC, dieldrin)	mg/l	0.001	0.0025	0.005
21	Ammonia	mg/l NH4		1.5	4 (*)

(*) In case of exceptional climatic or geographical conditions, standards may be exceeded
1 (phenol index) para-nitranilin 4 amino-antipyrine
2 (after extraction by petroleum ether)

Source: EC Directives 75/440/EEC and 79/869/EEC

No country made a trial to fill in pilot table 8. But, in a larger context (quality accounts of all water bodies, not only of the water bodies used for making drinking water), France has developed a pilot application in order to build quality accounts at the level of catchment areas. These accounts make it possible to measure the evolution of quality between two dates, to compare between geographic entities, and to assess the impacts of economic activities on the state of water.

4.2.2 France

4.2.2.1 Method

The main difficulty for elaborating water quality accounts is that quality of water is not an additive variable. Whereas the quality of a given m^3 of water may be defined, it cannot be added to the quality of another m^3. Moreover water flows and it quality changes every time. It is necessary to define a unit that enables aggregation. A first possibility would be to characterise the quality of the water for a river stretch, and then to add all stretches with the same quality. However this would not take into account the magnitude of river flows.

53 Directive 98/83/EC amending Directive 80/778/EEC.

Defined by the Norwegians J.Heldal and T Østdahl, a kilometre of standard river (km.s.r) is the unit which corresponds to a river one kilometre long which carries a flow of one cubic meter per second. A km.s.r can represent for instance a 1 km long watercourse with a 1 m^3/s outflow or a 0.5 km long watercourse with a 2 m^3/s outflow. This unit allows aggregating the quality, adding together all km.s.r. where the water has the same quality. Accounts for changes in quality can then be drawn.

Ifen developed a simplified method enabling the production of comparable quality accounts for each drainage basin[54] by using the number of km.s.r to weight each quality class.

The data used are maps of linear quality of the watercourses. These maps were not conceived for this purpose and they use a classification of the rivers in only 4 size classes: 'main rivers', 'large tributaries', 'rivers' and 'brooks'. Not all have a quality grade. It has been considered that information available for each class of watercourses was representative of the whole class.

Different indicators have been built up in the framework of this water quality evaluation system. Only the « organic and oxydizable matter » indicator has been kept for illustrating the method. It takes into consideration the following parameters: dissolved oxygen, BOD_5 (biochemical oxygen demand at 5 days), COD (chemical oxygen demand) and ammonium (ion NH_4^+). 5 classes have been built according to this indicator, noted 1A (best), 1B, 2, 3 and HC (not classified). Other indicators were built notably as regards nitrate and eutrophication.

4.2.2.2 Results

Two data sources were tested: a 1992 map, not drawn up strictly according to the assignment rules of the qualification system and a 1994 map, more in conformity with the indicator, but with less information on watercourses. Therefore, the differences displayed in the table below should not be attributed to differences in quality only.

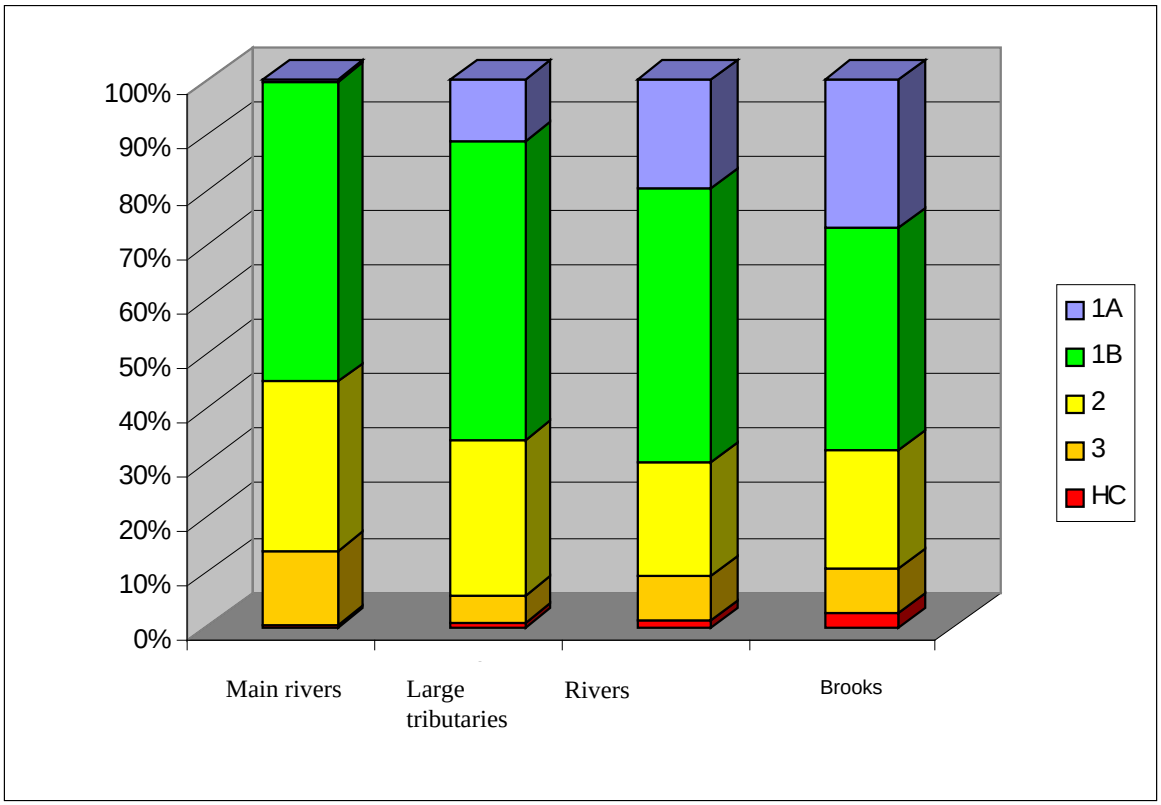
Table 4.2-2 Water quality account of French watercourses, organic matter indicator, 1 000 km.s.r

Watercourse category	1992 state					1994 state				
	1A	1B	2	3	HC	1A	1B	2	3	HC
Main rivers	5	1 253	891	510	177	8	1 583	893	358	12
Large tributaries	309	1 228	1 194	336	50	325	1 691	919	154	28
Rivers	260	615	451	128	47	306	749	322	110	18
Brooks	860	1 464	690	243	95	810	1 295	917	258	72
Total	**1 434**	**4 560**	**3 226**	**1 217**	**369**	**1 448**	**5 318**	**3 051**	**881**	**131**

Source: Ifen – The accounts of the quality of the watercourses –August 1999

[54] The European territory of France is broken down into 55 large drainage basins, under the management of 6 Water agencies. Each basin has a surface ranging between 6 000 and 13 000 km^2.

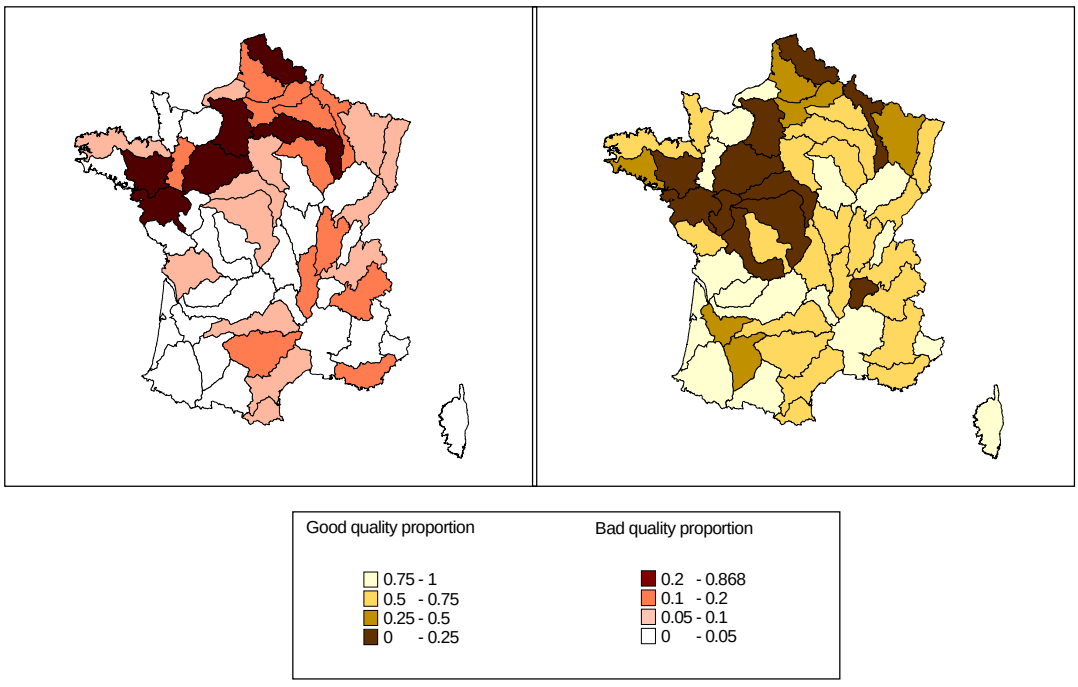
Figure 4.2-1 Distribution (in %) of the km.s.r quantities per quality grade and per size class of watercourses. 1994 organic and oxidizable matter indicator.



Source: Data from water agencies, RNB via BNDE, Ifen calculations

A geographical representation of the state in 1994 was also carried out by aggregating, in each of the 55 basins, the quantities of km.s.r of good classes (1A and 1B) and of bad classes (3 and HC). The proportion of km.s.r of good (left) or bad (right) quality is represented in the two following maps.

Map 4.2-1 Proportion of km.s.r of good or of bad quality, reported to all the classes of watercourses of each BV RNDE. 1994 state of oxidizable matter indicator.



Source: Data from water agencies, RNB via BNDE, Ifen calculations

The tables, graphs and maps shown above are the basic elements of water quality accounts. Complementary analyses have nevertheless been envisaged by Ifen, notably the calculation of an overall index of quality for a basin or a cluster of basins. This index takes into account the weight of each quality grade: indeed, the 5 quality classes result from cutting it into equal intervals of 20 grades of a continuous indicator ranging from 1 to 100.

This new index (recalculated in order to range from 1 to 5) gives a synthetic view of the results: a single national value can be produced by this method enabling time analysis or comparison between countries.

Table 4.2-3 Aggregated water quality grades by size class of watercourse

Indicator	**Size class of watercourses**				
	Main rivers	Large tributaries	Rivers	Brooks	**Total**
Organic matter (1992)	3.32	3.05	2.88	2.68	2.98
Organic matter (1994)	3.06	2.82	2.69	2.75	2.83

Source: Ifen – The accounts of the quality of the watercourses, August 1999

A two-stage improvement of the quality accounts is envisaged by Ifen: on the one hand, developing the geographical and hydrological databases, and on the other hand, developing, with the help of EUROWATERNET, the statistical surveys of water qualities up to producing continuous figures for the quality indicators instead of today's integer values of water quality classes.

4.3 Water quantity accounts

4.3.1 Description of water flows and stocks

As explained in section 1.2.1.3, in its present form, the set of pilot tables does not include any measurement of the flows of water in nature. Only water flows within the economy (water uses by economic activities) and between the economy and the nature (abstraction and discharges) are dealt with in pilot tables 6 to 9.

However flows of water in the nature, 'natural' flows, are important to assess and describe because they determine the availability of water for the economy. Natural flows not only affect the quantitative availability of water, but also the flows of pollutants. The Norwegian pilot application shows that an important part of the nitrogen emissions are due to natural flows. Furthermore, water has many *in situ* uses, which influence economic activities (fishing, hydroelectricity, river transportation; leisure, etc.).

In current national accounts, apart from groundwater which may have an economic value, natural water resources are not distinguished from the land they cover. Although a monetary valuation of the water resources as such seems out of range for the moment and outside of the agenda of national accounts developments, research is being carried out to study land valuation and hedonic pricing techniques could give rise to some progress. In any case due to its characteristics, water cannot be studied alone: a complete accounting framework should integrate also accounts on land use, on material flow balances of pollutants, etc.

The NAMEA-type framework can easily be extended without having to reconsider the present developments. In addition to parts A, B and C of the NAMEA framework used as a background for the pilot set of tables a fourth part D can describe in physical terms the ‘natural’ flows of water and of water pollutants. These natural flows are not under the control of any institutional unit. It means that although they may be influenced or induced by human activities, they are not totally controlled.

Natural flows of water could consist in: precipitation, inflows from other (foreign) inland water systems (surface or groundwater), outflows to other inland systems and to the sea, evapotranspiration and natural transfers between components of the hydrological system such as infiltration or run-off.

In this context, renewable resources are calculated as the sum of precipitation plus inflows less evapotranspiration; they also include the effects of natural transfers between components of the hydrological system. The natural accumulation in the water system is calculated by deducting, by component (groundwater or surface water), outflows to other hydrological water systems (or sea). The overall accumulation into the various components of the water system results from the natural accumulation and the economic balance.

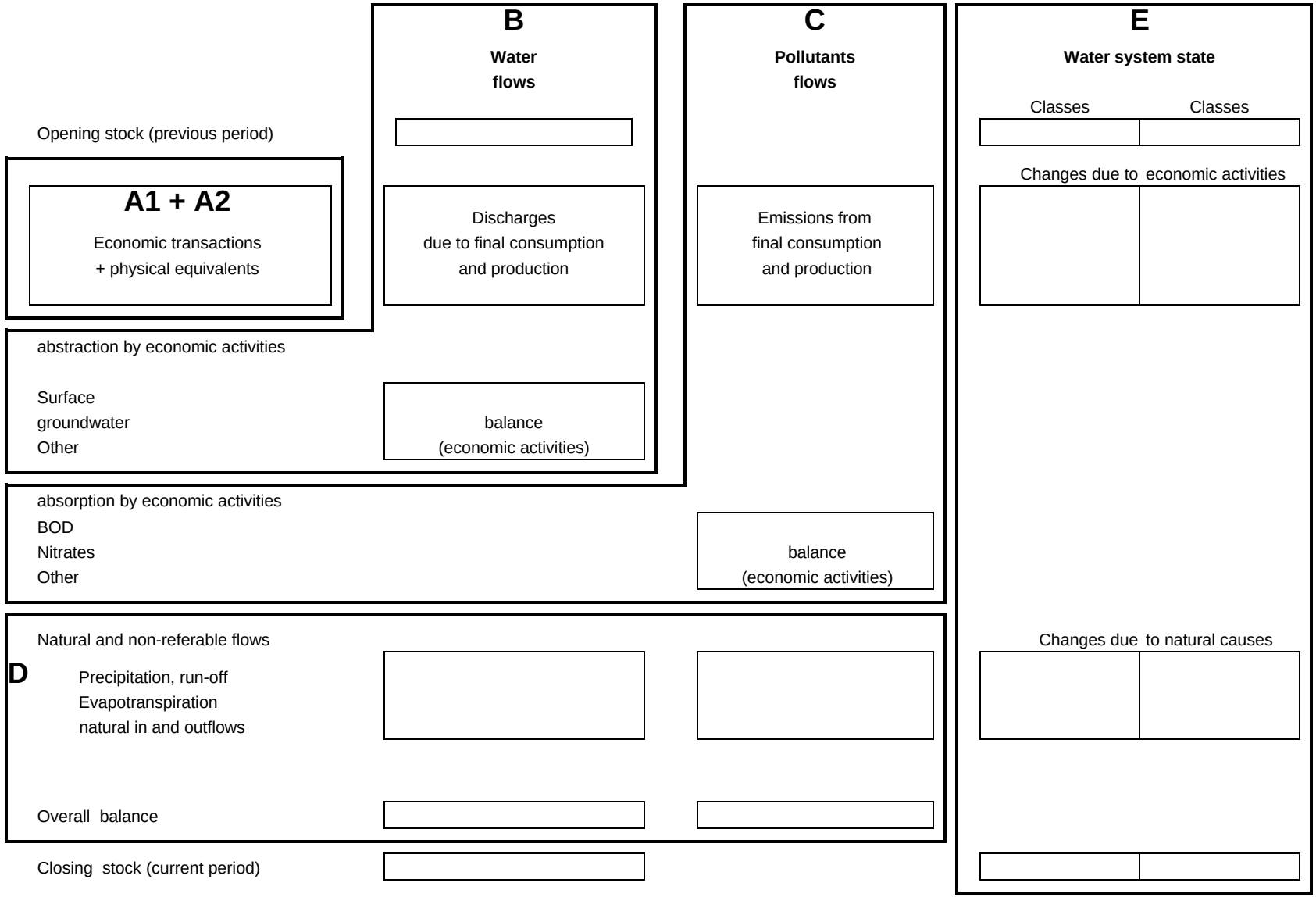
The same kind of description can apply to flows (and stocks) of water pollutant transported by the various natural flows of water: examples are atmospheric pollutants brought by acid rains, indirect pollution from fertiliser, pesticides, manure spread on agricultural land, etc.

The description of the flows of water can also be supplemented with the description of opening and closing stocks of water, i.e. the volume of water bodies filled with water at the beginning and the end of the accounting period. Overall accumulation would be equal to the change in stocks during the accounting period.

These stocks themselves can also be described for example in terms of km.s.r of different quality classes for surface water bodies (see Section 4.2) and a part E would record, by classes, the changes and the stocks at the beginning and end of the period. The sustainability would then be assessed through the evolution of such indicators as the aggregated water quality grades presented in Table 4.2-3.

There is still much work to be done before being able to build a complete system at the European level. What is important to note is that the proposed start leaves room for necessary improvement and extension.

Scheme 4.3-1 An extended NAMEA-type framework applied to water



4.3.2 Economic availability of water

The previous scheme includes a description of the stocks and flows of water resources. However, water resources which are not accessible given the current infrastructure, the quality of the water bodies, the relative price etc. should clearly not be included in this description of water resources which is linked to the economy. All water, though, should be recorded in a hydrological description, as also inaccessible water resources may be important to water management including because of the natural transfers between the different components of the hydrological system.

An indicator frequently used compares the abstraction of water in cubic meters with the amount of the renewable resources (definition in above section) in a certain period. Again, renewable resources are not 'economic' in their totality, nor may they be totally abstracted. Only a part of renewable resources are exploitable: a number of hydrological-environmental or socio-economic considerations or constraints reduce the possibility of abstraction. There are 'physical' constraints: for instance, during certain periods of the year, water is stored in soil or glaciers and cannot be abstracted. Water may also be 'lost' underground, i.e. that it infiltrates, but a corresponding aquifer is not identified. Secondly, for each component of the hydrological system and for a given period, a constraint is the maintenance of all its functions:

- for an aquifer, abstraction must not contradict the future replenishment of the aquifer and the maintenance of its functions (avoiding, e.g. salt intrusion, subsidence, stress due to insufficient supply of water for crops, springs drying, etc.).
- for water in lakes, reservoirs, dams, etc. and for current watercourses (rivers, brooks, etc.) abstraction must not threaten the maintenance of the economic, ecological or recreational 'in situ' functions or uses of water (support of biodiversity, bathing, fishing, sailing, outflows to other components of the inland water system, etc.).
- The replenishment speed for each component has to be considered, as well as the definition of a minimal flow which respects the constraints cited above. Again, with 'speed' and 'flow', we face the problem of the introduction of time in the accounts.

