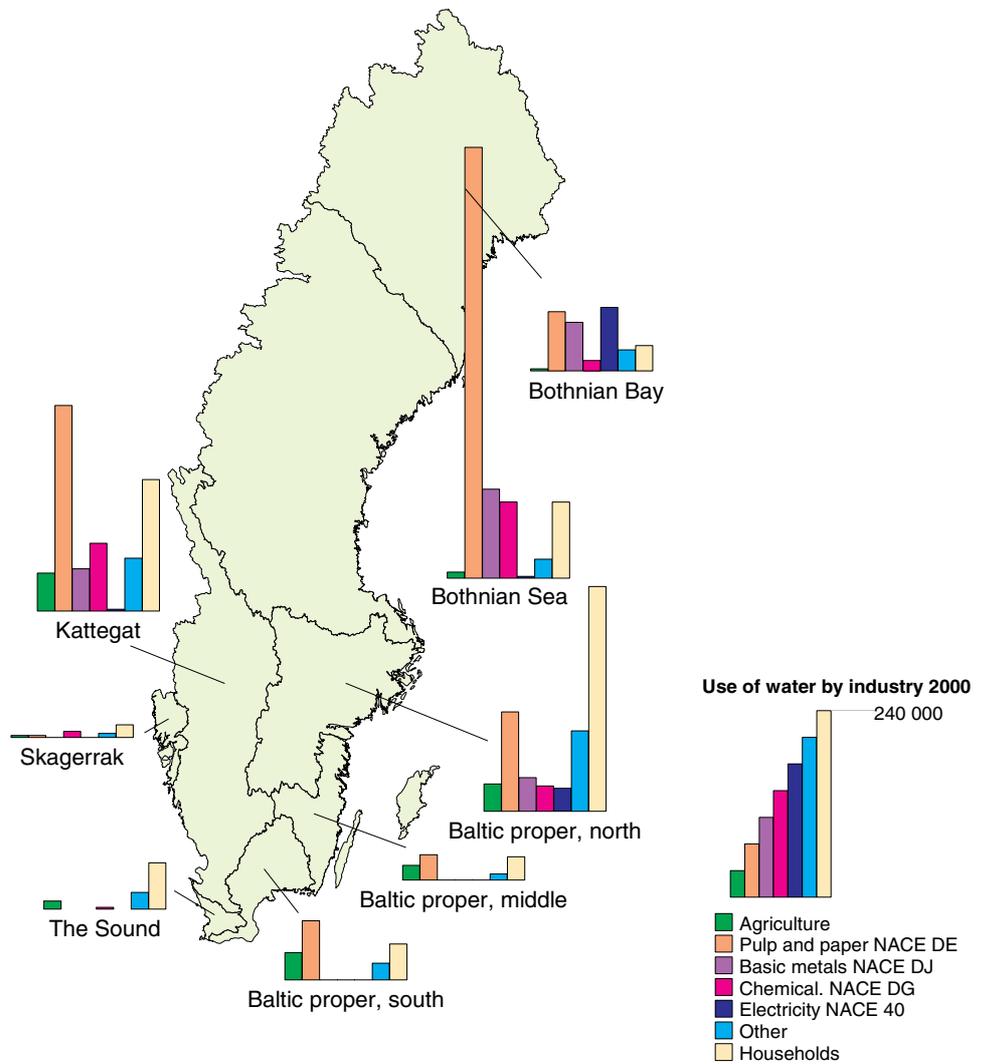


Rapport 2003:2

WATER ACCOUNTS 2000

- WITH DISAGGREGATION TO SEA BASINS



Rapport 2003:2

Water accounts 2000

-with disaggregation to Sea Basins

Environmental accounts

Water Accounts, - with disaggregation to Sea Basins

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Preface

Statistics Sweden has since 1993 a government commission to develop physical environmental accounts to focus on the connections between the environment and the economy. The environmental accounts connect economical data such as value added and employment in different industries with physical environmental data such as use of material/natural resources, emissions, and waste. The environmental accounts also include the environment industry, environmental taxes and environmental protection expenditures.

This study is a contribution to further development of the Water accounts. Water satellite accounts have earlier been presented for Sweden for the year 1995 containing both physical and monetary data on water abstraction, water-use, discharge and direct emissions of pollutants to water. The accounts were presented in a NAMEA-type framework. For this study, the first objective is to further develop the Water accounts for the year 2000 according to the tables proposed by the Eurostat task force on water Satellite Accounting.

The EU Water Framework Directive (WFD) was adopted by the European Parliament in 2000. The aim of the WFD is to prevent further deterioration of all waters and to achieve their 'good status'. The measures specified in the WFD in order to achieve 'good status' of waters will be coordinated at the level of river basin district (RBD). It is highly likely that the WFD will require more data for river basin districts. In this respect, the water satellite accounts and the combined economic and environmental data could be very useful. For that purpose the water satellite accounts have to be presented at the level of river basin district. The second objective of the study is to develop models for distributing physical and monetary data to river basin districts.

The report is prepared on the commission from Eurostat. The European Commission has contributed financially to the project. Gunnar Brånvall, Marianne Eriksson and Peter Fränngård have all contributed in preparing the report.

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Introduction to the report

The report starts with a chart showing the main flows of water related to the technosphere. Data for these flows is shown in the tables in the appendix. The tables are shown in a more aggregated form than the original tables in the suggested EU-framework. The aggregation is made according to data availability.

Chapter two contains a description of available data sources. Physical data is available for water abstraction, water use, wastewater, wastewater treatment and emissions. Monetary data is available for the public supply of water and wastewater treatment services and expenditure and investments for self-supply of waste water treatment in the manufacturing industry.

With the new Water Framework Directive all concerns about waters and their 'good status' will be coordinated at the level of river basins districts (RDB). In *chapter three* different methods to allocate data to RDB or Sea Basins are discussed. *Chapter four* contains an overview of results for water abstraction, water use, wastewater treatment and expenditure for water and wastewater treatment.

Chapter 5 contains 'Fact sheets' with aggregated information for each of the eight Sea basins. In the last section of the report all tables are brought together by Sea Basin.

1. Flows of water in Sweden

In Sweden there are 95 700 lakes with an area of 42 000 km², which is 9.3 percent of the total land area. The total freshwater resources that can be utilised in activities based on running water have been estimated at 178 000 Mm³, which is equal to the yearly run-off to the sea. The total abstraction in 2000 amounted to 2 700 Mm³ per year.

Figure 1 shows the most important flows of water related to the technosphere. The role of water resources in groundwater, surface water and sea-water as reservoirs for water abstraction are shown at the top of the figure. At the bottom of the figure, their role as recipients of (more or less) polluted water is illustrated. There are a few boxes shown in-between, representing the main human activities relating to water. These are classified according to NACE codes. Flows between the boxes are measured in Mm³ and refer to the year 2000.

Two of the activities are directly based on the qualitative treatment of water: NACE 41 (Collection, purification and distribution of water) abstracts raw water, produces and distributes tap water and sells it to customers. NACE 90.001 (Sewage disposal) represents Municipal Waste Water Treatment Plants (MWWTP), which produce the service of wastewater removal and treatment.

Raw water for tap water production is taken both from groundwater and surface water. Public waterworks serve about 90 per cent of the population. It is mostly in rural areas where households have private water abstraction. Public waterworks supply 6 per cent of the freshwater used in the manufacturing industry and also supply water for public use. In total, there are around 2 000 public waterworks, of which 375 are responsible for 86 per cent of the water abstraction.

There are around 2 000 MWWTPs, to which about 90 per cent of the population are connected. Almost 500 plants, which serve more than 2 000 people, treat about 90 per cent of the total wastewater. Standard sewage water is of course produced in every economic activity and it is usually taken care of by the MWWTPs. In addition to this, some process water is delivered from factories to MWWTPs.

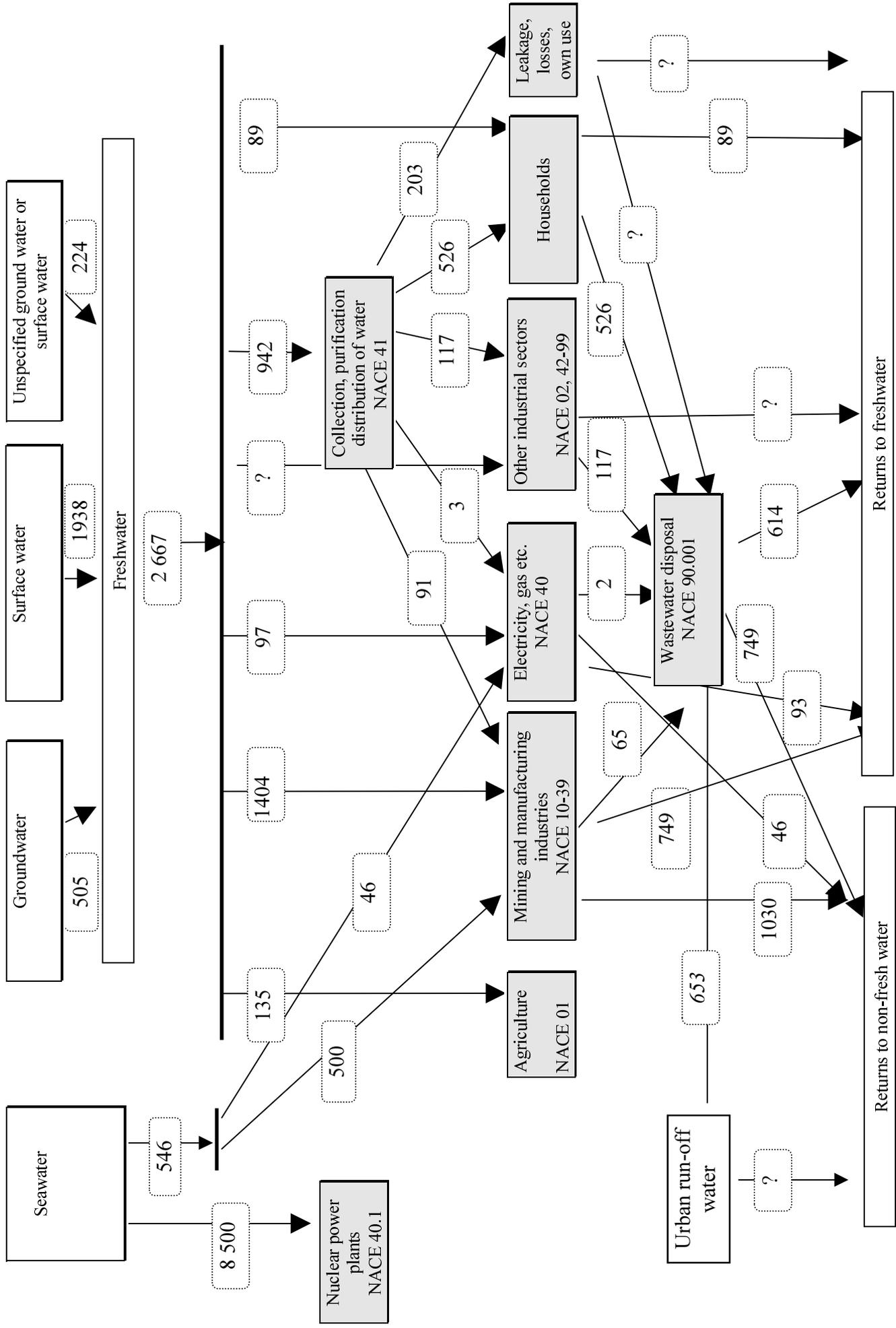
The abundance of water in Sweden is apparent from the large industrial abstraction of water, especially surface water - 1 400 Mm³ in 2000. These activities are concentrated to a few water-intensive process industries, notably the pulp and paper industry. Some large mining, steel and chemical plants are also quite water-intensive. Water is mainly used for cooling or in the production process. All industries that use water intensively are subject to rigorous environmental control, which imposes process water treatment requirements. Data on industrial discharges to water can be found annually in environmental reports. However, it should be mentioned that around half of the total industrial abstraction is used in stainless pipes for the purpose of cooling. This is considered to be discharged almost without pollution. These large industrial water flows do not correspond to

“water products”, but are rather to be considered as “auxiliary activities”, for example in the production of pulp. This makes it more difficult to study their economic implications.