Abstraction is not only limited by the requirement to maintain minimum flows or levels of water but also limited by current technology, by the costs of abstraction, purification and distribution compared to prices.

On the other hand, water may be used more than once. Water abstracted and discharged upstream may be used again further downstream. It would therefore in principle be possible that total water use exceeds 100% of the renewable resource. No Member State has yet tried to measure 'economically available' water.

5 Findings and outstanding issues

5.1 Lessons learned from pilot applications

In 14 EU Member States plus Norway, pilot studies on water accounts have been carried out. The general aim of the studies was to try to measure the interactions between economy and the water environment, but they varied to a high degree in their objectives, coverage and methods. What the studies had in common is that they used the concepts of national accounting to present physical data about water. Therefore, results can straightforwardly be compared to the detailed data for the economy available in the national accounts.

Thanks to the variety of the studies, much methodological material has been extracted, some studies complementing others. At this stage, the main conclusions to draw from the studies are the following.

General accounting framework

No result actually calls the chosen framework into question. The necessity to build a bridge between economic and environment statistics is obvious and the form of a satellite to national accounts seems well adapted.

Some deviations from the initial proposal in the implementation by certain Member States are worth discussing:

- Types of uses: since we must stop at a certain level of detail in the NACE classification, the question is raised regarding the possibility of grouping the NACE classes according to the type of use they make of water.
- Coverage: some countries extended the study to some seawater uses.
- Territorial level: countries have already begun to build some accounts at infra-national levels such as existing administrative entities (e.g. counties) or water-related geographical entities (hydrological basins). Given the importance of river basin integrity in the Water Framework Directive, these developments are particularly interesting and encouraging.
- Time: in relation to the cyclical characteristic of water, time appears as an essential element to account for, notably in the definition of sustainable economic development vis-à-vis water. For the moment, there are still difficulties in tackling this problem and research must go on.

It should also be highlighted that this test only included the economy's more obvious relations to water, essentially water distribution and wastewater treatment. In situ uses of water have not been covered.

Concepts

Overall, the concepts have not been questioned by the tests. However, in practical implementation, a number of concepts have not been fully respected. This may be due to a lack of data and, in this case, proxies have been provided. This is typically the case for different nomenclatures of activities, for example. Another reason is that, contrary to national accounts, it has not been a long time that European concepts regarding environmental statistics are in place, and they have not been sufficiently well harmonised yet. In particular, different classifications of water bodies could be found.

Pilot tables

One table, Table 8, on the abstraction of water for making drinking water by classes of water quality, has not been filled in by any country due to lack of data.

All other tables proposed by the Task Force have been filled in at least partially, by at least one country, if the question of the detailed format is put aside. This, in itself, proves its feasibility.

Nonetheless, a better clarification of their integration seemed necessary, as well as more precise definitions.

Eurostat will also have to consider which parts of the framework have the highest priority, referring in particular to the new political developments (notably the Water Framework Directive). In some countries, considering the present state of data availability, it will be rather costly to establish a complete data collection system.

Availability of data

Many countries concluded their study by saying that there are apparently many sources available and that it is just a question of organisation and harmonisation.

From this point of view, however, countries are not at an equal stage. Particular links have been noted with:

- the nature and degree of concern about water in the country (abundance or lack, good or poor quality),
- the administrative organisation of the water control (one national Environment Agency, regional 'water boards', local authorities),
- the local management of the water-related activities (private or public),
- the existence of a taxation system related to water (for abstraction and/or pollution).

Some monetary data regarding water (covering essentially NACE 41 activity) are already included in the main sets of national accounts and an extra unexpected result was that, through this pilot study, a number of Member States discovered new sources for improving their national accounts.

Analyses

Another unexpected outcome of the studies has been the provision by practically all Member States of analyses of the data collected: ratios, graphic analyses, times series, etc.

Indeed, consideration should be given as to how to present the results in a way adapted to users. This raises the question of extracting indicators from the global framework. Very interesting ones have been built in the different tests and Eurostat will have to consider how to include them in the framework.

5.2 Conclusions of the April 2002 Water Accounts Task Force

In April 2002 the Task Force on Water Accounting met once again. The meeting drew conclusions as concerns the results of the water accounts pilot exercises and developed a revised set of tables (presented in Annex 2). The joint meeting of the Working Group "Environment and Sustainable Development" and the Working Party "Economic Accounts for the Environment" (Luxembourg 1 to 3 October 2002) welcomed the progress made. The Working Party "Economic Accounts for the Environment" agreed that data collection from Member States should start based on the revised set of water accounts tables.

The main conclusions of the April 2002 meeting of the Water Accounts Task Force are summarised below. The Task Force had in front of it a draft revised set of water accounts tables which was the basis for discussion (the table numbers in the conclusions refer to this draft revised set).

5.2.1 Results of water accounts pilot exercises

After reviewing the draft Eurostat publication 'Water Accounts – Results of pilot studies' the Task force concluded that:

1. Sources of water-related data often exist but are not always easily accessible centrally. Accessibility depends on the organisation of water policy in countries. Where the competence is regional or local, data sources are often diverse and no central system is in place. Where shared waters are a common concern (such as the Rhine or the Baltic Sea) data availability may be better.
2. For some variables (e.g. pollutants) the quality of data is improving and expected to improve further due to the Integrated Pollution Prevention and Control Directive (IPPC) and the Water Framework Directive (WFD). At present rough estimates are often necessary.
3. The links among the standard set of water accounts tables, the OECD/Eurostat Joint Questionnaire on Inland Waters and the requirements of the WFD (e.g. the economic variables needed) should be improved and definitions harmonised to the maximum extent possible.
4. The tables that countries chose to test: some countries (e.g. E, NL, S) tried to implement the complete set of tables whereas others focused on subsets (e.g. physical flows or flows of pollutants) due to policy interest or in order to identify data gaps and devise strategies for improving information systems. Also institutional arrangements are reflected in the results. Where environmental agencies conducted the test, the focus was on physical data. For these countries, more tables could be implemented than were tested.

5. Primary data on water flows are often based on surveys that are multi-annual (e.g. D, NL). Annual water accounts linked to the national accounts are possible using interpolation and extrapolation methods. Some countries are moving towards annual data collection.

6. For the monetary data, the national accounts did not always provide sufficient detail and primary data sources were directly used. For example, where the same units undertake water supply and wastewater management, the business registers and the national accounts will apply the main activity criterion, classifying the whole of the economic data under either NACE 41 or NACE 90.01. For the water accounts, primary data were used to split these data.

7. The water accounts framework with its set of tables was considered practical and useful. Wider issues exist (e.g. state of water bodies, indirect effects) but should not be incorporated into the set of tables at this stage. The set of tables was considered a useful key input for modelling work that links pressures (abstraction, pollutants) to changes in state.

8. Seawater used mainly for cooling should be shown separately in the tables. It was however noted that for publication purposes the focus would often be on freshwater as the amounts of seawater used may be enormous.

9. Old table 8 (quality of the raw water abstracted for making drinking water) was not filled in by any country. Data by industry would not be available, only data from the waterworks could be expected. A similar table that was in the OECD/Eurostat Joint Questionnaire on Inland Waters has been deleted due to lack of response. However, as the data are expected to improve, Table 8 should be put on ice and re-considered together with the issue of the status (quality) of water bodies at a later stage.

10. A priority ranking for the tables was not useful, as all were essential.

5.2.2 The set of standard tables

The Task Force reviewed the proposed 'Revised set of standard water accounts tables' and concluded that:

11. Some changes in the set of tables will be made that are due to external events (new Joint Questionnaire definitions, revised NACE…).

12. Tables 8 and 13 will be removed from the standard set. Old table 7 will be split in two (one for abstractions, one for returns of water).

13. The industry classification was agreed. It was noted that some countries would have difficulties to provide the desired detail for services. The industry '75.12*' was discussed at length. Some countries had included data relating to flood defence or restoring the quality of water bodies – activities unrelated to water supply or wastewater management. The Task Force agreed to restrict the definition to activities related to water supply or wastewater management. To the extent possible, this industry should be split up and the data recorded under NACE 41 and 90.01, respectively. Flood protection, dredging of rivers, navigation and damages due to floods should be excluded altogether at this stage. Water abstracted but not used (e.g. pumping of water from polders in the Netherlands) is however included. If such activities are important, the category '75.12*' should be sub-divided.

14. The breakdown of products (drinking water, non-drinking water, and distribution services) will be kept although it was expected that this distinction was not important in most cases.

15. Types of uses: irrigation, cooling and 'other' will be distinguished. This will only be done in new tables 7A (abstractions of water) and 7B (returns of water), adding columns for cooling and a row 'of which irrigation' under the row 'Agriculture'. The 'Total abstractions' will be termed 'Gross abstractions' in accordance with the new Joint Questionnaire. It will be clarified in the notes to the tables that abstraction for distribution from non-freshwater sources will only include desalinated water and self-supplied water from non-freshwater sources is sea and brackish water mainly used for cooling.

16. The category 'rainwater, drainage and net infiltration' was agreed as an extra 'source' of water so as to ensure that abstractions and returns balance. The use 'environmental protection' as distinguished in Denmark represents about 2% of total fresh water abstraction and refers to abstracting groundwater for purposes of influencing water tables so as to prevent pollutants from entering areas designated for drinking water supply. This will be added as an additional example of 'abstraction not for use' in the notes to the tables.

17. All the original 8 heavy metals and other pollutants will be kept. No new pollutants will be added.

18. NPISHs will no longer be separately distinguished.

19. The industries in the tables were actually homogeneous branches of production in D and DK. Other countries used specific data sources for NACE 41 and 90.01 to arrive at a concept close to 'pure branches'. It was agreed that for NACE 41 and 90.01 such 'purification' should be done to the extent possible.

20. Deliveries among water producers exist but are perhaps not very important. Equally important are the uses of water by the water producers, e.g. for cleaning of pipes (5% of total water for distribution in S, 2% in D). These own uses appear in the physical tables but not in the monetary tables.

21. In table 2, the column for CPA 90.01 will be kept.

22. Old table 3 requested a split of water supply into sub-functions (purification, distribution). Only Sweden could do a split. The simplified version of table 3 without such sub-functions was agreed. The 'of which environmental' under taxes and subsidies will be deleted.

23. Self-supply in monetary terms (Table 4) is possible for wastewater management due to established specific data collection systems (SERIEE, environmental expenditure variables in the Structural Business Statistics Regulation, national environmental expenditure surveys). The notes to the table will explain that some of these sources may not provide all variables. E.g. compensation of employees, intermediate consumption and taxes on production may only be available as a sum; data on consumption of fixed capital may not be available directly and will have to be estimated using established national accounts procedures. For self-supply of water such specific sources are generally missing. Surveys or estimations based on physical quantities would be required. The columns referring to self-supply of water will be kept.

24. Tables 5 and 6 will be changed to be consistent with the conclusions above. No other changes will occur.

25. The Task Force discussed the usefulness and feasibility of splitting the discharges into 'returns to inland waters' and 'discharges to the sea'. It was noted that the boundary between inland waters and sea is often blurred due to estuaries. The split was nonetheless considered useful. There is no experience from the Joint Questionnaire as this split was newly introduced in the latest revision. Data that allow this split for the volumes of water discharged are available in many countries. It is more doubtful whether this split can be provided by industry.

26. The usefulness of consolidation items in Table 9 was discussed. A particular issue is leakage from the sewage network which cannot be measured directly. What can be estimated is the difference between the volumes of wastewater discharged to the sewage system and the volumes of wastewater discharged by the collection systems. This difference results from the net effect of rainwater that enters the sewage system, the infiltration of groundwater into the sewage system and the losses of wastewater through leakage. The order of magnitude for this difference is substantial (in some countries an order of 1/3 of the wastewater arriving at wastewater treatment plants). Therefore, this consolidation item will be kept. It will be clarified that the **net** infiltration (which can be negative) should be recorded as part of the column "rainwater, drainage and infiltration" in table 7A. A better title for this column will be sought to make the concept clearer. Two main components are usefully distinguished: a) water abstracted not for use from e.g. mining and construction sites and b) rainwater and net infiltration entering the sewage system.

27. Pumping for drying polders seems similar to pumping in mining activities. It will also be recorded in table 7A, column "rainwater, drainage and infiltration" as regards the physical flows, and a specific sub-column will be created in table 1 (column 75.12*) to record the corresponding production (see also above point 13).

28. The consolidation flows in table 9 can easily be introduced in tables 7A and 7B. Table 9 will therefore be replaced by an extension of tables 7A and 7B. This includes for example to add the re-used wastewater and the distribution losses in tables 7A and 7B (or directly in Table 5), and the resulting balance in table 7B. Cooling water returns will be shown also. The links to columns in other tables will be made clearer by specific reference numbers and by using the same titles.

29. Table 9A describes the transition from physical 'consumption' of freshwater (i.e. all water not returned to the inland water system) to the physical 'consumptive use' of water (i.e. mainly the water evaporated). The difference between these two concepts taken from the Joint Questionnaire is the water discharged to the sea. The Joint Questionnaire definition of 'consumptive use' also includes some (usually small) flows such as the incorporation of water into products or changes in stocks of produced water. The orders of magnitude of water incorporated in products are small (e.g. in Germany some 0.5% of total

freshwater use) but this share is higher e.g. for the industries where the incorporation of water takes place such as in manufacturing of beverages, dairy farming, construction (cement), etc. In Table 9A also the water removed from products is shown which mainly occurs during consumption of agricultural products and beverages by households. Only D and DK have information available to fill in table 9A. Following the many flows of water contained in other materials is complicated and requires estimations. For example, water incorporated in products from rain-fed agriculture does not come from abstraction (only irrigation water is recorded as abstracted) and could be recorded as an 'eco-system input'. Manure from agriculture spread on fields can include a lot of water (about 8% compared to total agricultural freshwater use in Germany) but may not be recorded as a discharge. Water may be contained in products imported and exported, or in organic waste that is incinerated or land filled. The category 'other consumptive uses' in Table 9A (essentially the water evaporated during use) is derived as a balancing item and thus also includes any statistical discrepancies. An attempt will be made to integrate Table 9A with table 7B for countries that need it.

30. For the tables on pollution the Task Force discussed two alternatives (tables 10 to 12 versus tables 10A to 13A). Theoretically, the "emission" of pollutants is the difference between the pollutants discharged in wastewater at the end of the production process and the pollutants contained already in the water purchased or abstracted at the beginning of the production process. In practice, estimating the true "emissions" of pollutants would require to assess the pollution loads in both the incoming water and the outgoing wastewater.

31. In statistical practice, some countries (e.g. A and NL) recorded actual emissions, while others (e.g. S and D) recorded only pollutants discharged in wastewater because data on the pollution content of abstracted water is not available. The latter approach corresponds to the assumption that water abstracted is not polluted which is realistic for some countries and pollutants. However, the differences between the two methods can be important for some heavy metals and for some processes. For example, the difference between the emissions (i.e. the pollutant load added by an industry) and the total discharge was 20% for zinc in Austria, mainly due to river water (already contaminated with zinc from roofs etc.) used for processing in the metal industry. Also for AOX the differences can be important. The Task Force concluded that alternative tables 10A, 11A, 12A and 13A should be maintained.

32. Table 11A will be kept for cases of distributed non-drinking water only. It will be assumed that drinking water does not include any significant quantities of the pollutants recorded in tables 10A to 13A.

33. To keep coherence with the recording of water flows, table 13A will be split in two: pollutants going to the fresh water system and pollutants going directly to the sea. For the moment (for example in the UK), this breakdown is possible for the total but not by industry. Table 13A will be complemented by a "Table 13Aa - of which: to the sea" to promote developments in data availability. Only net abstractions will be considered in table 10A and returned (unused) water will not be followed either in table 13A.

34. Information about the pollutants abstracted by internal treatment (within an establishment) would be very interesting but very few countries would have the data to do this. Extra information will thus not be required.

35. The old table 13 (on implicit prices) will be removed from the set of standard tables.

36. The monetary tables will be in national currency. For Member States outside the euro-zone, Eurostat will apply a standard conversion rate to the euro.

5.2.3 Presentation of results and indicators

As concerns the presentation of results and indicators the Task Force concluded that:

37. Implicit water prices (example of DK): DK does not show implicit water prices any more in its publications. Implicit water prices may be influenced more by the **location** of the economic activities than by the activities themselves. In rural areas, the water price is generally lower. Fixed payments represent fees paid for connection of new buildings to the networks. They are paid first by the construction industry and resold in the buildings' values.

38. The comparisons between costs and charges show an "election" effect for Ireland. It would be interesting to compare these series with the series of the uses in m^3.

39. A diagrammatic presentation of water flows (example of Spain, also done in e.g. Germany or Sweden) is particularly useful to detect missing information and to reconcile different sources, for instance actual measurements and estimates at different places. The flows should be presented proportionally with the

thickness of the arrows representing the order of magnitude of the flow. Also, physical consumption and consumptive uses should be shown (i.e. the diagram should balance).

40. DK publishes a “water intensity” indicator every year. Its power mainly lies in a time series analysis for the same industry: in that case, it shows how a specific industry improves its efficiency as regards the use of water. In some cases, however, results cannot be analysed in these terms: variations in water use by agriculture, for example, can be due to variations in rainfall. Such intensity data have been used in UK to decide upon the abandonment of certain crops, but interpretation of water intensities across industries requires care.

41. The same remark applies to eco-environmental industry profiles: they are most useful to analyse improvement/deterioration of eco-efficiency in a specific industry along the time dimension. Care needs to be taken as the results are sensitive to the level of aggregation of industries which may group together sub-industries with very different water use or pollution profiles (e.g. leather tanning with manufacture of leather products, finishing of textiles such as bleaching and dyeing together with weaving and manufacture of textile articles, etc.). With a view to regional accounts this issue may be even more important. The eco-profiles should be complemented by input-output analysis showing the allocation of the indicators to final demand categories. For instance, DK has estimated that 56% of its water use can be imputed to exports.

42. The “water productivity” indicator used e.g. in D shows the technological improvements (re-use of water, replacement of water by another product in certain uses, less consuming household equipment, etc.) but also the introduction of pricing for irrigation water in Eastern Germany. During the meeting, D distributed an “Abstract of the press conference report 2001 on environmental-economic accounting in Germany” showing different indicators: water uses by sector, discharge of wastewater, European comparisons of withdrawal of water and of withdrawal of water per inhabitant.

43. In NL, impacts of the different pollutants are grouped into environmental “themes” by attributing weights (supplied by the Environment Department) to them. In this representation, cleansing activities have, of course, negative impacts.

44. Maps were considered a very useful way of presenting results. Clear texts to explain the maps were considered essential.

45. S builds graphs showing on the X-axis the percentage change in the value added and on the Y-axis the percentage change in water use. According to the quadrant in which the time series is located, the degree of de-coupling of water use can be shown.