As seen from Figure 1, total abstraction for tap water production is around 940 Mm³, of which 737 Mm³ is distributed to end-users. The remaining 203 Mm³ is made up of losses or measuring errors by water abstraction/by use of water, leakages and own use by the waterworks. The leakages are presumed to come into the wastewater system by urban run-off. The total amount of wastewater reaching the MWWTPs is larger, around 1 365 Mm³. In order to explain the difference, we have introduced a box for drainage and run-off water, some of which finds its way into the wastewater systems of Swedish MWWTPs. (The present Swedish policy is to aim at a separate drainage network for this type of water.)

Figure 1 shows the total water flow for Sweden and is based on the tables in the appendix. Since all the tables are also shown by sea basin, the corresponding chart of water flows can be compiled for each sea basin.

Figure 1 Flow of water in the Swedish technosphere



2. Data sources

2.1 Physical data

2.1.1 Water abstraction and water use

Market-produced water from public, municipal waterworks

The trade association for Swedish water utilities, the Swedish Water and Waste water Association (Svenskt Vatten AB) has been collecting yearly statistics on municipal waterworks and municipal sewage treatment plants. The latest questionnaire covered the year 1997. Since then no data has been collected. Data collection will begin again in 2003 and the new survey will cover 2002.

Since there are no data for 2000, Statistics Sweden has set up an internal database to estimate data for 2000 for the purposes of this project. The database covers all municipalities and contains data on abstraction and use of water.

The main information was retrieved from the Svenskt Vatten survey from 1997 covering:

- total population
- population connected to public water system
- population connected to public sewage system
- water abstraction from groundwater or surface water
- purchase or sale of water to other municipalities
- use of water in industry, households, public use e.g. schools or recreation purpose, own use in waterworks and losses

In the 1997 questionnaire, information was missing from 50 of the 289 municipalities in Sweden. For the missing data, Statistics Sweden estimated the figures by using information from the 1995 survey.

In the database, the figures for use in industry were updated with information from the special survey made of the manufacturing industry for 2000 conducted by Statistics Sweden (see below). As a consequence, data on total abstraction and use were adjusted.

Non-market produced/self supply

Manufacturing industry

A special survey was carried out by Statistics Sweden on water use in the manufacturing industry in 2000. The survey covered the abstraction, use and discharge of water. A detailed postal survey was distributed to about 900 establishments who were asked to report data on water abstraction, use and discharge. These establishments belong to industries, which are known to be large water users from the

1983 and 1995 censuses. Water abstraction by other establishments was reported by a simplified postal survey.¹

Households

In the real estate assessment register concerning one- and two-dwelling buildings and weekend and holiday homes, it is possible to retrieve information on whether a property is connected to the public water/sewage system or not. Furthermore, there is information on whether the property has private water supply/treatment of sewage water or lack water/wastewater facilities. Combining information from the real estate assessment register with the population register provides information on the number of people who are not connected to the public water and sewage system. For households not connected to public water systems, mostly outside urban areas, estimations on the quantities of abstracted/used water are made using the average use (189 litre /day²) by those connected to public water supply. This might be a slight overestimation but is the best available information.

For weekend and holiday homes, the estimation on water abstraction/use is based on the number of properties and information on type of water and sewage system. The use of water was estimated by using information from a study conducted by the Royal Institute of Technology in Stockholm³. The following coefficients for litre per person and day are used to estimate water use.

	Litre/person and day, weekend and holiday homes		
	Connection to public sewage system	Private sewage system	No sewage system
Private water supply	200	200	50
Summer water	100	100	50
No water	50	50	50

Each property is assumed to be used by three persons for 60 days per year.

The use of water in weekend and holiday homes is probably underestimated mostly because of the difficulties in enumerating the number of weekend and holiday homes. Holiday houses on real estate assessed as other type of real estate e.g. farm estate or one-family houses are not included. In the 2000 assessment, there are 417 000 weekend and holiday homes assessed as separate real estate but approximately 600 000⁴ building are used as weekend and holiday homes.

The data on private abstraction of water by households refer to 2000.

¹ See www.scb.se/sm/MI16SM0101_inEnglish.asp and www.scb.se/sm/MI16SM0201_inEnglish.asp

² The average use per person connected to the public waterworks. Water withdrawal and water use in Sweden 1995 www.scb.se/sm/MI27SM9901.pdf

³ Lena Tilly, Salt grundvatten i kustnära områden, undersöknings och bedömningsmetoder. Länsstyrelsen i Stockholms län, Kungl. Tekniska högskolan, institutionen för mark och vattenresurser, juni 1990

⁴ Concentrations of weekend and holiday homes 2000 MI64SM 0101

Agriculture

Agriculture uses water for irrigation and for livestock.

Water for irrigation

A survey on water used for irrigation in Swedish agriculture was carried out in 1985. No full-scale surveys have been carried out since then. In 1991, the Swedish Board of Agriculture was commissioned to investigate the future need of irrigation in agriculture and a questionnaire was sent to about 800 farming enterprises. The result from the last survey indicated only limited changes in the quantities used for irrigation compared to 1985, so we have therefore used the data from 1985. The data refer to quantities needed in a dry summer.

Statistics Sweden is currently looking into finding methods to regularly estimate the amount of water used for irrigation. The result of these methodological studies will be available in 2003.

Water for livestock

The water needed for livestock is estimated by looking at the number of different animals and their yearly water needs. Data on the number of animals are taken from agricultural statistics. The data in the report refer to 1999, which is the year the latest survey covering all enterprises with more than 2 hectare of arable land or holdings with stocks of animals was conducted.

The yearly need was estimated for:

	m ³
Dairy cows	30,0
Sucker cows, heifers, calves	16,0
Horses	16,0
Boars, sows	13,0
Fattening pigs	0,875
Piglets	0,05
Sheep	2,5
Laying hens	0,1
Young fowl, slaughter chickens	0,04

The coefficients were obtained from the Swedish University of Agricultural Sciences.

Other sectors

There is currently no information on self-supply of water for other sectors. In 2003, a methodological study will be carried out at Statistics Sweden on the possibilities to get information on water-use by the private and public service sector outside urban areas.

2.1.2 Wastewater and wastewater treatment

The information on this subject has been taken from the database connected to the publication MI 22 SM 0101 *Discharges to water and sludge production in 2000 – Municipal wastewater treatment plants and some coastal industry*. The report was made by

Statistics Sweden on behalf of the Swedish Environmental Protection Agency (Swedish EPA) ⁵

Under Swedish environmental protection law, special permits are required to perform certain activities which are potentially harmful to the environment. Establishments with these activities – which are more than 2 000 in number – are also required to report their emission data to the supervisory agency once a year. Estimates are usually based on results of measurement programs. The primary data for the statistics stem from these reports.

Municipal wastewater treatment plants

Plants designed for more than 2 000 person equivalents, including industrial wastewater, are required to produce environmental reports. The number of such plants in 2000 was 478 and the statistics cover these plants. The data in this report are restricted to these plants. They have been mainly collected through a postal survey, but emission data for the 75 plants situated in Västra Götaland have been taken from the Swedish EPA's database EMIR.

Some pollution sources not included in these statistics should be mentioned: No measurements of emissions are known for smaller plants but it is estimated they account for less than 10 percent of municipal wastewater and could therefore be assumed to make a similar contribution to emissions.

Slightly more than one million people are living outside urban areas. They usually depend on self-supplied water and use septic tanks or similar devices to dispose of their wastewater.

There are also establishments which are too small to be covered by the reporting requirement and which are also beyond the reach of municipal wastewater networks.

Industrial emissions

The most water-intensive industry in Sweden is the pulp and paper industry, which mainly consists of around 75 plants. A special survey of these plants was conducted by the Swedish EPA and has been presented in a separate EPA report (NV Rapport 5154 – in Swedish only). The same data were used in MI SM 0101, with some minor changes.

Emissions from 22 coastal plants in other industries are also included in the statistics.

Not included are inland factories outside of the pulp and paper industry.

2.1.3 TRK – Transport, retention and source apportionment

In Sweden, a special project was performed in connection with the reporting to HELCOM, PLC-4, Recommendation 19/04. Yearly emissions of nitrogen and

⁵ The report is available (in Swedish) at <http://www.scb.se/publkat/publikation.asp?plopnr=239>.

phosphorus were estimated for all known point sources, even those which do not produce environmental reports. Also diffuse leaching from various types of land was estimated based on very detailed data. Incorporating weather data for 30 years, model calculations of leaching and transport were performed and calibrated to most known measurements in Swedish rivers during this period. The “gross” (average) load, emissions and leaches, of phosphorus and nitrogen, was calculated for drainage areas larger than 1 000 km². For nitrogen, “net” loads were also calculated using a special hydrological nitrogen retention model, HBV-N. The project is presented on the Internet at <http://www-nciws.slu.se/TRK/index.html> and the final report will be published shortly.

In this report, we cite a few results in table 12.

2.2. Monetary data

2.2.1 Public water supply and wastewater treatment

In Sweden, as in many other countries, the pricing system for freshwater and wastewater services is combined into one price for both services. Enterprises and households are normally charged one fee related to the amount of water they use, and in that fee the price for wastewater management is included. The fact that expenditure for both freshwater and wastewater is mixed together makes dividing the costs for each type of service difficult.

There are several sources of information on monetary data for the supply and use of water and wastewater treatment. There is no data source that provides all the necessary information, so a combination of several data sources is needed together with information on the physical volumes of water and wastewater. The main statistical sources are described below along with information about water and wastewater expenditure. These can be used to calculate monetary flows.

The municipal accounts

The municipal accounts are based on a yearly survey of all 289 municipalities in Sweden. The municipalities are asked to report their revenues, investments and expenditure for different domains (e.g. for production of water and wastewater treatment). The statistics are however aggregated so that a division between data for municipal waterworks and MWWTPs is not possible. There is also some non-response to be taken into consideration. For the municipal accounts 2000, there were 23 municipalities that either reported “no costs” for water production and wastewater treatment or did not reply at all. These municipalities account for nearly 25 per cent of the total water-use in Sweden. Information about water quantities within these municipalities indicates that there should be some production costs. Information about the number of citizens connected to the municipal water network strengthens this assumption. The reason for “non costs” in some municipalities is the corporatisation of former municipal waterworks and MWWTPs into municipality-owned companies or more seldom into private companies, which means that the accounts of the company are no longer included in the municipal accounts. Production costs and sometimes

also revenues are instead registered in the company accounts. Information about these enterprises is available in business statistics.

Business statistics

Business statistics at Statistics Sweden provide among other things information on costs and revenues within NACE 41 (Collection, purification and distribution of water) and 90001 (Sewage disposal). Among those companies, corporatised municipal plants, either private or wholly owned by the municipality, are included. The business statistics' questionnaire is sent out to all enterprises with 50 employees or more within for instance the mining and quarrying industry, manufacturing industry and energy production. For enterprises with less than 50 employees, information is gathered from other available sources. Statistics within different NACE groups are derived from enterprises divided into NACE groups according to their primary activity. Because of this, establishments belonging to enterprises (but not active within water production or wastewater treatment) are included in the total values. On the other hand, water and wastewater treatment activities may be carried out by a company that also conducts other activities such as energy production or distribution. The main activity in these cases may be NACE 40 and it is not possible to obtain separate information on such activities in NACE 41 or NACE 90001. This project has chosen to include only government-owned or municipal-owned enterprises active within water production or wastewater treatment; otherwise there would be overcoverage of companies with activities in water and wastewater other than the public supply of water and wastewater treatment.