46. The Task Force noted that when time series are available, decomposition techniques could be applied showing the factors that explain the total change (economic growth, structural change, technological improvements, etc.).

5.2.4 Future development needs

The Task Force concluded that:

47. The regionalisation of the water accounts and the water quality accounts are key direction for future development.

48. Regional accounts: in D, regional accounts have already been built for 2 Länder, others are currently being built. In the NL, accounts are being built at the river basin level, but confidentiality problems are met. In DK, regional data exist, but here also, confidentiality is a problem. In France, many of the data are available for the main river basins. In F and DK, public water supply data are also available at lower regional levels. In UK, the water companies can provide regional data and regional environmental accounts are being developed on different topics (air emissions…). In A, physical data are available for the 9 regions. S did already work on developing methods for regionalising the water accounts and now waits for a definition of the river basin districts by the legislator to begin implementing the breakdown.

49. Water quality accounts have been built in France, initially by combining water quality maps and measurement of the flows in the rivers. A specific accounting unit (the kmsr or kilometre of standard river) allows aggregation and comparisons of water quality. These accounts have also been tested in Ireland, England and Wales and Slovenia. The general view about this type of accounts was that they should be built by national environmental protection agencies and the European Environment Agency.

50. None of the countries represented at the Task Force plans to integrate the concern about time. Quarterly accounts are only needed for few countries where seasonal availability of water is a key issue.

51. Physical stocks of water have been determined for some countries. Canada is currently investigating possibilities for the monetary valuation of water stocks. Stocks are not a main concern at the European level. More interesting is the estimation of renewable resources and such an estimate is for example made in A and D by the Institutes of Hydrology. In some countries, the abstraction of water is taxed which could be the starting point for monetary valuation. Issues of stocks and stock valuation were considered interesting areas for future research.

52. In most countries, the implementation of the Water Framework Directive will imply sizeable developments. Key issues include regional accounts and emission data. In D, the WFD will imply new monetary data, regional data, data on emissions. In DK, Statistics Denmark is not directly involved in the implementation of the WFD but will participate on the pollutants part. Taxation of water is a key issue. Water in DK now has a higher share in the household budgets than electricity and as much as heating. Water prices are also a concern in France, where the plan is a disaggregation of annual and national accounts by industry and by region. The UK has recently finished the exploitation of a survey about abstractions and will try to fill in the data gaps concerning pollutant loads. NL is about to publish national data for 96, 97 and 98 and will regionalise the accounts if the necessary funding can be found. A will work on disaggregating to catchment areas and on the implementation of the WFD, notably on the recommendations of the WFD Working Groups and on efficient systems of data collection. S is currently finishing accounts for 2000, tries to improve the quality of the data, works on the harmonisation with the national accounts and will try to develop better data on pollutant loads.

Annex 1: Pilot water accounts tables used in the pilot exercises

The following tables, proposed for testing after the first round of meetings of the Eurostat Task Force on water accounting have been described in various parts of the document:

- The general framework, the definitions of the concepts and nomenclatures used, the links between the different tables in Chapter 1 Section 1.2.4,
- Tables 1 to 4 and Table 13 (water economy) in Section 2.1,
- Tables 5 to 9 (flows of water) in Section 2.2,
- Tables 10 to 12 (flows of pollutants) in Section 2.3.

Classifications used

Most of the concepts used in the tables refer to ESA, the classifications refer to NACE Rev.1 for activities, and to CPA for products.

Classification of industries (nearly all tables):

NACE Rev.1 at the level of subsections has been chosen with the following amendments.

Services have been grouped, as probable lesser users of water, while, on the contrary NACE 41, and parts of NACE 01, 75 and 90 have been isolated. However, in the broader context of satellite accounts integrating other environmental themes, it might conceivably be better to keep the service sectors separate.

NACE 90 has been broken down into 2 sub-classes:

a. 90* corresponding to the activity of sewage removal and treatment (production of CPA 90.00.11 product)
b. the other activities of NACE 90 have been grouped with the rest of the services.

The same applies to NACE A in order to isolate the producers of services of operation of irrigation systems and to NACE 75 in order to isolate the producers of administrative services related to water supply and sewage systems.

Classification of water-related products (Tables 1, 2, 5, 6, 8 and 13):

CPA level of sub-categories, but if possible, even part of a CPA sub-category, when referred to in the CPA explanatory notes, would be better.

Pilot Table 1 - Monetary supply table of some water-related products (in monetary units)

Economic product / Supplier		Water distribution and treatment (CPA codes)								Other products (second priority)
		Part 01.41.11 Operation of irrigation systems	41.00.11 Drinking water	41.00.12 Non-drinking water	41.00.20.01 Distribution services of drinking water	41.00.20.02 Distribution services of non drinking water	**41.00 Total distributed water**	**Part 75.12.13 Water-related administrative services**	**90.00.11 Sewage removal and treatment**	
01*	Operation of irrigation systems									
A*	Agriculture, hunting and forestry, except 01*									
B	Fishing									
CA	Mining and quarrying of energy producing materials									
CB	Mining and quarrying except energy producing materials									
DA	Manufacture of food products; beverages and tobacco									
DB	Manufacture of textiles and textiles products									
DC	Manufacture of leather and leather products									
DD	Manufacture of wood and wood products									
DE	Manufacture of pulp, paper; publishing and printing									
DF	Manufacture of coke, refined petroleum and nuclear fuel									
DG	Manufacture of chemicals, man-made fibres									
DH	Manufacture of rubber and plastic products									
DI	Manufacture of other non-metallic mineral products									
DJ	Manufacture of basic metals and fabrication of metal products									
DK	Manufacture of machinery and equipment n.e.c.									
DL	Manufacture of electrical and optical equipment									
DM	Manufacture of transport equipment									
DN	Manufacturing n.e.c.									
41	Collection, purification and distribution of water									
E*	Electricity, gas and water supply, except 41									
F	Construction									
75*	Public administrative services for water supply and sewage systems									
90*	Sewage removal and treatment services									
R*	Other services (G to Q, except 75* and 90*)									
Total output at basic prices										
Taxes on products										
	Of which environmental taxes									
Less subsidies on products										
	Of which environmental subsidies									
Imports CIF										
Total supply at purchasers' prices										

Pilot Table 2 - Monetary use table of some water-related products (in monetary units)

Economic product / User	Water distribution and treatment (CPA codes)								Other products (second priority)
	Part 01.41.11 Operation of irrigation systems	41.00.11 Drinking water	41.00.12 Non drinking water	41.00.20.01 Distribution services of drinking water	41.00.20.02 Distribution services of non drinking water	**41.00 Total distributed water**	**Part 75.12.13 Water-related administrative services**	**90.00.11 Sewage removal and treatment**	
01* Operation of irrigation systems									
A* Agriculture, hunting and forestry, except 01*									
B Fishing									
CA Mining and quarrying of energy producing materials									
CB Mining and quarrying except energy producing materials									
DA Manufacture of food products; beverages and tobacco									
DB Manufacture of textiles and textiles products									
DC Manufacture of leather and leather products									
DD Manufacture of wood and wood products									
DE Manufacture of pulp, paper; publishing and printing									
DF Manufacture of coke, refined petroleum and nuclear fuel									
DG Manufacture of chemicals, man-made fibres									
DH Manufacture of rubber and plastic products									
DI Manufacture of other non-metallic mineral products									
DJ Manufacture of basic metals and fabrication of metal products									
DK Manufacture of machinery and equipment n.e.c.									
DL Manufacture of electrical and optical equipment									
DM Manufacture of transport equipment									
DN Manufacturing n.e.c.									
41 Collection, purification and distribution of water									
E* Electricity, gas and water supply, except 41									
F Construction									
75* Public administrative services for water supply and sewage systems									
90* Sewage removal and treatment services									
R* Other services (G to Q, except 75* and 90*)									
Total intermediate consumption of industries									
Total final consumption									
Of which by government									
by NPISH									
by households									
Changes in inventories									
Exports FOB									
Total uses at purchasers' prices									

Pilot Table 3 - Economic accounts for some water-related economic activities (in monetary units, except for item 7)

	Non-financial corporations	General Government	NPISH	Households	Total
Production and generation of income accounts					
1 Total intermediate consumption					
2 Total value added, gross					
2.1 Compensation of employees					
2.2 Other taxes on production					
Of which: environmental taxes					
2.3 Less other subsidies on production					
Of which: environmental subsidies					
2.4 Consumption of fixed capital					
2.5 Net operating surplus					
3 Total output at basic prices					
3.1 Market					
3.2 Non-market					
Supplementary information about fixed capital and labour inputs					
4 Investment grants					
5 Gross fixed capital formation					
6 Closing stocks of fixed assets					
7 Total hours worked					

Ideally, a table must be filled in for each of the following major activities:

1 operation of irrigation systems (part of NACE 01)

2 production of distributed water (NACE 41), if possible broken down into:

- *2.1 production of drinking water, if possible broken down into:*
  - *2.1.1 abstraction*
  - *2.1.2 purification*
- *2.2 production of non-drinking water, if possible broken down into:*
  - *2.2.1 abstraction*
  - *2.2.2 purification*
- *2.3 distribution services of water, if possible broken down into:*
  - *2.3.1 for drinking water*
  - *2.3.2 for non-drinking water*

3 sewage removal and treatment (part of NACE 90), if possible broken down into:

- *3.1 removal*
- *3.2 treatment*
- *3.3 discharge*

4 administrative services related to water supply and sewage systems (part of NACE 75) and as much as possible for second priority activities.

Pilot Table 4 - Expenditure for some ancillary water-related activities (in monetary units, except for last column)

Expenditure	Current expenditure				Capital expenditure	Second priority		
	Intermediate consumption	Compensation of employees	Taxes related to water	Less subsidies related to water		Consumption of fixed capital	Closing stock of fixed assets	Labour inputs in total hours worked
01* Operation of irrigation systems								
A* Agriculture, hunting and forestry, except 01*								
B Fishing								
CA Mining and quarrying of energy producing materials								
CB Mining and quarrying except energy producing materials								
DA Manufacture of food products; beverages and tobacco								
DB Manufacture of textiles and textiles products								
DC Manufacture of leather and leather products								
DD Manufacture of wood and wood products								
DE Manufacture of pulp, paper; publishing and printing								
DF Manufacture of coke, refined petroleum and nuclear fuel								
DG Manufacture of chemicals, man-made fibres								
DH Manufacture of rubber and plastic products								
DI Manufacture of other non-metallic mineral products								
DJ Manufacture of basic metals and fabrication of metal products								
DK Manufacture of machinery and equipment n.e.c.								
DL Manufacture of electrical and optical equipment								
DM Manufacture of transport equipment								
DN Manufacturing n.e.c.								
41 Collection, purification and distribution of water								
E* Electricity, gas and water supply, except 41								
F Construction								
75* Public administrative services for water supply and sewage systems								
90* Sewage removal and treatment services								
R* Other services (G to Q, except 75* and 90*)								
Total industries								
Households for final consumption								
Total								

Ideally, a table must be filled in for each of the following activities: abstraction of water from water system; purification of abstracted water; internal recycling of water; internal treatment of wastewater before discharge; and discharge of wastewater into water system and as much as possible for second priority activities.

Pilot Table 5 - Physical supply of water (corresponding to Pilot Table 1 – in thousand m³)

Economic product / Supplier		Irrigation water delivered	Drinking water delivered	Non-drinking water delivered	Total drinking + non drinking	Wastewater collected by sewage networks	Wastewater treated by sewage networks
01*	Operation of irrigation systems						
A*	Agriculture, hunting and forestry, except 01*						
B	Fishing						
CA	Mining and quarrying of energy producing materials						
CB	Mining and quarrying except energy producing materials						
DA	Manufacture of food products; beverages and tobacco						
DB	Manufacture of textiles and textiles products						
DC	Manufacture of leather and leather products						
DD	Manufacture of wood and wood products						
DE	Manufacture of pulp, paper; publishing and printing						
DF	Manufacture of coke, refined petroleum and nuclear fuel						
DG	Manufacture of chemicals, man-made fibres						
DH	Manufacture of rubber and plastic products						
DI	Manufacture of other non-metallic mineral products						
DJ	Manufacture of basic metals and fabrication of metal products						
DK	Manufacture of machinery and equipment n.e.c.						
DL	Manufacture of electrical and optical equipment						
DM	Manufacture of transport equipment						
DN	Manufacturing n.e.c.						
41	Collection, purification and distribution of water						
E*	Electricity, gas and water supply, except 41						
F	Construction						
75*	Public administrative services for water supply and sewage systems						
90*	Sewage removal and treatment services						
R*	Other services (G to Q, except 75* and 90*)						
Total output							
Imports							
Total supply							

1 These flows of water correspond to the supply of ‘removal of wastewater’ service provided by NACE 90 industry

[2] These flows of water correspond to the supply of ‘treatment of wastewater’ service provided by NACE 90 industry.

The provision of ‘wastewater treatment’ service will also be recorded by corresponding pollutants flows tables (Tables 10 and 11)

Pilot Table 6 - Physical use of water (corresponding to Pilot Table 2 – in thousand m^3)

Economic product / User	Irrigation water used	Drinking water used	Non-drinking water used	Total drinking + non drinking	Wastewater discharged in sewage networks
01* Operation of irrigation systems					
A* Agriculture, hunting and forestry, except 01*					
B Fishing					
CA Mining and quarrying of energy producing materials					
CB Mining and quarrying except energy producing materials					
DA Manufacture of food products; beverages and tobacco					
DB Manufacture of textiles and textiles products					
DC Manufacture of leather and leather products					
DD Manufacture of wood and wood products					
DE Manufacture of pulp, paper; publishing and printing					
DF Manufacture of coke, refined petroleum and nuclear fuel					
DG Manufacture of chemicals, man-made fibres					
DH Manufacture of rubber and plastic products					
DI Manufacture of other non-metallic mineral products					
DJ Manufacture of basic metals and fabrication of metal products					
DK Manufacture of machinery and equipment n.e.c.					
DL Manufacture of electrical and optical equipment					
DM Manufacture of transport equipment					
DN Manufacturing n.e.c.					
41 Collection, purification and distribution of water					
E* Electricity, gas and water supply, except 41					
F Construction					
75* Public administrative services for water supply and sewage systems					
90* Sewage removal and treatment services					
R* Other services (G to Q, except 75* and 90*)					
Total intermediate consumption by industries					
Final consumption					
Of which: by government					
by households					
by NPISH					
Change in inventories					
Exports					
Total uses					

The flows of water recorded in last column correspond to the use, by industries or households, of the ‘removal of wastewater’ services provided by NACE 90 industry.

Pilot Table 7 - Total abstraction/discharge of water from/into the water bodies (in thousand m^3)

Abstracting/discharging economic agent		Abstraction from			Total abstraction	Discharge into			Total discharge
		Surface fresh water	Ground fresh water	Other water		Surface fresh water	Ground fresh water	Other water	
01*	Operation of irrigation systems								
A*	Agriculture, hunting and forestry, except 01*								
B	Fishing								
CA	Mining and quarrying of energy producing materials								
CB	Mining and quarrying except energy producing materials								
DA	Manufacture of food products; beverages and tobacco								
DB	Manufacture of textiles and textiles products								
DC	Manufacture of leather and leather products								
DD	Manufacture of wood and wood products								
DE	Manufacture of pulp, paper; publishing and printing								
DF	Manufacture of coke, refined petroleum and nuclear fuel								
DG	Manufacture of chemicals, man-made fibres								
DH	Manufacture of rubber and plastic products								
DI	Manufacture of other non-metallic mineral products								
DJ	Manufacture of basic metals and fabrication of metal products								
DK	Manufacture of machinery and equipment n.e.c.								
DL	Manufacture of electrical and optical equipment								
DM	Manufacture of transport equipment								
DN	Manufacturing n.e.c.								
41	Collection, purification and distribution of water								
E*	Electricity, gas and water supply, except 41								
F	Construction								
75*	Public administrative services for water supply and sewage systems								
90*	Sewage removal and treatment services								
R*	Other services (G to Q, except 75* and 90*)								
Total industries									
Households for final consumption									
Total									

Abstraction by NACE 41 for production of distributed water as well as direct abstractions by other industries for their ancillary activities have to be reported in this table.

Similarly, discharges into water bodies by NACE 90 as well as direct discharges by other industries have to be reported here.

Pilot Table 8 - Abstraction from water bodies for the preparation of drinking water (in thousand m^3)

Abstracting economic agent		Surface water				Groundwater	Other water
		Quality A1(*)	A2, not A1	A3, not A2	Not meeting standards		
01*	Operation of irrigation systems						
A*	Agriculture, hunting and forestry, except 01*						
B	Fishing						
CA	Mining and quarrying of energy producing materials						
CB	Mining and quarrying except energy producing materials						
DA	Manufacture of food products; beverages and tobacco						
DB	Manufacture of textiles and textiles products						
DC	Manufacture of leather and leather products						
DD	Manufacture of wood and wood products						
DE	Manufacture of pulp, paper; publishing and printing						
DF	Manufacture of coke, refined petroleum and nuclear fuel						
DG	Manufacture of chemicals, man-made fibres						
DH	Manufacture of rubber and plastic products						
DI	Manufacture of other non-metallic mineral products						
DJ	Manufacture of basic metals and fabrication of metal products						
DK	Manufacture of machinery and equipment n.e.c.						
DL	Manufacture of electrical and optical equipment						
DM	Manufacture of transport equipment						
DN	Manufacturing n.e.c.						
41	Collection, purification and distribution of water						
E*	Electricity, gas and water supply, except 41						
F	Construction						
75*	Public administrative services for water supply and sewage systems						
90*	Sewage removal and treatment services						
R*	Other services (G to Q, except 75* and 90*)						
Total industries							
Households for final consumption							
Total abstraction							

(*) Quality standards refer to Directives 75/440/EEC and 79/869/EEC. They are recalled in the body text at Section 4.3.

Pilot Table 9 - Balance of water flows between the economy and the water system (in thousand m^3)

Economic agent	(+) Abstraction (Table 7)	(-) Leaks and losses	(+) Urban drainage	(-) Economic transactions on water (Table 5)	(+) Economic transactions on water (Table 6)	(-) Economic transactions on wastewater (Table 6)	(+) Economic transactions on wastewater (Table 5)	(-) Discharge of wastewater (Table 7)	Balance = consumption
01* Operation of irrigation systems									
A* Agriculture, hunting and forestry, except 01*									
B Fishing									
CA Mining and quarrying of energy producing materials									
CB Mining and quarrying except energy producing materials									
DA Manufacture of food products; beverages and tobacco									
DB Manufacture of textiles and textiles products									
DC Manufacture of leather and leather products									
DD Manufacture of wood and wood products									
DE Manufacture of pulp, paper; publishing and printing									
DF Manufacture of coke, refined petroleum and nuclear fuel									
DG Manufacture of chemicals, man-made fibres									
DH Manufacture of rubber and plastic products									
DI Manufacture of other non-metallic mineral products									
DJ Manufacture of basic metals and fabrication of metal products									
DK Manufacture of machinery and equipment n.e.c.									
DL Manufacture of electrical and optical equipment									
DM Manufacture of transport equipment									
DN Manufacturing n.e.c.									
41 Collection, purification and distribution of water									
E* Electricity, gas and water supply, except 41									
F Construction									
75* Public administrative services for water supply and sewage systems									
90* Sewage removal and treatment services									
R* Other services (G to Q, except 75* and 90*)									
Total industries									
Households (for final consumption)									
Total									

Pilot Table 10 - Pollutants discharged by economic activities into the sewage network (in physical units: kg, tonnes or a more adapted unit)

Pollutants / Economic agent		BOD	COD	Suspended solids	Heavy metals								Phosphorus (total)	Nitrogen (total)
					As	Cd	Hg	Cu	Cr	Ni	Pb	Zn		
01*	Operation of irrigation systems													
A*	Agriculture, hunting and forestry, except 01*													
B	Fishing													
CA	Mining and quarrying of energy-producing materials													
CB	Mining and quarrying except energy-producing materials													
DA	Manufacture of food products; beverages and tobacco													
DB	Manufacture of textiles and textiles products													
DC	Manufacture of leather and leather products													
DD	Manufacture of wood and wood products													
DE	Manufacture of pulp, paper; publishing and printing													
DF	Manufacture of coke, refined petroleum and nuclear fuel													
DG	Manufacture of chemicals, man-made fibres													
DH	Manufacture of rubber and plastic products													
DI	Manufacture of other non-metallic mineral products													
DJ	Manufacture of basic metals and fabrication of metal products													
DK	Manufacture of machinery and equipment n.e.c.													
DL	Manufacture of electrical and optical equipment													
DM	Manufacture of transport equipment													
DN	Manufacturing n.e.c.													
41	Collection, purification and distribution of water													
E*	Electricity, gas and water supply, except 41													
F	Construction													
75*	Public administrative services for water supply and sewage systems													
90*	Sewage removal and treatment services													
R*	Other services (G to Q, except 75* and 90*)													
Total industries														
Households for final consumption														
TOTAL														

Pilot Table 11 - Pollutants discharged to water bodies by economic activities (in physical units: kg, tonnes or a more adapted unit)

Pollutants / Economic agent		BOD	COD	Suspended Solids	Heavy metals								Phosphorus (total)	Nitrogen (total)
					As	Cd	Hg	Cu	Cr	Ni	Pb	Zn		
01*	Operation of irrigation systems													
A*	Agriculture, hunting and forestry, except 01*													
B	Fishing													
CA	Mining and quarrying of energy producing materials													
CB	Mining and quarrying except energy producing materials													
DA	Manufacture of food products; beverages and tobacco													
DB	Manufacture of textiles and textiles products													
DC	Manufacture of leather and leather products													
DD	Manufacture of wood and wood products													
DE	Manufacture of pulp, paper; publishing and printing													
DF	Manufacture of coke, refined petroleum and nuclear fuel													
DG	Manufacture of chemicals, man-made fibres													
DH	Manufacture of rubber and plastic products													
DI	Manufacture of other non-metallic mineral products													
DJ	Manufacture of basic metals and fabrication of metal products													
DK	Manufacture of machinery and equipment n.e.c.													
DL	Manufacture of electrical and optical equipment													
DM	Manufacture of transport equipment													
DN	Manufacturing n.e.c.													
41	Collection, purification and distribution of water													
E*	Electricity, gas and water supply, except 41													
F	Construction													
75*	Public administrative services for water supply and sewage systems													
90*	Sewage removal and treatment services													
R*	Other services (G to Q, except 75* and 90*)													
	Total industries													
	Households for final consumption													
	TOTAL													
	p.m. fertilisers spread on soils by agriculture													

Pollutants can be discharged into the water bodies either directly by industries and households not connected to the sewage network or by the operators of the sewerage (NACE 90).

Pilot Table 12 - Pollutants subtracted by economic activities (in physical units: kg, tonnes or a more adapted unit)

Pollutants / Economic agent		BOD	COD	Suspended solids	Heavy metals								Phosphorus (total)	Nitrogen (total)
					As	Cd	Hg	Cu	Cr	Ni	Pb	Zn		
01*	Operation of irrigation systems													
A*	Agriculture, hunting and forestry, except 01*													
B	Fishing													
CA	Mining and quarrying of energy producing materials													
CB	Mining and quarrying except energy producing materials													
DA	Manufacture of food products; beverages and tobacco													
DB	Manufacture of textiles and textiles products													
DC	Manufacture of leather and leather products													
DD	Manufacture of wood and wood products													
DE	Manufacture of pulp, paper; publishing and printing													
DF	Manufacture of coke, refined petroleum and nuclear fuel													
DG	Manufacture of chemicals, man-made fibres													
DH	Manufacture of rubber and plastic products													
DI	Manufacture of other non-metallic mineral products													
DJ	Manufacture of basic metals and fabrication of metal products													
DK	Manufacture of machinery and equipment n.e.c.													
DL	Manufacture of electrical and optical equipment													
DM	Manufacture of transport equipment													
DN	Manufacturing n.e.c.													
41	Collection, purification and distribution of water													
E*	Electricity, gas and water supply, except 41													
F	Construction													
75*	Public administrative services for water supply and sewage systems													
90*	Sewage removal and treatment services													
R*	Other services (G to Q, except 75* and 90*)													
	Total industries													
	Households for final consumption													
	TOTAL													

Pollutants can be absorbed by economic activities *before* economic use (e.g. elimination of germs before drinking, filtering of suspended solids before use for cooling) as well as *after* economic use (treatment of wastewater).

Pilot Table 13 - Average purchasers' prices of some water-related economic products (in monetary units per m^3)

Economic product / Economic agent		Part 01.41.11 Operation of irrigation systems	41.00.11 Drinking water	41.00.12 Non-drinking water	41.00.20.01 Distribution services of drinking water	41.00.20.02 Distribution services of non- drinking water	41.00 Total distributed water	Part 75.12.13 Water-related administrative services	90.00.11 Sewage removal and treatment
01*	Operation of irrigation systems								
A*	Agriculture, hunting and forestry, except 01*								
B	Fishing								
CA	Mining and quarrying of energy producing materials								
CB	Mining and quarrying except energy producing materials								
DA	Manufacture of food products; beverages and tobacco								
DB	Manufacture of textiles and textiles products								
DC	Manufacture of leather and leather products								
DD	Manufacture of wood and wood products								
DE	Manufacture of pulp, paper; publishing and printing								
DF	Manufacture of coke, refined petroleum and nuclear fuel								
DG	Manufacture of chemicals, man-made fibres								
DH	Manufacture of rubber and plastic products								
DI	Manufacture of other non-metallic mineral products								
DJ	Manufacture of basic metals and fabrication of metal products								
DK	Manufacture of machinery and equipment n.e.c.								
DL	Manufacture of electrical and optical equipment								
DM	Manufacture of transport equipment								
DN	Manufacturing n.e.c.								
41	Collection, purification and distribution of water								
E*	Electricity, gas and water supply, except 41								
F	Construction								
75*	Public administrative services for water supply and sewage systems								
90*	Sewage removal and treatment services								
R*	Other services (G to Q, except 75* and 90*)								
Average price of intermediate consumption of industries									
Average price for households' final consumption									
Average FOB price for exports									
Average purchaser's price									

Annex 2: Revised set of standard water accounts tables and explanatory notes

This Annex 2 presents the new standard set of water accounts tables and explanatory notes. This new set of tables was produced and agreed by the Water Accounts Task Force in 2002, and approved by the Working Party 'Economic Accounts for the Environment' in October 2002.

Explanatory notes

The water accounts framework

Pressures by economic activities on the water system (e.g. abstraction of water and discharges of pollutants) and economic responses (e.g. water purification and wastewater treatment) can easily be described in a matrix format. This matrix presents the flows of water and of polluting substances in physical units as well as the monetary transactions connected to water by classes of economic activities.

The framework uses the concepts of the European System of Accounts (ESA 95) and the European nomenclatures of economic activities and products (NACE and CPA) to present the economy in a simplified national accounting matrix (NAM) with a focus on water-related issues. This NAM is extended to describe flows of water between the economy and the environment and emissions of pollutants to water due to economic activities.

In principle, such a NAMEA-type framework for water would consist of four parts.

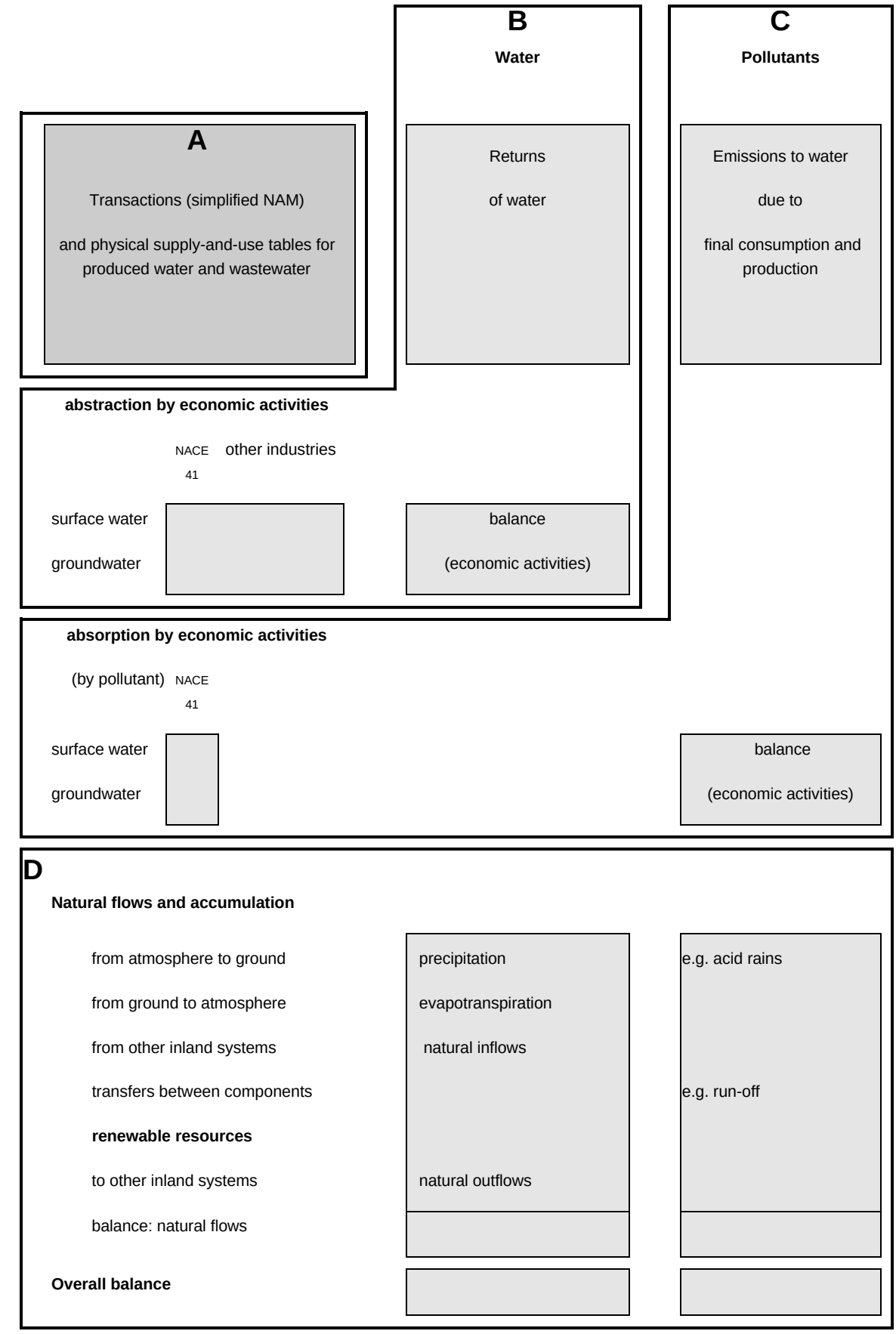
A) A NAM describing the **economic transactions**, i.e. the supply and use tables of the national accounts together with income, capital and rest of the world accounts. Monetary flows corresponding to ancillary activities related to self-supply of water and own account treatment of wastewater could be specified through "of which" columns. Supply and use tables in physical units could be added to describe flows of distributed water and collected wastewater within the economy.

B) The second part shows the **flows of water in physical units** (cubic meters) between the economy and the environment. This includes abstraction (including abstraction by economic activities for self-supply) by components of the water system and returns of (waste) water into the various components of the hydrological system. Net uses of water for intermediate and final consumption, increases in inventories and imports and exports of water could be shown as well.

C) The **emissions of pollutants** to water could be recorded in a third part, by pollutant, according to their origin (economic activity) and to the component of the water system in which they are emitted. The subtraction of pollutants from natural water bodies by economic activities may also be presented by pollutant and by component of the water system. These activities could include purification of abstracted water prior to using it.

D) A fourth part regarding the **flows within nature** of water and water pollutants described in physical units could be added. These flows are not under the (total) control of any economic agent even though possibly influenced by human activities. Precipitation, inflows from other inland water systems, evapotranspiration, natural transfers between components of the water system (infiltration, runoff etc.) and the corresponding indirect emissions to water bodies (e.g. indirect pollution from fertilisers, pesticides and acid rain) could be included in this section.

In principle, a 5th part could be added to describe the quality of water in nature (e.g. water quality accounts for rivers) and of the stocks of water in nature.


B
Water
C
Pollutants
A
Transactions (simplified NAM)
and physical supply-and-use tables for produced water and wastewater
Returns
of water
Emissions to water
due to
final consumption and production
abstraction by economic activities
NACE 41
other industries
surface water
groundwater
balance
(economic activities)
absorption by economic activities
(by pollutant) NACE 41
surface water
groundwater
balance
(economic activities)
D
Natural flows and accumulation
from atmosphere to ground
precipitation
e.g. acid rains
from ground to atmosphere
evapotranspiration
from other inland systems
natural inflows
transfers between components
e.g. run-off
renewable resources
to other inland systems
natural outflows
balance: natural flows
Overall balance
monetary and physical data
physical data only

In the standard set of tables, the scope is restricted to parts A) - economic transactions related to water, flows of water inside the economy, B) - flows of water between the economy and the environment) and C) - exchange of pollutants between the economy and the water environment, while D) is not included for the moment.

This framework would still be very large due to NAM data that are not specific to water. In the set of standard tables, only data specific to water have been selected to make the set of tables easier to manipulate.

Furthermore, some economic uses of water and not all emissions of pollutants are not covered. Notably, in situ uses of water (such as water transport or hydroelectricity) as well as economic actions consisting in fighting against water (e.g. in case of flood) are excluded. Only a selection of pollutants will be followed.

A2-1.1 The set of standard tables

The set consists of 13 tables.

Table 1 - Supply of distributed water and of wastewater services
Table 2 - Use of distributed water and of wastewater services
Table 3 – Economic accounts for water distribution and wastewater collection industries
Table 4 - Expenditures for self-supply of water and of wastewater treatment
Table 5 - Physical flows of water corresponding to economic supply recorded in table 1
Table 6 - Physical flows of water corresponding to economic uses recorded in table 2
Table 7 - Abstractions of water
Table 8 - Returns of water
Table 9 - Freshwater balance
Table 10 – Pollutant loads of freshwater abstracted for self-supply
Table 11 – Pollutant loads of wastewater discharged to the sewage system
Table 12 - Pollutant loads of cooling and wastewater returned to the environment
Table 13 – Pollutant loads of cooling and wastewater returned to non-fresh sources

The tables are organised in **3 main groups**:

- tables 1 to 4 are in monetary units and describe economic transactions,
- tables 5 to 9 describe physical flows of water,
- tables 10 to 13 report physical flows of pollutants.

There is a direct correspondence between the economic and physical tables.

The **cells that are usually most important have been framed** in the tables. This does not mean that other cells are necessarily empty. For instance, in table 1, NACE 41 is the normal producer and thus supplier of non-drinking water (product CPA 41.00.12). This does not exclude the possibility of a supply of non-drinking water by NACE 40, for instance, as the output of a secondary activity. Wastewater re-used can be provided by NACE 90.01 to NACE 41, which, in turn, distributes it to other users. Conversely, it has been assumed in table 2 that all manufacturing industries are potential users of non-drinking water, while, in practice, only few manufacturing industries may use this kind of water. Some service industries (e.g. car washing services) may also use non-drinking water.

Classifications: industries and homogenous branches

Industries or homogeneous branches may be used in the tables.

Industries. When industries are used, the supply of each water-related product is recorded according to the main activity of its producer. That is to say that secondary production of these products is recorded under the heading corresponding to the main activity of their producer. For instance, the main activity of industry NACE group 90.01 is the collection and treatment of wastewater but this industry may also supply treated wastewater for re-use and thus be a supplier of e.g. non-drinking water (CPA 41.00.12). General public services activities (NACE section L) can supply water or wastewater services if these services are directly provided by the county, the municipality, etc. Manufacturing industries that abstract water for their own use

(self-supply) may supply some of this water to other users. This means that secondary output of water-related products may come from many industries and many of the non-framed cells may be filled in.

Homogeneous branches. Secondary activities can be reclassified to the corresponding homogeneous branch. In that case, all CPA products beginning by 41 are attributed to NACE 41 whatever the main activity of their actual producer, and so on. Only the framed cells are filled in, plus the total columns.

Both presentations have their pros and cons, depending on the analysis that is in mind.

When focusing on the water supply or wastewater collection and treatment activities, attention should be paid to the classification of economic agents dealing with activities coded under NACE 41, 75 and 90.01. The organisation of water management differs across countries and even across regions or districts within a country. Some activities related to water supply (NACE 41) and wastewater collection and treatment (NACE 90.01) are carried out by central or local government agents. These activities are not always classified under NACE 41 or NACE 90.01 but sometimes with "public administration and defence" (NACE 75). This can for example occur when the local governments' accounts are not detailed enough to separate water supply or sewage collection from other activities. In some countries, the same producer units practise both activities of water supply (NACE 41) and wastewater management (NACE 90): one is their main activity, the other their secondary activity. Whenever possible, these activities should be estimated and reclassified. In this case please indicate in a note any differences this treatment introduces in relation to standard national accounts.

Classifications: nomenclatures of activities (NACE) and products (CPA)

The set of tables uses the NACE Rev. 1.1 at its subsections level with some extra detail as regards activities related to water and the CPA 2002. In the tables, an asterisk marks codes that are not exactly matching NACE and CPA definitions. It must be noted that the NACE Rev. 1.1 and the CPA 2002 will only enter into force on 1 January 2003. However, national classifications are generally more detailed so that often it will be possible to provide data according to the new NACE and CPA and for the codes marked with an asterisk. Important categories of NACE and the corresponding categories of CPA are summarised below. In case of differences between the new and earlier classifications, references to both versions are made.