Industrial consumption of purchased goods and services

Business statistics in Statistics Sweden is also responsible for a survey on the industrial consumption of purchased goods and services (for instance consumption of municipal freshwater and wastewater treatment). The survey is extended over three years. The enquiry is sent out to enterprises with 50 employees or more within NACE 10-41. Every year, one third of all enterprises in the population are examined. Only two thirds have been looked at up to now and the statistics are not finished. At the moment information from this survey is not available. Hopefully it will be an important data source in the future.

The national accounts

In the national accounts (NA) there is information in the I/O matrix on the supply and use of water and wastewater services. In Sweden, compilations are made for the aggregated sector NACE 41 and 90001. The NA has so far used an older I/O model. When comparing costs for water and wastewater with quantities, the implicit price showed a considerable variation between different industries, which implies, that the data sources for this must be checked and improved. The national accounts are currently producing new data for 2000 and at the same time they perform an inspection of their system. The new statistics on input goods and services will be used together with other information.

Municipal tariffs for water and wastewater

The trade association for Swedish water utilities, the Swedish Water and Wastewater Association, Svenskt Vatten AB, has been collecting yearly statistics on tariffs (fixed price and variable) for an average household in a one-family building charged by each municipality. There is also information of the percentage of the

tariff that will cover the cost for water and the percentage that will cover the cost for wastewater treatment. There is no collection of information on tariffs for industries. According to a quick Internet search, the tariff for industries differ a lot depending on the amount of water, size of the meter and in some municipalities also on the content of pollutants in the wastewater delivered to the municipal wastewater treatment plant.

2.2.2 Expenditure for self-supply of water and of wastewater treatment

There is no information about expenditure for self-supply of water. When it comes to wastewater treatment, information on own-produced services for own use is difficult to obtain, other than for the manufacturing industry. Information is also available in the obligatory and annually survey of environmental protection expenditure in the manufacturing industry. From that survey, information about own production costs for wastewater management can be used. The survey includes current and capital expenditure in enterprises within the environmental domain wastewater. Expenditure for methods that aim to reduce emissions to water in general, not only expenditure related to wastewater treatment, is included. Current expenditure includes expenditure in the form of energy, chemicals and labour linked with own treatment. Payments for external services (to MWWTPs) are however not included in the questionnaire and survey, but discussions to include this variable goes on. The data in the report refer to "Environmental protection expenditure in industry 1999/2000"⁶.

⁶ Environmental protection expenditure in industry 2000, MI23SM0101

3. Distribution to Sea basins

The report from the government committee (SOU 2002:105 'Klart som vatten') delivered 4 Dec 2002 states:

'Sweden will raise its level of ambition in efforts to protect its waters. This is a consequence of the Water Directive adopted by the European Parliament and the Council in December 2000. The aim is to protect water quality and aquatic ecosystems and to secure long-term water supplies in the Community. The framework directive applies to both surface water and groundwater. "Good water status" shall be achieved by 2015. No deterioration in water quality will be accepted. Central tasks involve establishing environmental objectives for water and programmes of action. This work is to be completed by 2009. Authorities are to be established, and these should be based around natural river basins rather than existing administrative boundaries. EC directives are binding for Member States, which means that each Member State is obliged to ensure that the directive is incorporated in national legislation'.

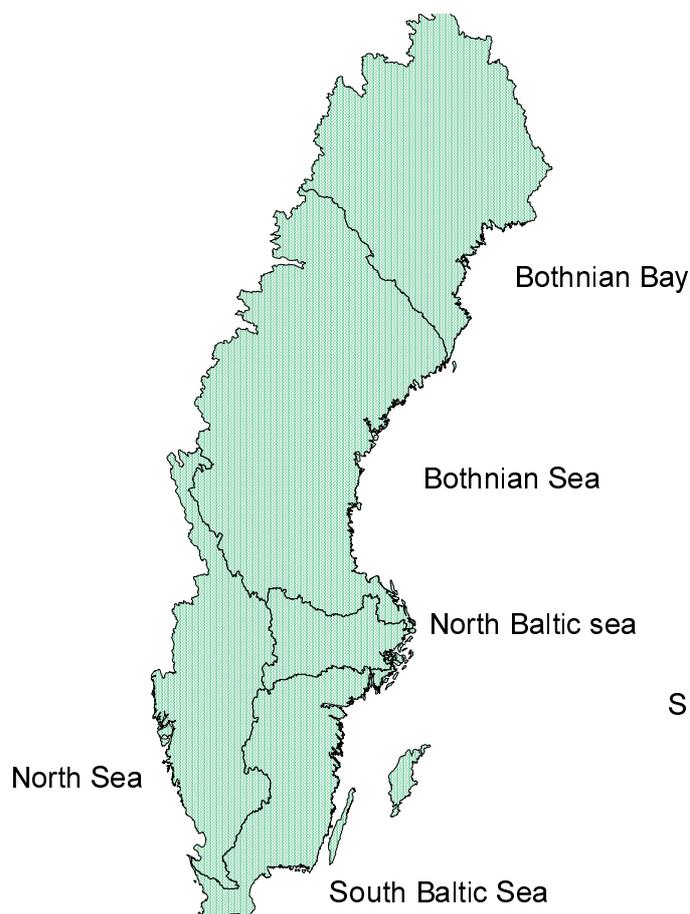
In October 2001, the Government appointed a one-man committee to draw up a proposal on an organisation for the implementation of the EC framework directive in Sweden (Dir 2001:78). The committee took the name "The Committee on Swedish Water Administration". Its assignment also included analysing the prospects of introducing water charges in Sweden, proposing forms for environmental cooperation on water bodies and submitting a proposal regarding responsibility for supervision of contingency measures for water supply.