NACE class 41.00 - Collection, purification and distribution of water. The products corresponding to this activity are CPA 41.00.1 - distributed water[55] - with a further subdivision into drinking water (CPA 41.00.11) and non-drinking water (CPA 41.00.12) – and CPA 41.00.2 - distribution services of water, including notably reading and maintenance of meters. NACE 41 includes desalting of seawater to produce water as the principal product of interest. NACE 41 excludes the operation of irrigation systems for agricultural purposes (classified in NACE 01.41 - Agricultural service activities; landscape gardening) and the treatment of wastewater solely in order to prevent pollution (classified in NACE 90.01 – collection and treatment of sewage). The breakdown of distributed water into drinking water, non-drinking water and distribution services is not expected to be important in most cases.

NACE class 90.01 - Collection and treatment of sewage. This class includes:

- collecting and transporting of human wastewater from one or several users, as well as rain water by means of sewerage networks, collectors, tanks and other means of transport (sewage vehicles etc.) and their treatment and disposal
- treatment of wastewater by means of physical, chemical and biological processes like dilution, screening, filtering, sedimentation, etc.
- maintenance and cleaning of sewers and drains
- emptying and cleaning of cesspools and septic tanks, sinks and pits from sewage, servicing of chemical toilets
- treatment of wastewater from swimming pools and from industry

NACE class 01.41* - operation of irrigation systems. The operation of irrigation systems is part of NACE class 01.41 – Agricultural service activities; landscape gardening and the corresponding product is part of CPA 01.41.11 - services incidental to agricultural production. These irrigation systems are supposed to be a

[55] In the official English CPA terminology, the product of this activity is called 'natural water'. We here use the wording 'distributed water', like in the French version of the CPA, to avoid possible confusion with water in nature.

specific provision of water to farmers, especially through a network of open air canals the feeding and allocation of which is managed.

NACE class 75.12* - public administration for water. Water-related public administration is part of NACE class 75.12 - Regulation of the activities of agencies that provide health care, education, cultural services and other social services, excluding social security. The corresponding product is part of **CPA 75.12.13 -** administrative housing and community amenity services. This product supplied by government includes: "services provided by offices, bureaux, departments and programme units engaged in developing and administering regulations concerning *water supply*; public administrative services related to (…) *sewage system operation."*

The definition of activities recorded under 75.12* is restricted to activities related to water supply or wastewater management. Activities that are not related to water supply or wastewater management such as flood protection, repair of damages due to floods, dredging of rivers, navigation and restoring the quality of water bodies are to be excluded. Water abstracted but not used (e.g. pumping of water from polders) is however included. If such activities are important, the category 75.12* should be sub-divided.

In principle, NACE 75.12 should only include regulatory activities such as those of water-related departments in central and regional governments. In practice, however, some activities related to water supply or sewage collection carried out by central or local government agents may not be classified under NACE 41 or NACE 90.01 but under NACE 75 - public administration and defence. This can for example occur when the local government accounts are not detailed enough to separate water supply or sewage collection from other activities. It may also occur that these services only invest in new networks and are the owners of the water supply networks or of the sewage systems, whereas the operation of these systems is contracted out.

To the extent possible, this industry should be split up and the data recorded under NACE 41 and 90.01, respectively.

Mineral waters come under CPA 15.98.11 and are not included in the list of water-related economic products followed through the accounts. However, the corresponding abstraction of water will be considered as an ancillary activity by beverage producers. **Distilled water** is part of CPA 24.13.42 (Other inorganic compounds n.e.c.) and is not included either.

Table-by-table description

Table 1 - Supply of distributed water and of wastewater services

The purpose of table 1 is to show the economic output of water-related products as well as possible imports to determine the total supply in monetary units of drinking, non-drinking and irrigation water, of sewage collection and treatment services, and of some water-related administrative services. The supply of water-related products is recorded at basic prices. Taxes less subsidies and imports are included in table 1, providing the figures of total supply at purchasers' prices.

Only supply implying an economic transaction between two different economic agents is to be recorded in this table: this generally implies a monetary counterpart. Expenditures connected to self-supplied water (water abstracted and purified for own use) and to ancillary activities regarding own account wastewater treatment are to be recorded in table 4.

If no distinction is possible between drinking and non-drinking, the column "total distributed water" can be used. It should be noted that:

- *Drinking water* does not refer to the actual use of water, but to its quality (= water usable for drinking purposes).
- *Non-drinking water* implies that less purification is needed than for drinking water, but some purification might be necessary. This type of water is mostly used in some industrial processes.

Table 1 is directly linked to table 5.

Table 2 - Use of distributed water and of wastewater services

Table 2 reports the uses of the water-related products for intermediate and final consumption, exports and inventory changes. The framed cells reflect the assumption that all industries and households will be users of

drinking water and of wastewater collection and treatment services, while only agriculture, mining and manufacturing industries use non-drinking water.

Final consumption should be recorded as actual final consumption ("individual consumption" concept - see ESA definitions in annex). The government is therefore the "collective consumer" of its own production of collective non-market services (for instance of administrative services of water control), whereas the use of water and of wastewater services by households should be recorded in the row "final consumption by households" even if these services have been supplied to them free of charge by the government.

Changes in inventories are probably insignificant: this row corresponds to changes in the volumes of already purified water, e.g. water stored in reservoirs (water towers).

Only uses implying an economic transaction between two different economic agents are to be recorded in this table: this generally implies a monetary counterpart, except in such cases as individual consumption or inventory changes explained above. Expenditures connected to the (own) use of self-supplied water and to ancillary activities regarding own account wastewater treatment are to be recorded in table 4.

If water is exchanged between water producers and distributors (for instance in case of temporary insufficiency of a local source), these exchanges should be recorded at the crossing of NACE 41 (or 01.41*) and the corresponding type of water which is exchanged. The price of this water is generally lower since it does not include the cost of distribution to the final users.

Table 2 is linked to table 6.

Table 3 – Economic accounts for water distribution and wastewater collection industries

This table is a summary of the ESA production and generation of income accounts of each of the major industries related to water. Supplementary information about fixed capital and labour inputs is also asked. ESA definitions and concepts are applied (see annex for a reminder of the definitions). Secondary (non-water-related) activities are thus included when the tables are based on industries whereas secondary water-related activities by other industries are included when the tables are based on homogeneous branches.

The institutional sector headings of the sub-columns are the producing sectors. For simplification, NPISHs (non-profit institutions serving households, see definition in annex) are put together with households and their production costs reported in table 4 under the "households" row. This case is assumed to be rare, for example local water supply associations of households in rural areas. Expenditure for self-supply of water and ancillary activities regarding wastewater treatment are not recorded here but in table 4.

Table 4 - Expenditures for self-supply of water and of wastewater treatment

This table describes activities related to water carried out:

- as "ancillary" activities by industries, i.e. for their own use (e.g. direct abstraction of water from a river by a manufacturer of basic metals for cooling purposes or own account wastewater treatment by a manufacturer of chemicals);
- or by the households for their own consumption (e.g. self-supply of water with individual pumps and the use of septic tanks for treating wastewater in rural areas not connected to a sewage network).

Table 4 includes information more or less similar to that in table 3. In the national accounts, these expenditures are recorded either as intermediate consumption, compensation of employees and fixed capital formation by the industry under review or as final consumption by households (potentially also as fixed capital formation when the buying of the septic tank is included in the value of a house). The table selects within their total expenditures only those related to the self-supply of water or of wastewater treatment.

As only activities for own use are included, only costs of production are asked for: there are no corresponding sales.

The information required for table 4 will often be available for wastewater management from established specific data collection systems such as national environmental protection expenditure surveys and other sources on environmental expenditure. Some of these sources may not provide all variables. E.g. compensation of employees, intermediate consumption and taxes on production may only be available as a sum of 'current expenditure'; data on consumption of fixed capital may not be available directly and will have to be estimated using established national accounts procedures.

For self-supply of water such specific sources are not likely to be available in many countries at present. Physical quantities of water abstracted for self-supply and average costs could be used to estimate these data.

Table 5 - Physical flows of water corresponding to economic supply recorded in table 1

Table 5 corresponds to table 1 but is expressed in physical units. Table 5 records, by supplying industry, the water delivered and the wastewater collected in thousand m^3.

Purely monetary rows (e.g. taxes) or non-material services (e.g. distribution services) are not shown and sewage collection and treatment services have been converted into the corresponding flows of wastewater.

In order to maintain consistency with the monetary tables, flows of water to be recorded here correspond to the economic transactions, i.e. flows of water delivered at the end of the production process for NACE 41 products and flows of wastewater collected at the beginning of the production process for NACE 90.01 products. Water or wastewater potentially lost during its transportation to or from the user should not be recorded here (but will be recorded in table 9).

Table 7 will describe the environmental origin (i.e. the abstraction) of the flows of water exchanged between economic agents. However, some of the economic freshwater exchanges have only an economic origin: re-use of wastewater implies that the water abstracted from the environment at the beginning of the economic process is sold repeatedly. Freshwater coming from desalinated seawater must also be isolated because it results from an economic transformation of non-fresh water into freshwater and it will be necessary to build the balance of the flows of freshwater between the economy and the environment. These two supplementary pieces of information have therefore been introduced in table 5.

Table 6 - Physical flows of water corresponding to economic uses recorded in table 2

Similarly, table 6 is the replica of table 2 in physical units (thousand m^3).

Table 7 - Abstractions of water and Table 8 - Returns of water

Table 7 describes the abstractions of water from the environment and table 8 the discharges of wastewater and other returns of water back to the environment.

Table 7 shows abstractions according to the type of water body used as a source. 3 types of water bodies are distinguished: fresh surface water, fresh groundwater and non-fresh water sources in coherence with the OECD/Eurostat Joint Questionnaire on inland waters (see annex for a definition of the water sources and of the water flows). All water abstracted by water producers should be recorded in the columns “abstraction for distribution” even if some of this water is not finally delivered to end users: part of the water abstracted is lost during distribution or is used by the water producers to clean the networks.

Abstraction of water from the environment as a consequence of self-supply by industries or households is also to be reported in the columns “abstraction for self-supply” in table 7.

The columns under ‘Abstraction not for use’ report abstractions that are not induced by a use of water. Water displaced by pumping and draining but not used (e.g. pumping from mining or construction sites) should be reported under “mine and drainage water” (column A9). Other examples are: pumping of water from polders to keep the water table low; abstraction of groundwater in order to influence groundwater tables so as to prevent pollutants from entering areas designated for drinking water supply, and water abstracted for re-charging other water bodies.

Abstraction from non-fresh water sources will essentially be sea and brackish water abstracted for cooling purposes. A small amount of seawater may be abstracted for desalination or other purposes.

Table 8 shows the various returns to the environment including the returns of (treated or untreated) wastewater by the sewage system, individual returns of wastewater from industries and households (e.g. via septic tanks) and returns of fresh cooling water. The returns of unused water (column R1) correspond to the mine and drainage water abstracted but not used. The total returns of freshwater (column R10) are broken down by destination: returns to non-fresh water bodies and returns to freshwater bodies. The returns of non-fresh water to non-fresh sources (R13) are sea and brackish water used for cooling and returned to the sea after use.

The flows recorded in table 5 and 6 were the end-of-pipe flows in the production process of distribution of water (distributed water arriving at the consumer's place) and the beginning-of-pipe flows in the production process of wastewater removal and treatment (wastewater collected at the consumer's place). Tables 7 and 8, on the contrary, describe the flows at the beginning of the process for NACE 41 (abstraction of water from the environment in order to purify and distribute it) and the flows at the end of the process for NACE 90 (discharge of the treated or untreated wastewater back to the environment).

Urban rainwater run-off collected in sewers will be included in the wastewater returned by sewage network in table 8 (column R4) whereas the wastewater discharged into the sewage system by the users of sewage services (column PU6 in table 6) will not include this urban run-off. Also leakage from the sewage network as well as the infiltration of groundwater into sewage systems may occur. These flows cannot be measured directly but can be very substantial. The difference between the volumes of wastewater collected from users and the volumes of wastewater discharged by the sewage systems to the environment represents the net effect of rainwater that enters the sewage system, the infiltration of groundwater into the sewage system and the losses of wastewater through leakage. This net flow should be recorded under 'rainwater and net infiltration' (column A10) in table 7.

Table 9- Freshwater balance

Table 9 establishes the balance of the flows of *freshwater* between the economy and the water system in physical terms. Columns from tables 5, 6, 7 and 8 are re-arranged in order to get a global view of the freshwater flows and in order to derive indicators of physical consumption of water for each industry. It is important to note that only freshwater flows are reported here, and the balance is settled with the fresh water system. Therefore, water abstracted from the fresh water system but then discharged into the sea is considered as "consumed" (i.e. removed from the fresh water system). As this disappearance from the fresh water system is not linked to the use made of the water but to the way of returning water after use, the concept of "consumptive use" is also introduced (i.e. mainly the water evaporated). The difference between these two concepts taken from the OECD/Eurostat Joint Questionnaire is the water discharged to the sea.

Consumptive uses can be further broken down into components. The first component is evaporation from distribution networks (e.g. open canals used for distributing irrigation water). The second component is the incorporation of water into other products. The orders of magnitude of water incorporated in products are typically small but can be important for the industries where the incorporation of water takes place (manufacturing of beverages, dairy farming, making of concrete, etc.).

Water removal from products (which is a negative consumption) occurs mainly during consumption of agricultural products and beverages by households. Water removal can also occur during other activities such as making sugar from sugar beets.

The category 'other consumptive uses' in Table 9 essentially represents the water evaporated during use and is derived as a balancing item. This balancing item may thus also include any statistical discrepancies. Changes in stocks of produced water may also be shown in the row 'changes to inventories'.

Following all the flows of water contained in other products or in waste can be complex and requires estimations. Water may be contained in products imported and exported, or in organic waste that is land filled. Manure from agriculture spread on fields can include a lot of water. Sewage sludge from wastewater treatment will contain water also. Water incorporated in products from rain-fed agriculture does not come from abstraction (only irrigation water is recorded as abstracted in table 7). If this flow is considered important it could be recorded in an extra column to avoid inconsistencies between the water available for use and the return of wastewater for industries and households.

The concepts of physical consumption and consumptive uses have different analytical potentials depending on the industry under review. For industries not specifically related to water, it may be interesting to know what types of consumptive uses are systematically involved. For NACE 41 and 01.41*, it should be noted that desalinated water and re-use of water change the balance and that this could be important for the judgement of the consumption by the whole economy.

Tables 10 to 13 – Pollutant loads

The aim of tables 10 to 13 is to record the pollutants that are added by the economic uses of water as well as the subtraction of pollutants by economic activities of purification and treatment.

The pollutants recorded in the table are BOD, COD, (see annex for the definitions), suspended solids, 8 heavy metals, phosphorous and nitrogen. The unit for all these tables is a measure of weight (kg or tonne, depending on the pollutant under review). The reference period is a year.

The aim is to record the **emissions** of pollutants by economic activities into water bodies. This means that only the pollutants added by economic activities should be recorded. For instance, if an industry abstracts 1 m^3 of water which already contains q_0 kg of a pollutant and returns to a river 1 m^3 of wastewater with q_1 kg, a discharge of q_1 kg to the river is recorded, but only (q_1 minus q_0) kg has been added to the inland water system by the industry. Thus only (q_1 minus q_0) kg should be recorded as the emission by this industry. In practice, to estimate these emissions, it will usually be necessary to measure or estimate the pollutant loads in the incoming and in the outgoing flows of water for each economic agent.

A set of 4 tables (10, 11, 12 and 13) describes the pollutant loads of the flows of water at different steps of their way from abstraction via circulation within the economy to returns to the environment. Pollutant loads of water are recorded at abstraction (table 10), at discharge to the sewage network prior to treatment by the sewage operators (table 11) and at return to the environment (table 12). Table 13 shows those pollutant loads recorded in table 12 that are returned to the sea. Therefore, subtracting table 13 from table 12 allows calculating the discharges of pollutants into the fresh water environment.

A full description of the pollutant loads of all water flows recorded in tables 5 to 9 would be very complex and would require many tables. As many water flows are of no particular interest for determining the emissions of pollutants by the economy, simplifications are made:

- Unused water is ignored, assuming that these water flows contain the same amount of pollutants when abstracted (flow A9 in table 7) and when returned (flow R1 in table 8).
- Irrigation water (part of flows A3 and A6, R3) is also ignored. The hypothesis of identical loads of pollutants at the abstraction and return steps may be unrealistic for irrigation. The plants and the soil may absorb pollutants contained in the irrigation water. New pollutants may be added due to soil erosion or manure, fertiliser, pesticides, etc. spread on the fields. However, the pollutant loads in returned irrigation water are considered as an indirect pollution (via the soil) which is out of the scope of the water accounts in their present form. Estimates of diffuse pollution from non-point sources by agriculture can be recorded in the OECD/Eurostat Joint Questionnaire on Inland Waters. The total diffuse pollution from non-point sources by agriculture will include pollution induced by rain-fed agriculture, i.e. pollution carried by rainwater that is not surveyed in the water accounts tables for the moment. Therefore, diffuse pollution by agriculture should be reported in the water accounts only as a 'for memory' item in table 12.[56]
- Distributed water is assumed to contain no significant amounts of the pollutants that are recorded in tables 10 to 13. This assumption applies to all flows in the distribution process: water abstracted by distributors (A3), leaks during distribution (R2), water distributed to the users (PS4). Purification of drinking water generally involves other pollutants than those recorded in the water accounts tables at present. There might be some purification of distributed non-drinking water that involves pollutants recorded in the water accounts tables, but in most countries the flows of distributed non-drinking water are much smaller than those of drinking water.
- The pollutant content of the flows of non-fresh water is not estimated (neither at abstraction, nor at return) because the focus of the accounts is on fresh water and because non-fresh water is mainly used for cooling in the production of electricity and therefore should not change much in pollution content.

Therefore, in order to calculate the emissions to water bodies, only the pollutant content of the following flows of water need to be tracked (see also the simplified scheme below):

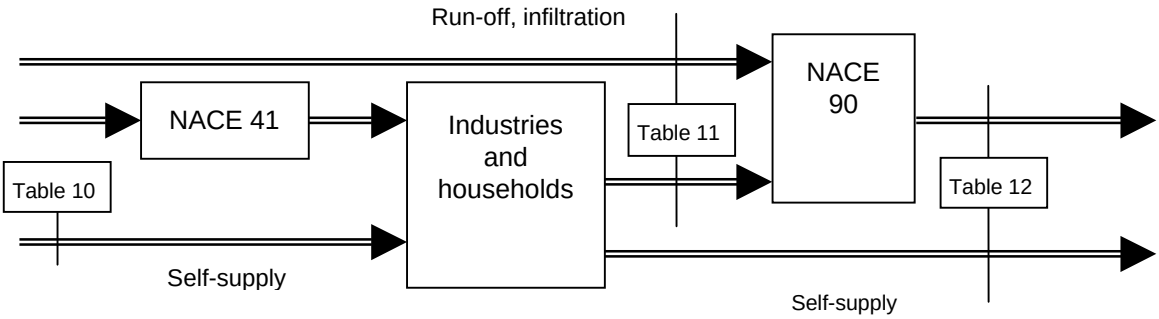
- at abstraction (table 10): only abstractions for self-supply from fresh sources. This corresponds to flow A6 in table 7.[57] The pollutant content of water abstracted for irrigation is ignored.
- at discharge to the sewage network (table 11), including unallocated discharge due to urban run-off and unallocated changes in pollution load due to leakage from the sewage system and infiltration of groundwater into the sewage system. This corresponds to flows PU6 in table 6 and A10 in table 7.

[56] This may be changed in a future revision, when methods are available that allow estimating how much of the diffuse pollution from agriculture is from returned irrigation water, and how much of the pollution in returned irrigation water is due to economic causes (fertiliser use etc.)

[57] If no direct information is available on the pollution content of fresh water abstracted for self-supply, average water quality data could be applied to row A6 in table 7. Some of the components of flow A6 may be assumed to contain no significant amounts of the pollutants recorded in tables 10 to 13, for example, water abstracted by households for their own use.

Practically, this means that the pollution content should be measured or estimated first in the outgoing flows from industries (or households) and a second time in the incoming flows at the treatment plants (or at the outlet of the sewage system when collected wastewater is discharged without treatment).

- at return to the environment (table 12). This corresponds to flows of wastewater and of returned fresh cooling water, i.e. flows R4, R6 and R8 in table 8. It should be noted that, in comparison to the OECD/Eurostat Joint Questionnaire, estimates of pollutant content of returned fresh cooling water are required in the water accounts, due to the potentially significant amounts of some pollutants discharged with cooling water (e.g. heavy metals by industries such as manufacture of basic metals).
- at return to non-fresh sources (table 13). This corresponds to the discharge of wastewater and of fresh cooling water to non-fresh sources, that is to say flows R5, R7 and R9 in table 8.



The emissions of pollutants by a specific industry other than NACE 01.41*, 41 and 90.01 can be calculated by the following formula: table 11 *(discharge to sewage system)* plus table 12 *(direct discharge to the environment)* minus table 10 *(pollutant content of water abstracted for self-supply)*. This formula gives the gross emissions, i.e. including the emissions into the sewage network prior to treatment by the sewage operators.

For NACE 01.41* and 41 it is assumed that neither the water abstracted nor the water delivered contains significant amounts of the pollutants that are recorded in the set of standard tables. The emissions of NACE 01.41* and 41 are equal to the sum of table 11 and table 12.

The (negative) emissions by NACE 90.01 are calculated by subtracting table 11 (Supplementary table row "Total received by sewage system") from table 12. This is a convention, because the negative emissions by NACE 90.01 include the depollution of flow A10 whose composition and origin is not known. Flow A10 is the result of 3 separate flows with different origins and pollution content: rainwater/urban run-off, leaks from the sewage network and infiltration of groundwater into the sewage network. In principle, the volumes and pollution loads of the three flows should be estimated separately. However, this does not seem to be feasible given current data availability. Even if separate estimates are possible, the allocation of these loads to industries and households is not straightforward. The pollution content of leaks and infiltration flows could be allocated to the operators of the sewage systems (typically NACE 90) which are responsible for the network. It would be difficult to allocate the pollutant content of rainwater/urban run-off to the industries (or households) that "caused" them. Another problem is the **"**natural" pollution potentially collected with the rainwater/urban run-off such as dust and dry and wet deposition of air pollutants part of which has already been accounted for as air emissions in the NAMEA air standard tables.

Therefore, at present, the net infiltration into the sewage system (flow A10) is not allocated to economic agents. However, the data can be used to calculate the de-pollution by NACE 90.01, which is equivalent to the pollution load of R4 minus the pollution load of PU6 and A10. Data may also be used to make comparisons of the efficiency of the different treatment systems across countries and over time by type of treatment.

Annex: Terms and definitions

Terms and definitions used in the 2002 OECD/Eurostat Joint Questionnaire on Inland Waters

Definition of categories of water sources

(Fresh) surface water
Water which flows over, or rests on the surface of a land mass, natural watercourses such as rivers, streams, brooks, lakes, etc., as well as artificial watercourses such as irrigation, industrial and navigation canals, drainage systems and artificial reservoirs. For purposes of the joint questionnaire, bank filtration is included under (fresh) surface water. Seawater and transitional waters, such as brackish swamps, lagoons and estuarine areas are not considered (fresh) surface water and so are included under non-fresh water sources.

(Fresh) groundwater
Freshwater which is being held in, and can usually be recovered from, or via, an underground formation. All permanent and temporary deposits of water, both artificially charged and naturally, in the subsoil, of sufficient quality for at least seasonal use. This category includes phreatic water-bearing strata, as well as deep strata under pressure or not, contained in porous or fracture soils. For purposes of the joint questionnaire, groundwater includes springs, both concentrated and diffused, which may be sub-aqueous.

Non-fresh water sources
Includes seawater and transitional water, such as brackish swamps, lagoons and estuarine areas. Such water resources may be of great importance locally, although in a national context, they are usually of lesser importance as compared to surface and groundwater resources.

Definitions of flows within the economy or between economy and environment

Water gross abstraction (or withdrawal)
Water removed from any source, either permanently or temporarily. Mine water and drainage water are included. Water abstractions from groundwater resources in any given time period are defined as the difference between the total amount of water withdrawn from aquifers and the total amount charged artificially or injected into aquifers. Water abstractions from precipitation (e.g. rain water collected for use) should be included under abstractions from surface water. The amounts of water artificially charged or injected are attributed to abstractions from that water resource from which they were originally withdrawn. Water used for hydroelectricity generation is an in-situ use and should be excluded.

Returned water
Water abstracted from any fresh water source and discharged into fresh waters without use, or before use. Occurs primarily during mining, construction activities. Discharges to the sea are excluded.

Supply of water
Delivery of water to final users including abstraction for own final use (self-supply).

Self-supply
Abstraction of water by the user for own final use.

Re-used water
Water that has undergone wastewater treatment and is delivered to a user as reclaimed wastewater. This means the direct supply of treated effluent to the user. Excluded is wastewater discharged into a watercourse and used again downstream. Recycling within industrial sites is excluded.

Water losses
Volume of water lost during transport (through leakage or evaporation) between a point of abstraction and a point of use, or between points of use and reuse.

Consumptive water use
Water abstracted which is no longer available for use because it has evaporated, transpired, been incorporated into products and crops, or consumed by man or livestock. Water losses due to leakages during the transport of water between the point or points of abstraction and the point or points of use are excluded.

Total water consumption
Water abstracted which is no longer available for use because it has evaporated, transpired, been incorporated into products and crops, consumed by man or livestock, ejected directly to the sea, or otherwise removed from fresh water resources. Water losses due to leakages during the transport of water between the point or points of abstraction and the point or points of use are excluded. For the purpose of the Joint Questionnaire, total water consumption equals consumptive water use plus discharges to the sea.

Wastewater
Water which is of no further immediate value to the purpose for which it was used or in the pursuit of which it was produced because of its quality, quantity or time of occurrence. However, wastewater from one user can be a potential supply to a user elsewhere. Cooling water is not considered to be wastewater for the purpose of the Joint Questionnaire.

Water use
Refers to water that is actually used by end users for a specific purpose within a territory, such as for domestic use, irrigation or industrial processing. Excludes returned water.

Irrigation use
Artificial application of water on lands to assist in the growing of crops and pastures.

Irrigation water
Water which is applied to soils in order to increase their moisture content and to provide for normal plant growth. For purposes of the Joint Questionnaire, data reported under this item fit in NACE/ISIC division 01.

Cooling water
Water which is used to absorb and remove heat. In this questionnaire cooling water is broken down into cooling water used in the generation of electricity in power stations, and cooling water used in other industrial processes.

Discharge of used water
Water discharged into fresh waters after use (with or without treatment) so that it becomes available again for abstraction. Discharges to the sea are excluded.

Wastewater generated
a) the quantity of water in cubic meters that has been polluted during use by adding waste.
b) the substances (pollution in kg BOD/day or comparable) that have been added to the wastewater. The origin can be domestic use (used water from bathing, toilets, cooking, etc.) or industrial use.

Definitions of pollutants

BOD = Biological oxygen demand (mass concentration of dissolved oxygen consumed under specific conditions by the biological oxidisation of organic and/or inorganic matter in water)

COD = Chemical oxygen demand (mass concentration of oxygen consumed under specific conditions by the chemical oxidisation with bichromate of organic and/ or inorganic matter in water)

Definitions of types of treatment

Primary treatment
Treatment of (urban) wastewater by a physical and/or chemical process involving settlement of suspended solids, or other process in which the BOD5 of the incoming wastewater is reduced by at least 20% before discharge and the total suspended solids of the incoming wastewater are reduced by at least 50%.

Secondary treatment
Treatment of (urban) wastewater by a process generally involving biological treatment with a secondary settlement or other process, resulting in a BOD removal of at least 70% and a COD removal of at least 75%.

Tertiary treatment
Treatment (additional to secondary treatment) of nitrogen and/or phosphorous and/or any other pollutant affecting the quality or a specific use of water: microbiological pollution, colour etc. Treatment efficiencies: organic pollution removal of at least 95% for BOD, or 85% for COD, or nitrogen removal of at least 70%, or

phosphorus removal of at least 80%, or microbiological removal to achieve faecal coliform counts of < 1000/100 ml.

National accounts terms (ESA 1995)

Institutional units

Non-financial corporations: this sector consists of institutional units whose distributive and financial transactions are distinct from those of their owners and which are market producers, whose principal activity is the production of goods and non-financial services.

General government: this sector includes all institutional units which are non-market producers whose output is intended for individual and collective consumption, and mainly financed by compulsory payments made by the units belonging to other sectors, and/or institutional units principally engaged in the redistribution of national income and wealth.

Households: this sector covers individuals or groups of individuals as consumers and possibly also as entrepreneurs producing market goods and non-financial and financial services (market producers) provided that, in the latter case, the corresponding activities are not those of separate entities treated as quasi-corporations. It also includes individuals or groups of individuals as producers of goods and non-financial services for exclusively own final use.

NPISHs: Non-profit institutions serving households consist of non-profit institutions which are separate legal entities, serve households and are private other non-market producers. Their principal resources are derived from voluntary contributions in cash or in kind from households in their capacity of consumers, from payments made by general governments and from property income.

Activities

The principal (or main) activity: is the activity whose value added exceeds that of any other activity carried out within the same unit. The classification of the principal activity is determined by reference to NACE, first at the highest level of the classification and then at more detailed levels. **A secondary activity** is an activity carried out in addition to the principal activity. The output of a secondary activity is a secondary product. The output of **an ancillary activity** is not intended for use outside the enterprise. An ancillary activity is a supporting activity undertaken within an enterprise in order to create the conditions within which the principal or secondary activities can be carried out.

Economic transactions

Output: consists of the products created during the accounting period. **Market output** consists of output that is disposed of on the market or intended to be disposed of on the market.

Basic price: is the price receivable by the producers from the purchaser for a unit of a good or service produced as output minus any tax payable plus any subsidy receivable on that unit as a consequence of its production or sale. It excludes any transport charges invoiced separately by the producer. It includes any transport margins charged by the producer on the same invoice, even when they are included as a separate item on the invoice.

Intermediate consumption: consists of the value of goods and services consumed as inputs by a process of production, excluding fixed assets whose consumption is recorded as consumption of fixed capital. The goods and services may be either transformed or used up by the production process.

Final consumption expenditure: consists of expenditure incurred by resident institutional units on goods or services that are used for the direct satisfaction of individual needs or wants or the collective needs of members of the community. Final consumption expenditure may take place on the domestic territory or abroad.

Actual final consumption: consists of the goods or services that are acquired by resident institutional units for the direct satisfaction of human needs, whether individual or collective.

Goods and services for individual consumption: ('individual goods and services') are acquired by a household and used to satisfy the needs and wants of members of that household. Individual goods and services have the following characteristics:

a) It must be possible to observe and record the acquisition of the good or services by an individual household or member thereof and also the time at which it took place;

b) the household must have agreed to the provision of the good or service and take whatever action is necessary to make it possible, for example by attending a school or clinic;

c) the good or service must be such that its acquisition by one household or person, or possibly by a small, restricted group of persons, precludes its acquisition by other households or persons.

Services for collective consumption: ('collective services') are provided simultaneously to all members of the community or all members of a particular section of the community, such as all households living in a particular region. Collective services have the following characteristics:

a) they can be delivered simultaneously to every member of the community or to particular sections of the community, such as those in a particular region or locality;

b) the use of such services is usually passive and does not require the explicit agreement or active participation of all the individuals concerned;

c) the provision of a collective service to one individual does not reduce the amount available to other in the same community or section of the community. There is no rivalry in acquisition.

Compensation of employees: is defined as the total remuneration, in cash or in kind, payable by an employer to an employee in return for work done by the latter during the accounting period.

Consumption of fixed capital: represents the amount of fixed assets used up, during the period under consideration, as a result of normal wear and tear and foreseeable obsolescence, including a provision for losses of fixed assets as a result of accidental damage which can be insured against.

Gross capital formation: consists of resident producers' acquisitions, less disposals, of fixed assets during a given period plus certain additions to the value of non-produced assets realised by the productive activity of producer or institutional units. Fixed assets are tangible or intangible assets produced as outputs from processes of production that are themselves used repeatedly or continuously, in processes of production for more than one year.

Investment grants: consist of capital transfers in cash or in kind made by governments or by the rest of the world to other resident or non-resident institutional units to finance all or part of the costs of their acquiring fixed assets.

Revision of the NACE

NACE (Rev.1) 90 (sewage and refuse disposal services, sanitation and similar services) comprised only one class, and it was only at the level of the products (CPA 90.00.11 'Sewage removal and treatment services' and CPA 90.00.12 'treatment services of cesspools and septic tanks') that it was possible to isolate water-related activities.

NACE Rev.1.1 will introduce classes within this group 90 and in particular:

New NACE class 90.01 'Collection and treatment of sewage' includes:

- collecting and transporting of human wastewater from one or several users, as well as rain water by means of sewerage networks, collectors, tanks and other means of transport (sewage vehicles etc.) and their treatment and disposal
- treatment of wastewater by means of physical, chemical and biological processes like dilution, screening, filtering, sedimentation, etc.
- maintenance and cleaning of sewers and drains
- emptying and cleaning of cesspools and septic tanks, sinks and pits from sewage, servicing of chemical toilets
- treatment of wastewater from swimming pools and from industry

It excludes:

- construction of sewer systems (see 45.21)

- clearing, de-blocking of sewers (45.33)
- treatment of polluted ground or surface water in combination with cleaning up of environmental pollution (see 90.03).

Revision of the COFOG

The new 1998 version introduced a specific class (05) for environmental protection with the sub-class 05.2.0 *Wastewater management***,** including:

- administration, supervision, inspection, operation or support of sewage systems and wastewater treatment;
- grants, loans or subsidies to support the operation, construction, maintenance or upgrading of such systems.

Water supply (06.3.0) is now part of class 06 'housing and community amenities'. It includes:

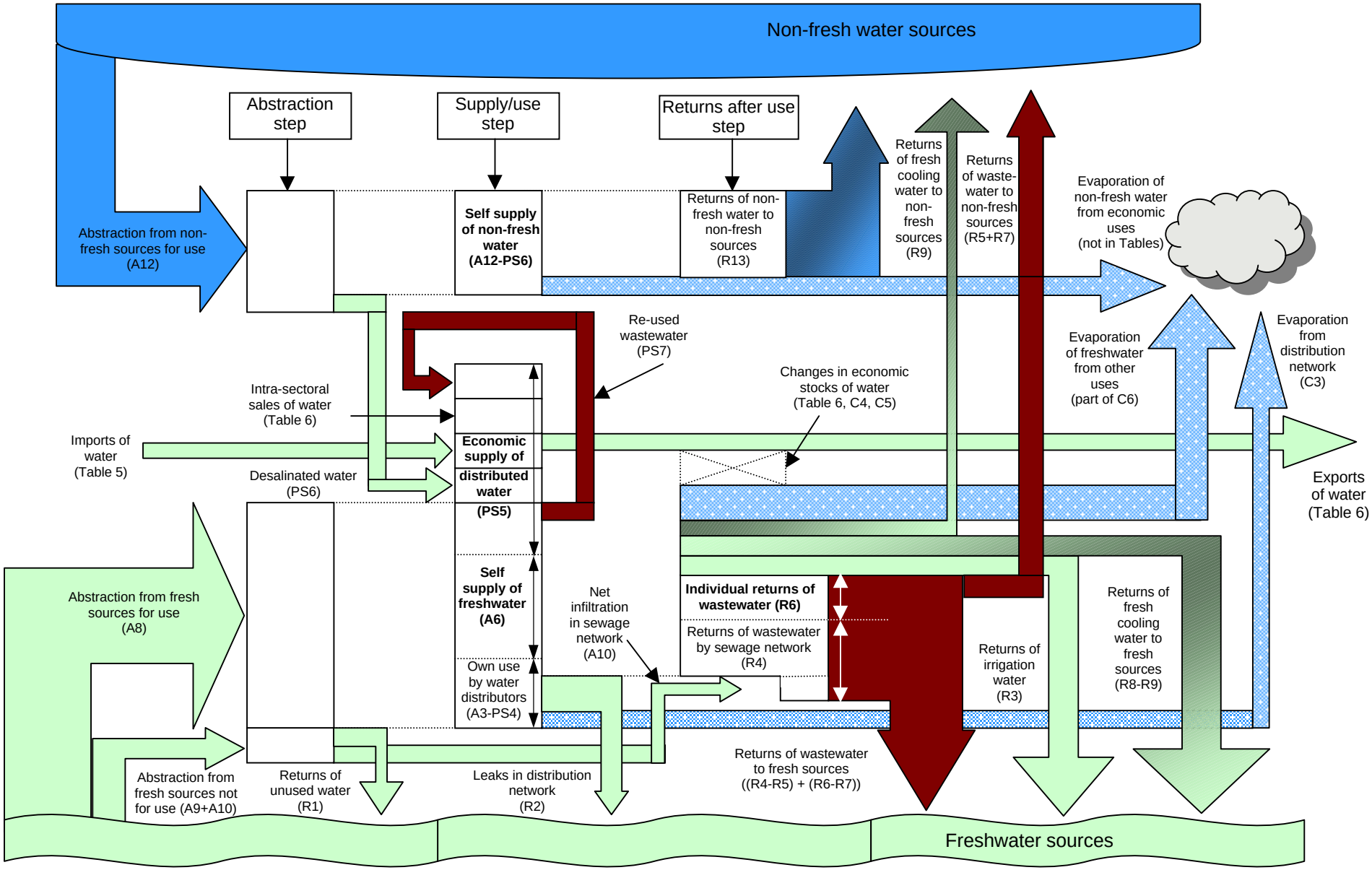
- administration of water supply affairs; assessment of future needs and determination of availability in terms of such assessment; supervision and regulation of all facets of potable water supply including water purity, price and quantity controls;
- construction or operation of non-enterprise-type of water supply systems;
- production and dissemination of general information, technical documentation and statistics on water supply affairs and services;
- grants, loans or subsidies to support the operation, construction, maintenance or upgrading of water supply systems.

It excludes:

- irrigation systems (classified in 04.2.1);
- multipurpose projects (04.7.4);
- collection and treatment of wastewater (05.2.0).