In the proposal from the committee in Dec. 2002, Sweden is to be divided into five water districts. These districts will be based on the river basins' connection with the major Sea basins (see map below).

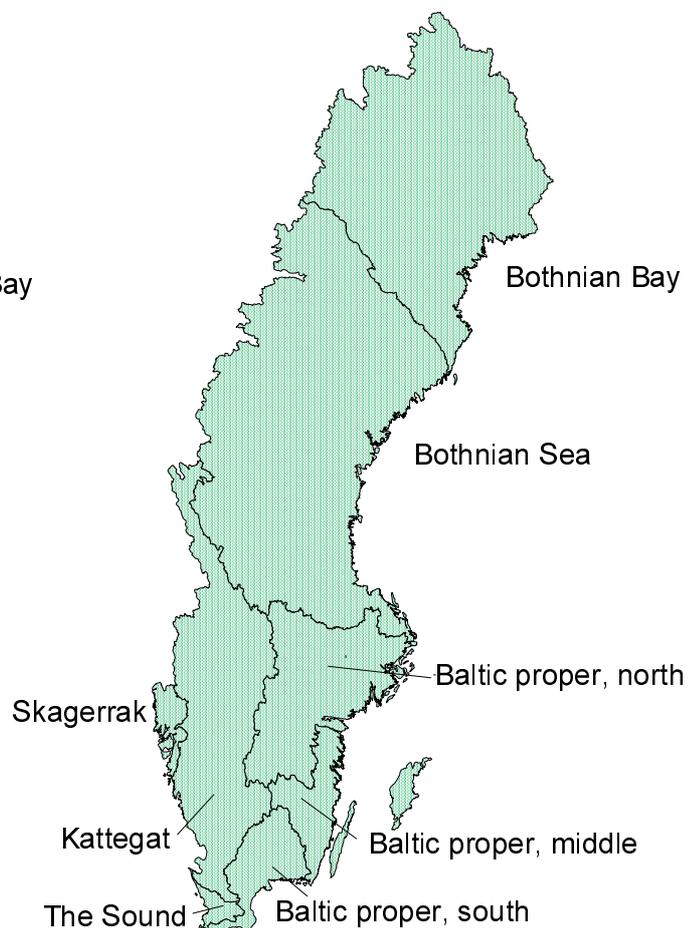
The objective of this project was to test methods of disaggregating data from the national water accounts to water districts. When the project started (spring 2002), it preceded the investigation on using the division to water districts in the project. After discussion with the Swedish EPA, we decided to use a division into eight basins that have been commonly used when presenting data on water issues.

Map 1 Water districts and Sea basins

Proposal for five water districts



Eight Sea basins



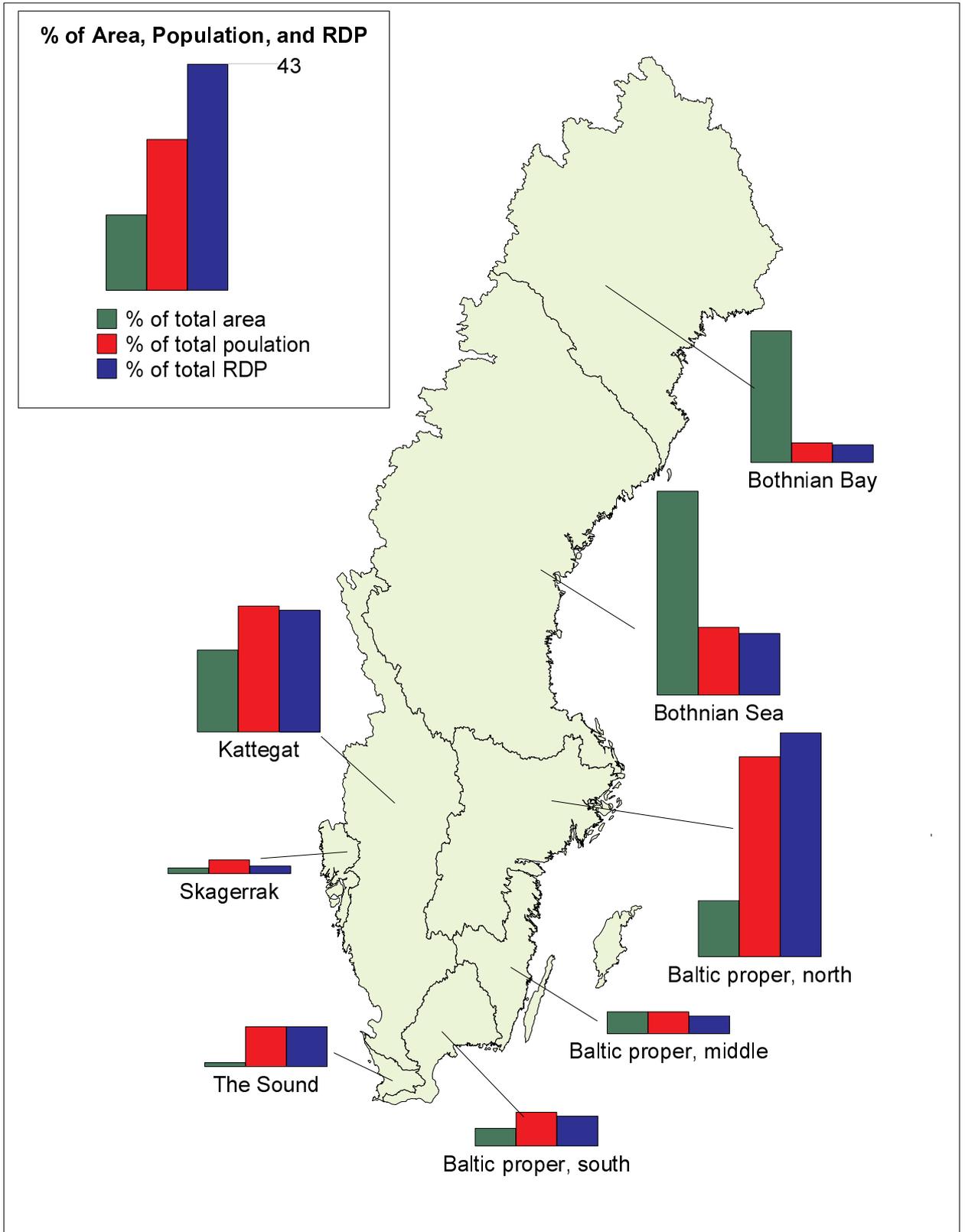
Some basic information about the eight Sea Basins is shown below.