Scheme A-1 Scheme illustrating the main flows of water recorded in the water accounts tables

(References in brackets refer to column numbers of tables 5 to 9)



Final Table 1 - Supply of distributed water and of wastewater services (in thousand national currency units)

		Type of products	Water and wastewater services (CPA codes)								
			Part of 01.41.11 Operation of irrigation systems	41.00.11 Drinking water	41.00.12 Non-drinking water	41.00.20 Distribution services of water	**41.00 Total distributed water**	**Part of 75.12.13 Water related administrative services**			**90.01 Collection and treatment of sewage**
								Related to NACE 41	Related to NACE 90.01	Other services abstracting water	
			MS1	MS2	MS3	MS4	MS5= MS2+MS3+MS4	MS6	MS7	MS8	MS9
Producing industry	01.41*	Operation of irrigation systems									
	A*	Agriculture, hunting and forestry, except 01.41*									
	B	Fishing									
	CA	Mining and quarrying of energy producing materials									
	CB	Mining and quarrying, except energy producing materials									
	DA	Manufacture of food products, beverages and tobacco									
	DB	Manufacture of textiles and textiles products									
	DC	Manufacture of leather and leather products									
	DD	Manufacture of wood and wood products									
	DE	Manufacture of pulp, paper, publishing and printing									
	DF	Manufacture of coke, refined petroleum and nuclear fuel									
	DG	Manufacture of chemicals, man-made fibres									
	DH	Manufacture of rubber and plastic products									
	DI	Manufacture of other non-metallic mineral products									
	DJ	Manufacture of basic metals and fabricated metal products									
	DK	Manufacture of machinery and equipment n.e.c									
	DL	Manufacture of electrical and optical equipment									
	DM	Manufacture of transport equipment									
	DN	Manufacturing n.e.c									
	40	Electricity, gas, steam and hot water supply									
	41	Collection, purification and distribution of water									
	F	Construction									
	G	Wholesale and retail trade, repair									
	H	Hotels and restaurants									
	I	Transport, storage and communication									
	J	Financial intermediation									
	K	Real estate, renting and business activities									
	75.12 *	Public administration for water									
	L*	Public administration, except 75.12*									
	M	Education									
	N	Health and social work									
	90.01	Collection and treatment of sewage									
	O*	Other community, social and personal services, except 90.01									
	PQ*	Other and not broken down activities									
Total output at basic prices											
Taxes on products											
Less subsidies on products											
Imports CIF											
Total supply at purchasers' prices											

Final Table 2 - Uses of distributed water and of wastewater services (in thousand national currency units)

	Type of water		Irrigation water delivered	Drinking water delivered	Non-drinking water delivered	Total drinking + non-drinking water	Total water delivered			Wastewater collected by sewage networks
							Total	Of which: desalinated water	Of which: wastewater re-used	
			PS1	PS2	PS3	PS4= PS2+PS3	PS5= PS1+PS4	PS6	PS7	PS8
Producing industry	01.41*	Operation of irrigation systems								
	A*	Agriculture, hunting and forestry, except 01.41*								
	B	Fishing								
	CA	Mining and quarrying of energy producing materials								
	CB	Mining and quarrying, except energy producing materials								
	DA	Manufacture of food products, beverages and tobacco								
	DB	Manufacture of textiles and textiles products								
	DC	Manufacture of leather and leather products								
	DD	Manufacture of wood and wood products								
	DE	Manufacture of pulp, paper, publishing and printing								
	DF	Manufacture of coke, refined petroleum and nuclear fuel								
	DG	Manufacture of chemicals, man-made fibres								
	DH	Manufacture of rubber and plastic products								
	DI	Manufacture of other non-metallic mineral products								
	DJ	Manufacture of basic metals and fabricated metal products								
	DK	Manufacture of machinery and equipment n.e.c								
	DL	Manufacture of electrical and optical equipment								
	DM	Manufacture of transport equipment								
	DN	Manufacturing n.e.c								
	40	Electricity, gas, steam and hot water supply								
	41	Collection, purification and distribution of water								
	F	Construction								
	G	Wholesale and retail trade, repair								
	H	Hotels and restaurants								
	I	Transport, storage and communication								
	J	Financial intermediation								
	K	Real estate, renting and business activities								
	75.12 *	Public administration for water								
	L*	Public administration, except 75.12*								
	M	Education								
	N	Health and social work								
	90.01	Collection and treatment of sewage								
	O*	Other community, social and personal services, except 90.01								
	PQ*	Other and not broken down activities								
Total output										
Imports										
Total supply										

Final Table 3 - Economic accounts for water distribution and wastewater collection industries (in thousand national currency units)

Type of activity	Operation of irrigation systems (part of NACE 01.41)		Collection, purification and distribution of water (NACE 41)		Water related administrative services (part of NACE 75.12)			Collection and treatment of sewage (NACE 90.01)	
					Related to NACE 41	Related to NACE 90.01	Other services abstracting water		
Type of institutional unit	Corporations	General government	Corporations	General government	General government	General government	General government	Corporations	General government
Production and generation of income accounts									
1 Total intermediate consumption									
2 Total value added, gross									
2.1 Compensation of employees									
2.2 Other taxes on production									
2.3 Less other subsidies on production									
2.4 Consumption of fixed capital									
2.5 Net operating surplus									
3 Total output at basic prices									
3.1 Market water-related output									
3.2 Non-market water-related output									
3.3 Non-water-related output									
Fixed capital									
4 Investment grants received									
5 Gross fixed capital formation									
6 Closing stocks of fixed assets									
Labour inputs									
7 Total hours worked									

Final Table 4 - Expenditure for self-supply of water and of wastewater treatment (in thousand national currency units)

			Self-supply of water								Self-supply of wastewater collection and treatment							
			Current expenditure					Capital expenditure	Closing stock of fixed assets	Labour inputs in total hours worked	Current expenditure					Capital expenditure	Closing stock of fixed assets	Labour inputs in total hours worked
			Inter-mediate consump-tion	Compen-sation of employees	Taxes related to self-supply of water	Less subsidies related to self-supply of water	Consump-tion of fixed capital				Inter-mediate consump-tion	Compen-sation of employees	Taxes related to self-supply of treatment and removal	Less subsidies related to self-supply of treatment and removal	Consump-tion of fixed capital			
Self-supplying industry	01.41*	Operation of irrigation systems																
	A*	Agriculture, hunting and forestry, except 01.41*																
	B	Fishing																
	CA	Mining and quarrying of energy producing materials																
	CB	Mining and quarrying, except energy producing materials																
	DA	Manufacture of food products, beverages and tobacco																
	DB	Manufacture of textiles and textiles products																
	DC	Manufacture of leather and leather products																
	DD	Manufacture of wood and wood products																
	DE	Manufacture of pulp, paper, publishing and printing																
	DF	Manufacture of coke, refined petroleum and nuclear fuel																
	DG	Manufacture of chemicals, man-made fibres																
	DH	Manufacture of rubber and plastic products																
	DI	Manufacture of other non-metallic mineral products																
	DJ	Manufacture of basic metals and fabricated metal products																
	DK	Manufacture of machinery and equipment n.e.c.																
	DL	Manufacture of electrical and optical equipment																
	DM	Manufacture of transport equipment																
	DN	Manufacturing n.e.c.																
	40	Electricity, gas, steam and hot water supply																
	41	Collection, purification and distribution of water																
	F	Construction																
	G	Wholesale and retail trade, repair																
	H	Hotels and restaurants																
	I	Transport, storage and communication																
	J	Financial intermediation																
	K	Real estate, renting and business activities																
	75.12 *	Public administration for water																
	L*	Public administration, except 75.12*																
	M	Education																
	N	Health and social work																
	90.01	Collection and treatment of sewage																
	O*	Other community, social and personal services, except 90.01																
	PQ*	Other and not broken down activities																
Total industries																		
Households for their own consumption																		
Total industries																		

Final Table 5 - Physical flows of water corresponding to economic supply recorded in Table 1 (in thousand m^3)

	Type of water	Irrigation water delivered	Drinking water delivered	Non-drinking water delivered	Total drinking + non-drinking water	Total water delivered			Wastewater collected by sewage networks
						Total	Of which: desalinated water	Of which: wastewater re-used	
		PS1	PS2	PS3	PS4= PS2+PS3	PS5= PS1+PS4	PS6	PS7	PS8
Producing industry	01.41* Operation of irrigation systems								
	A* Agriculture, hunting and forestry, except 01.41*								
	B Fishing								
	CA Mining and quarrying of energy producing materials								
	CB Mining and quarrying, except energy producing materials								
	DA Manufacture of food products, beverages and tobacco								
	DB Manufacture of textiles and textiles products								
	DC Manufacture of leather and leather products								
	DD Manufacture of wood and wood products								
	DE Manufacture of pulp, paper, publishing and printing								
	DF Manufacture of coke, refined petroleum and nuclear fuel								
	DG Manufacture of chemicals, man-made fibres								
	DH Manufacture of rubber and plastic products								
	DI Manufacture of other non-metallic mineral products								
	DJ Manufacture of basic metals and fabricated metal products								
	DK Manufacture of machinery and equipment n.e.c								
	DL Manufacture of electrical and optical equipment								
	DM Manufacture of transport equipment								
	DN Manufacturing n.e.c								
	40 Electricity, gas, steam and hot water supply								
	41 Collection, purification and distribution of water								
	F Construction								
	G Wholesale and retail trade, repair								
	H Hotels and restaurants								
	I Transport, storage and communication								
	J Financial intermediation								
	K Real estate, renting and business activities								
	75.12 * Public administration for water								
	L* Public administration, except 75.12*								
	M Education								
	N Health and social work								
	90.01 Collection and treatment of sewage								
	O* Other community, social and personal services, except 90.01								
	PQ* Other and not broken down activities								
Total output									
Imports									
Total supply									

Final Table 6 - Physical flows of water corresponding to economic uses recorded in Table 2 (in thousand m^3)

	Type of water		Irrigation water received PU1	Drinking water received PU2	Non-drinking water received PU3	Total drinking + non-drinking water received PU4= PU2+PU3	**Total water received** PU5= PU1+PU4	**Wastewater discharged to sewage networks** PU6
Consuming industry	01.41*	Operation of irrigation systems						
	A*	Agriculture, hunting and forestry, except 01.41*						
	B	Fishing						
	CA	Mining and quarrying of energy producing materials						
	CB	Mining and quarrying, except energy producing materials						
	DA	Manufacture of food products, beverages and tobacco						
	DB	Manufacture of textiles and textiles products						
	DC	Manufacture of leather and leather products						
	DD	Manufacture of wood and wood products						
	DE	Manufacture of pulp, paper, publishing and printing						
	DF	Manufacture of coke, refined petroleum and nuclear fuel						
	DG	Manufacture of chemicals, man-made fibres						
	DH	Manufacture of rubber and plastic products						
	DI	Manufacture of other non-metallic mineral products						
	DJ	Manufacture of basic metals and fabricated metal products						
	DK	Manufacture of machinery and equipment n.e.c						
	DL	Manufacture of electrical and optical equipment						
	DM	Manufacture of transport equipment						
	DN	Manufacturing n.e.c						
	40	Electricity, gas, steam and hot water supply						
	41	Collection, purification and distribution of water				Intra-sectoral sales		
	F	Construction						
	G	Wholesale and retail trade, repair						
	H	Hotels and restaurants						
	I	Transport, storage and communication						
	J	Financial intermediation						
	K	Real estate, renting and business activities						
	75.12 *	Public administration for water						
	L*	Public administration, except 75.12*						
	M	Education						
	N	Health and social work						
	90.01	Collection and treatment of sewage						
	O*	Other community, social and personal services, except 90.01						
	PQ*	Other and not broken down activities						
Total intermediate consumption of industries								
Final consumption								
	by government							
	by households							
Change in inventories								
Exports								
Total uses								

Final Table 7 - Abstraction of water (in thousand m³)

	Type of abstraction	Abstraction from freshwater sources											From non fresh-water sources		Total abstraction
		Abstraction for distribution			Abstraction for self-supply				Abstraction not for use			Total freshwater abstraction	Total non-freshwater	Of which: for cooling	
		Fresh surface water	Fresh ground water	Total fresh water	Fresh surface water	Fresh ground water	Total fresh-water	Of which: for cooling	Total freshwater abstraction for use	Mine and drainage water	Rainwater & net infiltration into sewage system				
		A1	A2	A3	A4	A5	A6	A7	A8=A3+A6	A9	A10	A11=A8+A9 +A10	A12	A13	A14=A11+A12
Abstracting industry	01.41* Operation of irrigation systems														
	A* Agriculture, hunting and forestry, except 01.41*														
	Of which: for irrigation														
	B Fishing														
	CA Mining and quarrying of energy producing materials														
	CB Mining and quarrying, except energy producing materials														
	DA Manufacture of food products, beverages and tobacco														
	DB Manufacture of textiles and textiles products														
	DC Manufacture of leather and leather products														
	DD Manufacture of wood and wood products														
	DE Manufacture of pulp, paper, publishing and printing														
	DF Manufacture of coke, refined petroleum and nuclear fuel														
	DG Manufacture of chemicals, man-made fibres														
	DH Manufacture of rubber and plastic products														
	DI Manufacture of other non-metallic mineral products														
	DJ Manufacture of basic metals and fabricated metal products														
	DK Manufacture of machinery and equipment n.e.c														
	DL Manufacture of electrical and optical equipment														
	DM Manufacture of transport equipment														
	DN Manufacturing n.e.c														
	40 Electricity, gas, steam and hot water supply														
	41 Collection, purification and distribution of water														
	F Construction														
	G Wholesale and retail trade, repair														
	H Hotels and restaurants														
	I Transport, storage and communication														
	J Financial intermediation														
	K Real estate, renting and business activities														
	75.12 * Public administration for water														
	L* Public administration, except 75.12*														
	M Education														
	N Health and social work														
	90.01 Collection and treatment of sewage														
	O* Other community, social and personal services, except 90.01														
	PQ* Other and not broken down activities														
Total industries															
Households (for final consumption)															
Total															

Final Table 8 - Returns of water (in thousand m³)

Type of return		Returns of unused water	Leaks from distribution networks	Returns from irrigation	Returns of wastewater by sewage systems		Individual returns of wastewater		Returns of fresh cooling water		Returns of freshwater			Returns of non-fresh water to non-fresh sources
					Total	Of which: to non-fresh water sources	Total	Of which: to non-fresh water sources	Total	Of which: to non-fresh water sources	Total	Of which: to non-fresh water sources	Of which: to freshwater sources	
		R1=A9	R2	R3	R4	R5	R6	R7	R8	R9	R10= R1+R2+R3+ R4+R6+R8	R11= R5+R7+R9	R12= R10-R11	R13
Returning industry	01.41* Operation of irrigation systems													
	A* Agriculture, hunting and forestry, except 01.41*													
	Of which: from irrigation													
	B Fishing													
	CA Mining and quarrying of energy producing materials													
	CB Mining and quarrying, except energy producing materials													
	DA Manufacture of food products, beverages and tobacco													
	DB Manufacture of textiles and textiles products													
	DC Manufacture of leather and leather products													
	DD Manufacture of wood and wood products													
	DE Manufacture of pulp, paper, publishing and printing													
	DF Manufacture of coke, refined petroleum and nuclear fuel													
	DG Manufacture of chemicals, man-made fibres													
	DH Manufacture of rubber and plastic products													
	DI Manufacture of other non-metallic mineral products													
	DJ Manufacture of basic metals and fabricated metal products													
	DK Manufacture of machinery and equipment n.e.c													
	DL Manufacture of electrical and optical equipment													
	DM Manufacture of transport equipment													
	DN Manufacturing n.e.c													
	40 Electricity, gas, steam and hot water supply													
	41 Collection, purification and distribution of water													
	F Construction													
	G Wholesale and retail trade, repair													
	H Hotels and restaurants													
	I Transport, storage and communication													
	J Financial intermediation													
	K Real estate, renting and business activities													
	75.12 * Public administration for water													
	L* Public administration, except 75.12*													
	M Education													
	N Health and social work													
	90.01 Collection and treatment of sewage													
	Returned without treatment													
	Returned after primary treatment													
	Returned after secondary treatment													
	Returned after tertiary treatment													
	O* Other community, social and personal services, except 90.01													
	PQ* Other and not broken down activities													
Total industries														
Households (from final consumption)														
Total														

Final Table 9 - Freshwater balance (in thousand m^3)

			Total freshwater abstraction	Balance of economic flows				(-) Total returns of freshwater to fresh sources	(=) Physical consumption of freshwater	(-) Returns of freshwater to non-fresh water sources	(=) Consumptive water uses	Of which:			
				(+) Water received	(-) Water delivered	(-) Wastewater discharged to sewage system	(+) Wastewater collected by sewage system					Evaporation from distribution networks	Water incorporated in products	Water removed from products	Others (including other evaporation of freshwater)
			=A11	=PU5	=PS5	=PU6	=PS6	=R12	C1	=R11	C2	C3	C4	C5	C6= C2-C3-C4+C5
Industry	01.41*	Operation of irrigation systems													
	A*	Agriculture, hunting and forestry, except 01.41*													
		Of which: irrigation water													
	B	Fishing													
	CA	Mining and quarrying of energy producing materials													
	CB	Mining and quarrying, except energy producing materials													
	DA	Manufacture of food products, beverages and tobacco													
	DB	Manufacture of textiles and textiles products													
	DC	Manufacture of leather and leather products													
	DD	Manufacture of wood and wood products													
	DE	Manufacture of pulp, paper, publishing and printing													
	DF	Manufacture of coke, refined petroleum and nuclear fuel													
	DG	Manufacture of chemicals, man-made fibres													
	DH	Manufacture of rubber and plastic products													
	DI	Manufacture of other non-metallic mineral products													
	DJ	Manufacture of basic metals and fabricated metal products													
	DK	Manufacture of machinery and equipment n.e.c													
	DL	Manufacture of electrical and optical equipment													
	DM	Manufacture of transport equipment													
	DN	Manufacturing n.e.c													
	40	Electricity, gas, steam and hot water supply													
	41	Collection, purification and distribution of water													
	F	Construction													
	G	Wholesale and retail trade, repair													
	H	Hotels and restaurants													
	I	Transport, storage and communication													
	J	Financial intermediation													
	K	Real estate, renting and business activities													
	75.12 *	Public administration for water													
	L*	Public administration, except 75.12*													
	M	Education													
	N	Health and social work													
	90.01	Collection and treatment of sewage													
	O*	Other community, social and personal services, except 90.01													
	PQ*	Other and not broken down activities													
Total industries															
Households (final consumption)															
Change in inventories															
Rest of the World															
Total															

Final Table 10 - Pollutant loads of freshwater abstracted for self-supply (pollutant content of flow A6 in table 7)

		Type of pollutant	Biochemical oxygen demand in tonnes O2	Chemical oxygen demand in tonnes O2	Suspended solids in tonnes	Heavy metals								Phosphorus (total) in tonnes	Nitrogen (total) in tonnes
						As in kg	Cd in kg	Hg in kg	Cu in kg	Cr in kg	Ni in kg	Pb in kg	Zn in kg		
Industry	01.41*	Operation of irrigation systems													
	A*	Agriculture, hunting and forestry, except 01.41*													
	B	Fishing													
	CA	Mining and quarrying of energy producing materials													
	CB	Mining and quarrying, except energy producing materials													
	DA	Manufacture of food products, beverages and tobacco													
	DB	Manufacture of textiles and textiles products													
	DC	Manufacture of leather and leather products													
	DD	Manufacture of wood and wood products													
	DE	Manufacture of pulp, paper, publishing and printing													
	DF	Manufacture of coke, refined petroleum and nuclear fuel													
	DG	Manufacture of chemicals, man-made fibres													
	DH	Manufacture of rubber and plastic products													
	DI	Manufacture of other non-metallic mineral products													
	DJ	Manufacture of basic metals and fabricated metal products													
	DK	Manufacture of machinery and equipment n.e.c													
	DL	Manufacture of electrical and optical equipment													
	DM	Manufacture of transport equipment													
	DN	Manufacturing n.e.c													
	40	Electricity, gas, steam and hot water supply													
	41	Collection, purification and distribution of water													
	F	Construction													
	G	Wholesale and retail trade, repair													
	H	Hotels and restaurants													
	I	Transport, storage and communication													
	J	Financial intermediation													
	K	Real estate, renting and business activities													
	75.12 *	Public administration for water													
	L*	Public administration, except 75.12*													
	M	Education													
	N	Health and social work													
	90.01	Collection and treatment of sewage													
	O*	Other community, social and personal services, except 90.01													
	PQ*	Other and not broken down activities													
Total industries															
Households for final consumption															
Total															

Final Table 11 - Pollutant loads of wastewater discharged to the sewage network (pollutant content of flow PU6 in table 6)

	Type of pollutant		Biochemical oxygen demand	Chemical oxygen demand	Suspended solids	Heavy metals								Phosphorus (total)	Nitrogen (total)
						As	Cd	Hg	Cu	Cr	Ni	Pb	Zn		
			in tonnes O2	in tonnes O2	in tonnes	in kg	in kg	in kg	in kg	in kg	in kg	in kg	in kg	in tonnes	in tonnes
Industry	01.41*	Operation of irrigation systems													
	A*	Agriculture, hunting and forestry, except 01.41*													
	B	Fishing													
	CA	Mining and quarrying of energy producing materials													
	CB	Mining and quarrying, except energy producing materials													
	DA	Manufacture of food products, beverages and tobacco													
	DB	Manufacture of textiles and textiles products													
	DC	Manufacture of leather and leather products													
	DD	Manufacture of wood and wood products													
	DE	Manufacture of pulp, paper, publishing and printing													
	DF	Manufacture of coke, refined petroleum and nuclear fuel													
	DG	Manufacture of chemicals, man-made fibres													
	DH	Manufacture of rubber and plastic products													
	DI	Manufacture of other non-metallic mineral products													
	DJ	Manufacture of basic metals and fabricated metal products													
	DK	Manufacture of machinery and equipment n.e.c													
	DL	Manufacture of electrical and optical equipment													
	DM	Manufacture of transport equipment													
	DN	Manufacturing n.e.c													
	40	Electricity, gas, steam and hot water supply													
	41	Collection, purification and distribution of water													
	F	Construction													
	G	Wholesale and retail trade, repair													
	H	Hotels and restaurants													
	I	Transport, storage and communication													
	J	Financial intermediation													
	K	Real estate, renting and business activities													
	75.12 *	Public administration for water													
	L*	Public administration, except 75.12*													
	M	Education													
	N	Health and social work													
	90.01	Collection and treatment of sewage													
	O*	Other community, social and personal services, except 90.01													
	PQ*	Other and not broken down activities													
Total industries															
Households from final consumption															
Total															

Supplementary table: Pollutant loads received by sewage system for treatment/discharge
(pollutant content of flows PS8 in table 5 and A10 in table 7)

For discharge without treatment*														
For primary treatment only**														
For secondary treatment**														
For tertiary treatment**														
Total received by sewage system for treatment/discharge														

**….Measured at the point of discharge when there is no treatment*

***…Measured at the entrance of the treatment plants*

Final Table 12 - Pollutant loads of cooling and wastewater returned to the environment (pollutant content of flows R4, R6 and R8 in Table

		Type of pollutant	Biochemical oxygen demand in tonnes O2	Chemical oxygen demand in tonnes O2	Suspended solids in tonnes	Heavy metals								Phosphorus (total) in tonnes	Nitrogen (total) in tonnes
						As in kg	Cd in kg	Hg in kg	Cu in kg	Cr in kg	Ni in kg	Pb in kg	Zn in kg		
Industry	01.41*	Operation of irrigation systems													
	A*	Agriculture, hunting and forestry, except 01.41*													
	B	Fishing													
	CA	Mining and quarrying of energy producing materials													
	CB	Mining and quarrying, except energy producing materials													
	DA	Manufacture of food products, beverages and tobacco													
	DB	Manufacture of textiles and textiles products													
	DC	Manufacture of leather and leather products													
	DD	Manufacture of wood and wood products													
	DE	Manufacture of pulp, paper, publishing and printing													
	DF	Manufacture of coke, refined petroleum and nuclear fuel													
	DG	Manufacture of chemicals, man-made fibres													
	DH	Manufacture of rubber and plastic products													
	DI	Manufacture of other non-metallic mineral products													
	DJ	Manufacture of basic metals and fabricated metal products													
	DK	Manufacture of machinery and equipment n.e.c													
	DL	Manufacture of electrical and optical equipment													
	DM	Manufacture of transport equipment													
	DN	Manufacturing n.e.c													
	40	Electricity, gas, steam and hot water supply													
	41	Collection, purification and distribution of water													
	F	Construction													
	G	Wholesale and retail trade, repair													
	H	Hotels and restaurants													
	I	Transport, storage and communication													
	J	Financial intermediation													
	K	Real estate, renting and business activities													
	75.12 *	Public administration for water													
	L*	Public administration, except 75.12*													
	M	Education													
	N	Health and social work													
	90.01	Collection and treatment of sewage													
		Discharged without treatment													
		Discharged after primary treatment													
		Discharged after secondary treatment													
		Discharged after tertiary treatment													
	O*	Other community, social and personal services, except 90.01													
	PQ*	Other and not broken down activities													
Total industries															
Households from final consumption															
Total															

For memory: Pollutant loads from other sources returned to non-fresh sources

Diffuse pollution from agriculture (non-point sources)														
Any other sources (please specify*)														

**…Could for example include pollutant loads in drainage water flows from agriculture or non-point pollution from run-off from roads not captured by sewage systems.*

Final Table 13 - Pollutant loads of cooling and wastewater returned to non-fresh sources (flows R5, R7 and R9 in Final Table 8)

		Type of pollutant	Biochemical oxygen demand	Chemical oxygen demand	Suspended solids	Heavy metals								Phosphorus (total)	Nitrogen (total)
						As	Cd	Hg	Cu	Cr	Ni	Pb	Zn		
			in tonnes O2	in tonnes O2	in tonnes	in kg	in kg	in kg	in kg	in kg	in kg	in kg	in kg	in tonnes	in tonnes
Industry	01.41*	Operation of irrigation systems													
	A*	Agriculture, hunting and forestry, except 01.41*													
	B	Fishing													
	CA	Mining and quarrying of energy producing materials													
	CB	Mining and quarrying, except energy producing materials													
	DA	Manufacture of food products, beverages and tobacco													
	DB	Manufacture of textiles and textiles products													
	DC	Manufacture of leather and leather products													
	DD	Manufacture of wood and wood products													
	DE	Manufacture of pulp, paper, publishing and printing													
	DF	Manufacture of coke, refined petroleum and nuclear fuel													
	DG	Manufacture of chemicals, man-made fibres													
	DH	Manufacture of rubber and plastic products													
	DI	Manufacture of other non-metallic mineral products													
	DJ	Manufacture of basic metals and fabricated metal products													
	DK	Manufacture of machinery and equipment n.e.c													
	DL	Manufacture of electrical and optical equipment													
	DM	Manufacture of transport equipment													
	DN	Manufacturing n.e.c													
	40	Electricity, gas, steam and hot water supply													
	41	Collection, purification and distribution of water													
	F	Construction													
	G	Wholesale and retail trade, repair													
	H	Hotels and restaurants													
	I	Transport, storage and communication													
	J	Financial intermediation													
	K	Real estate, renting and business activities													
	75.12 *	Public administration for water													
	L*	Public administration, except 75.12*													
	M	Education													
	N	Health and social work													
	90.01	Collection and treatment of sewage													
		Discharged without treatment													
		Discharged after primary treatment													
		Discharged after secondary treatment													
		Discharged after tertiary treatment													
	O*	Other community, social and personal services, except 90.01													
	PQ*	Other and not broken down activities													
Total industries															
Households from final consumption															
Total															

For memory: Pollutant loads from other sources

Diffuse pollution from agriculture (non-point sources)														
Any other sources (please specify*)														

**…Could for example include pollutant loads in drainage water flows from agriculture or non-point pollution from run-off from roads not captured by sewage systems.*

Annex 3: Water-relevant European directives

Extracts from the Water Framework Directive

The **EU Water Framework Directive** (WFD) was adopted by the European Parliament and the Council on 23 October 2000. It entered into force at the time of its publication in the Official Journal of the European Communities, on 22 December 2000 as Directive 2000/60/EC, 'establishing a framework for Community action in the field of water policy'.

Two articles of the FWD (Articles 5 and 9) directly introduce economic elements:

" …Article 5 – Characteristics of the river basin district, review of the environmental impact of human activity and economic analysis of water use

1. Each Member State shall ensure that for each river basin district or for the portion of an international river basin district falling within its territory:

- *an analysis of its characteristics,*
- *a review of the impact of human activity on the status of surface waters and on groundwater, and*
- *an economic analysis of water use*[58]

is undertaken according to the technical specifications set out in Annexes II and III and that it is completed, at the latest, four years after the date of entry into force of this Directive.

2. The analyses and reviews mentioned under paragraph 1 shall be reviewed, and if necessary updated, at the latest, 13 years after the date of entry into force of this Directive and every six years thereafter… "

" …Article 9 – Recovery of costs for water services

1. Member States shall take account of the principle of recovery of the costs of water services, including environmental and resource costs, having regard to the economic analysis conducted according to Annex III, and in accordance, in particular, with the polluter-pays principle.

Member States shall ensure by 2010:
– that water-pricing policies provide adequate incentives for users to use water resources efficiently, and thereby contribute to the environmental objectives of this Directive,
– an adequate contribution of the different water users, disaggregated into at least industry, households and agriculture, to the recovery of the costs of water services, based on the economic analysis conducted according to Annex III and taking account of the polluter pays principle.

Member States may in so doing have regard to the social, environmental and economic effects of the recovery as well as the geographic and climatic conditions of the region or regions affected…"

But, other references to economics are found elsewhere in the FWD text, in particular in all paragraphs related to measurement of pressures:

" *…Member States shall collect and maintain information on the type and magnitude of the significant anthropogenic pressures*[59] *to which the surface water bodies in each river basin district are liable to be subject, in particular the following…* "

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58 This economic analysis is further briefly developed in Annex III:
'*The economic analysis shall contain enough information in sufficient detail (taking account of the costs associated with collection of the relevant data) in order to:*
(a) make the relevant calculations necessary for taking into account, under Article 9, the principle of recovery of the costs of water services, taking account of long term forecasts of supply and demand for water in the river basin district and, where necessary:
– estimates of the volume, prices and costs associated with water services, and
– estimates of relevant investment including forecasts of such investments;
(b) make judgements about the most cost-effective combination of measures in respect of water uses to be included in the programme of measures under Article 11 based on estimates of the potential costs of such measures.'

59 The following are cited, in particular:
1. estimation and identification of significant point and diffuse source pollution;
2. estimation and identification of significant water abstraction for urban, industrial, agricultural and other uses, including seasonal variations and total annual demand, and of loss of water in distribution systems;

pressures which inevitably send back to the measurement of economic activities.

And, last but not least, exceptions to the achievement of the objectives of the WFD can be accepted for economic reasons: for example, Article 4 states that:

*" …5- Member States may aim to achieve **less stringent environmental objectives** than those required under paragraph 1 for specific bodies of water when they are **so affected by human activity**, as determined in accordance with Article 5(1), or their natural condition is such that the achievement of these objectives would be infeasible or **disproportionately expensive**, and all the following conditions are met:*

(a) *the environmental and **socio-economic needs** served by such human activity **cannot be achieved by other means**, which are a significantly better environmental option not entailing disproportionate costs; …"*

List of other water-relevant directives

1. Directives establishing emissions limit values and environmental quality standards:

– Directive 76/464/EEC on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community and its daughter Directives
  - Mercury Discharges Directive (82/176/EEC)
  - Cadmium Discharges Directive (83/513/EEC)
  - Mercury Directive (84/156/EEC)
  - Hexachlorocyclohexane Discharges Directive (84/491/EEC)
  - Dangerous Substance Discharges Directive (86/280/EEC)

2. Other existing EU legislation on water quality

– Bathing Water Quality Directive (76/160/EEC)
– Urban Wastewater Treatment Directive (98/15/EEC amending Council Directive 91/271/EEC)
– IPPC Directive (96/61/EC – industrial wastewater treatment)
– Nitrates Directive (91/676/EEC)
– Drinking Water Directive (98/83/EC amending Directive 80/778/EEC)

3. Other EU legislation referred to in the WFD

– Birds' Directive (79/409/EEC)
– Major Accidents Directive (96/82/EC – Seveso)
– Environmental Impact Assessment Directive (85/337/EEC)
– Sewage Sludge Directive (86/278/EEC)
– Plant Protection Products Directive (91/414/EEC)
– Habitats Directive (92/43/EEC)

3. estimation and identification of artificial recharge for groundwater;
4. estimation and identification of the impact of significant water flow regulation, including water transfer and diversion, on overall flow characteristics and water balances; and
5. estimation of land use patterns, including identification of the main urban, industrial and agricultural areas and, where relevant, fisheries and forests.

Annex 4: NACE Rev. 1, 2-digits with further detail for water-related activities

Section A	**Agriculture, hunting and forestry**
01	Agriculture, hunting and related service activities
01.4	Agricultural and animal husbandry service activities, except veterinary activities
01.41	Agricultural service activities
01.5	Hunting, trapping and game propagation, including related service activities
02	Forestry, logging and related service activities
Section B	**Fishing**
05	Fishing, operation of fish hatcheries and fish farms; service activities incidental to fishing
05.0	Fishing, operation of fish hatcheries and fish farms; service activities incidental to fishing
05.02	Operation of fish hatcheries and fish farms
Section C	**Mining and quarrying**
Subsection CA	*Mining and quarrying of energy producing materials*
10	Mining of coal and lignite; extraction of peat
11	Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying
12	Mining of uranium and thorium ores
Subsection CB	*Mining and quarrying, except of energy producing materials*
13	Mining of metal ores
14	Other mining and quarrying
Section D	**Manufacturing**
Subsection DA	*Manufacture of food products, beverages and tobacco*
15	Manufacture of food products and beverages
15.9	Manufacture of beverages
15.98	Production of mineral waters and soft drinks
16	Manufacture of tobacco products
Subsection DB	*Manufacture of textiles and textile products*
17	Manufacture of textiles
18	Manufacture of wearing apparel; dressing and dyeing of fur
Subsection DC	*Manufacture of leather and leather products*
19	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear
Subsection DD	*Manufacture of wood and wood products*
20	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
Subsection DE	*Manufacture of pulp, paper and paper products; publishing and printing*
21	Manufacture of pulp, paper and paper products
22	Publishing, printing and reproduction of recorded media
Subsection DF	*Manufacture of coke, refined petroleum products and nuclear fuel*
23	Manufacture of coke, refined petroleum products and nuclear fuel
Subsection DG	*Manufacture of chemicals, chemical products and man-made fibres*
24	Manufacture of chemicals and chemical products
Subsection DH	*Manufacture of rubber and plastic products*
25	Manufacture of rubber and plastic products
Subsection DI	*Manufacture of other non-metallic mineral products*
26	Manufacture of other non-metallic mineral products
Subsection DJ	*Manufacture of basic metals and fabricated metal products*
27	Manufacture of basic metals
28	Manufacture of fabricated metal products, except machinery and equipment
Subsection DK	*Manufacture of machinery and equipment n.e.c.*
29	Manufacture of machinery and equipment n.e.c.
Subsection DL	*Manufacture of electrical and optical equipment*
30	Manufacture of office machinery and computers
31	Manufacture of electrical machinery and apparatus n.e.c.
32	Manufacture of radio, television and communication equipment and apparatus
Subsection DM	*Manufacture of transport equipment*
34	Manufacture of motor vehicles, trailers and semi-trailers

35	Manufacture of other transport equipment
Subsection DN	*Manufacturing n.e.c.*
36	Manufacture of furniture; manufacturing n.e.c.
37	Recycling
Section E	**Electricity, gas and water supply**
40	Electricity, gas, steam and hot water supply
40.3	Steam and hot water supply
41	Collection, purification and distribution of water
41.0	Collection, purification and distribution of water
41.00	Collection, purification and distribution of water
Section F	**Construction**
45	Construction
Section G	**Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods**
50	Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel
51	Wholesale trade and commission trade, except of motor vehicles and motorcycles
52	Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods
Section H	**Hotels and restaurants**
55	Hotels and restaurants
Section I	**Transport, storage and communication**
60	Land transport; transport via pipelines
61	Water transport
62	Air transport
63	Supporting and auxiliary transport activities; activities of travel agencies
64	Post and telecommunications
Section J	**Financial intermediation**
65	Financial intermediation, except insurance and pension funding
66	Insurance and pension funding, except compulsory social security
67	Activities auxiliary to financial intermediation
Section K	**Real estate, renting and business activities**
70	Real estate activities
71	Renting of machinery and equipment without operator and of personal and household goods
72	Computer and related activities
73	Research and development
74	Other business activities
Section L	**Public administration and defence; compulsory social security**
75	Public administration and defence; compulsory social security
Section M	**Education**
80	Education
Section N	**Health and social work**
85	Health and social work
Section O	**Other community, social and personal service activities**
90	Sewage and refuse disposal, sanitation and similar activities
90.0	Sewage and refuse disposal, sanitation and similar activities
90.00	Sewage and refuse disposal, sanitation and similar activities
91	Activities of membership organizations n.e.c.
92	Recreational, cultural and sporting activities
93	Other service activities
Section P	**Private households with employed persons**
95	Private households with employed persons
Section Q	**Extra-territorial organizations and bodies**
99	Extra-territorial organizations and bodies

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Related websites

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European Commission – DG Environment: http://europa.eu.int/comm/dgs/environment

European Environment Agency: http://www.eea.eu.int/

European Topic Centre on Water: http://water.eionet.eu.int/

World Resources Institute: http://www.wri.org/

Organisation for Economic Co-operation and Development: http://www.oecd.org

United Nations Environment Programme: http://www.unep.org/