Sea Basin	Total area, km ^{2,7}	Population	Regional GDP, million SEK
Bothnian Bay	114 249	344 000	69 283
Bothnian Sea	177 239	1 134 000	237 223
Baltic proper, north	48 560	3 397 000	855 270
Baltic proper, middle	19 582	374 000	70 021
Baltic proper, south	15 432	556 000	116 112
The Sound	2 939	696 000	153 881
Kattegat	71 150	2 134 000	468 694
Skagerrak	5 207	248 000	32 738
Total	450 295 ⁸	8 883 000	2 004 652

⁷ Data source: Statistical report Na 11 SM 9701 www.scb.se/statistik/mi0999/mi0999tab1.xls

⁸ Data Source: Statistical report MI 65 SM 0201 www.scb.se/sm/MI65SM0201_ikortadrag.asp

Map 2 Percentage of total area, total population and Regional Domestic Product by SeaBasin



Allocation of national data to sea basins was done mainly using four methods.

1. Allocation of aggregated municipality data to Sea basins

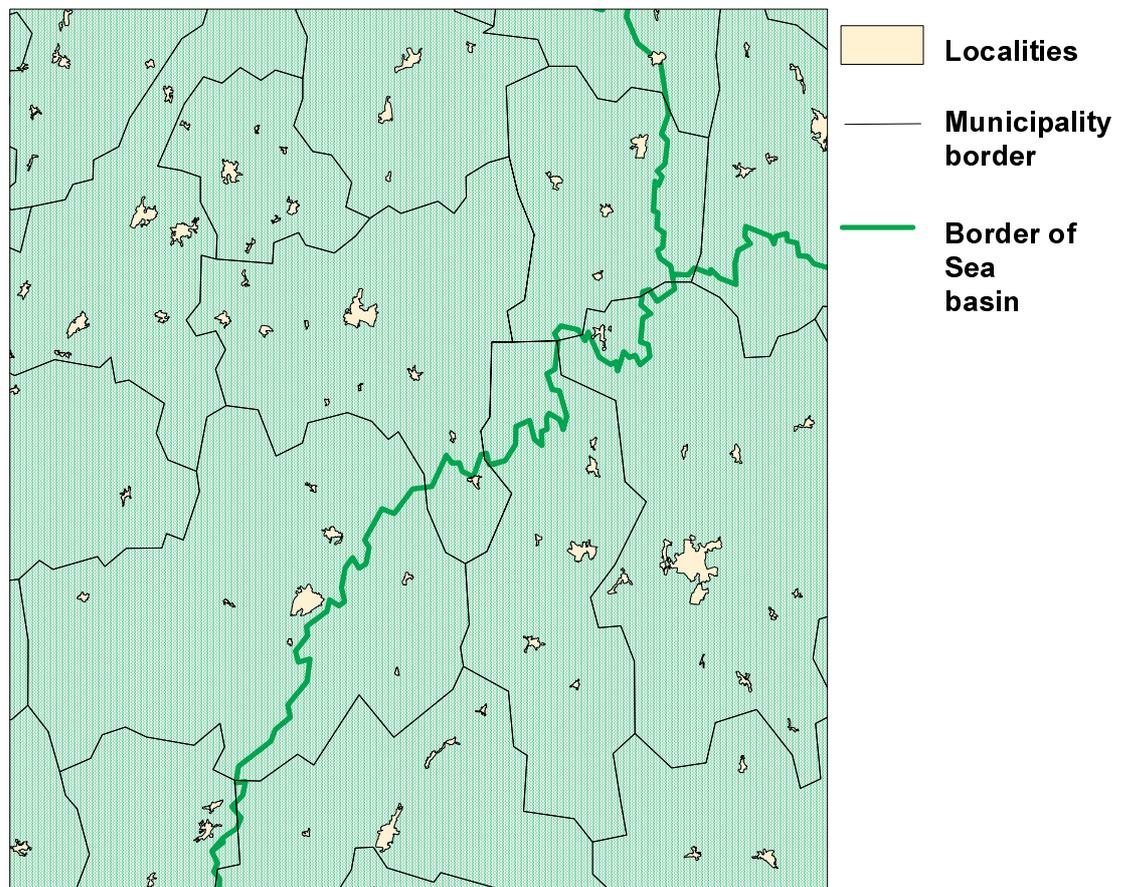
In Sweden, there are 289 municipalities and 85 per cent of the population live in localities/urban areas covering 1.5 per cent of the total land area. By using geographic information systems (GIS), it is possible to combine digital maps for municipalities, localities and sea basins. The first step is to find municipalities that are entirely within one sea basin. The second step is to examine the municipalities that intersect with two sea basins. For most of the municipalities that intersected with two Sea basins only a minor part of the municipality or the part with all major urban areas could be allocated to one sea basin. For the remaining municipalities, data were disaggregated according to the percentage of the population in urban areas.

119 municipalities were entirely within one sea basin, 165 municipalities intersected with a minor part and 5 municipalities were split between two sea basins (Norrtälje, Heby, Nässjö, Uppvidinge, Tierp).

This method was used for data concerning the supply and use of distributed water, both physical and monetary data.

Map 3 Example of allocation of municipalities to Sea basins

In the example below, the whole municipality was assigned to one sea basin



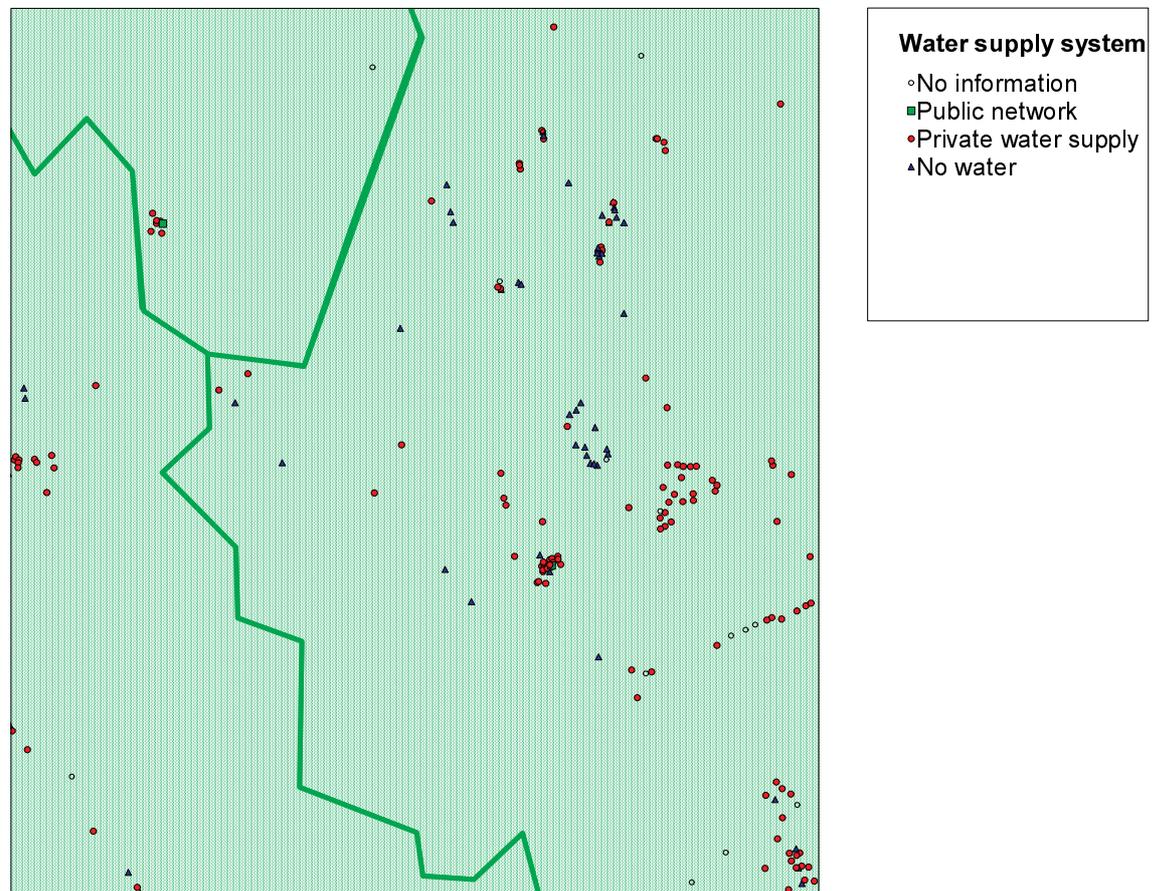
2. Environmental statistics are compiled for sea basins

In Sweden, there are 114 main drainage areas with outflow to the sea. The 114 drainage areas and coastal areas situated in between can easily be aggregated to sea basins. The basic statistics concerning the 'Abstraction and use of water in the manufacturing industry' and 'Discharges to water and sludge production in 2000 by municipal wastewater treatment plants and some coastal industry' are compiled for drainage basins.

3. Information on exact geographical location of the basic data

The self-supply of water for households not connected to the public network was estimated using information from the real estate assessment register and the population register (see 'data sources'). The real estate register contains information on x, y coordinates, which by using GIS can be allocated to a sea basin.

Map 4 Example of allocating real estates to Sea basins



4. Using national data together with distribution keys

The survey on environmental expenditure in the manufacturing industry contains data on investments and expenditure for wastewater, (see data sources above). The survey was designed to obtain national data, which meant that disaggregation to the regional level could only be performed for larger areas and the uncertainty will be substantial. The data refer to companies. One

company can have several establishments in different sea basins. To disaggregate the national EPE data, information from the special survey on water use in the manufacturing industry was used. The survey also contained information about the quantities of wastewater directly discharged to water bodies. That information was available by sea basin and industry. The total expenditure for each industry was allocated to sea basins in relation to the quantities of discharged water.

4. Results

4.1 Water abstraction

In table A, the total abstraction of fresh water is shown. In 2000, the abstraction of fresh water amounted to 2 667 million m³, (the known abstraction)⁹. Above that, 0,5 million m³ of seawater was abstracted. Of the total abstraction 35 per cent was produced by the public waterworks and 65 per cent was self-supply.

In the public waterworks, 51 per cent was groundwater and 49 per cent surface water. From the public waterworks, 738 million m³ of the total abstracted 941 million m³ was distributed to end-users. The rest was losses, used in the plants for cleaning, etc., and unknown use.

Of the total abstraction in the manufacturing industry, 98 per cent was surface water and 2 per cent groundwater.

Table A: Abstraction of fresh water in 2000 by sea basin, 1000 m³

Sea basin	Public water-works	Self supply			Total
	NACE 41	Agriculture NACE A 01	Industry NACE 10-40	Households	
Bothnian Bay	39 566	1 446	212 490	3 097	256 599
Bothnian Sea	125 698	7 076	635 327	15 882	783 983
Baltic proper, north	377 680	28 452	196 623	23 315	626 070
Baltic proper, middle	32 880	16 463	27 632	6 747	83 722
Baltic proper, south	52 755	29 622	72 063	7 004	161 444
The Sound	28 978	9 831	3 209	2 438	44 456
Kattegat	272 446	40 734	345 985	25 619	684 784
Skagerrak	11 675	1 280	8 065	5 269	26 289
Total	941 676	134 906	1 501 393	89 385	2 667 360

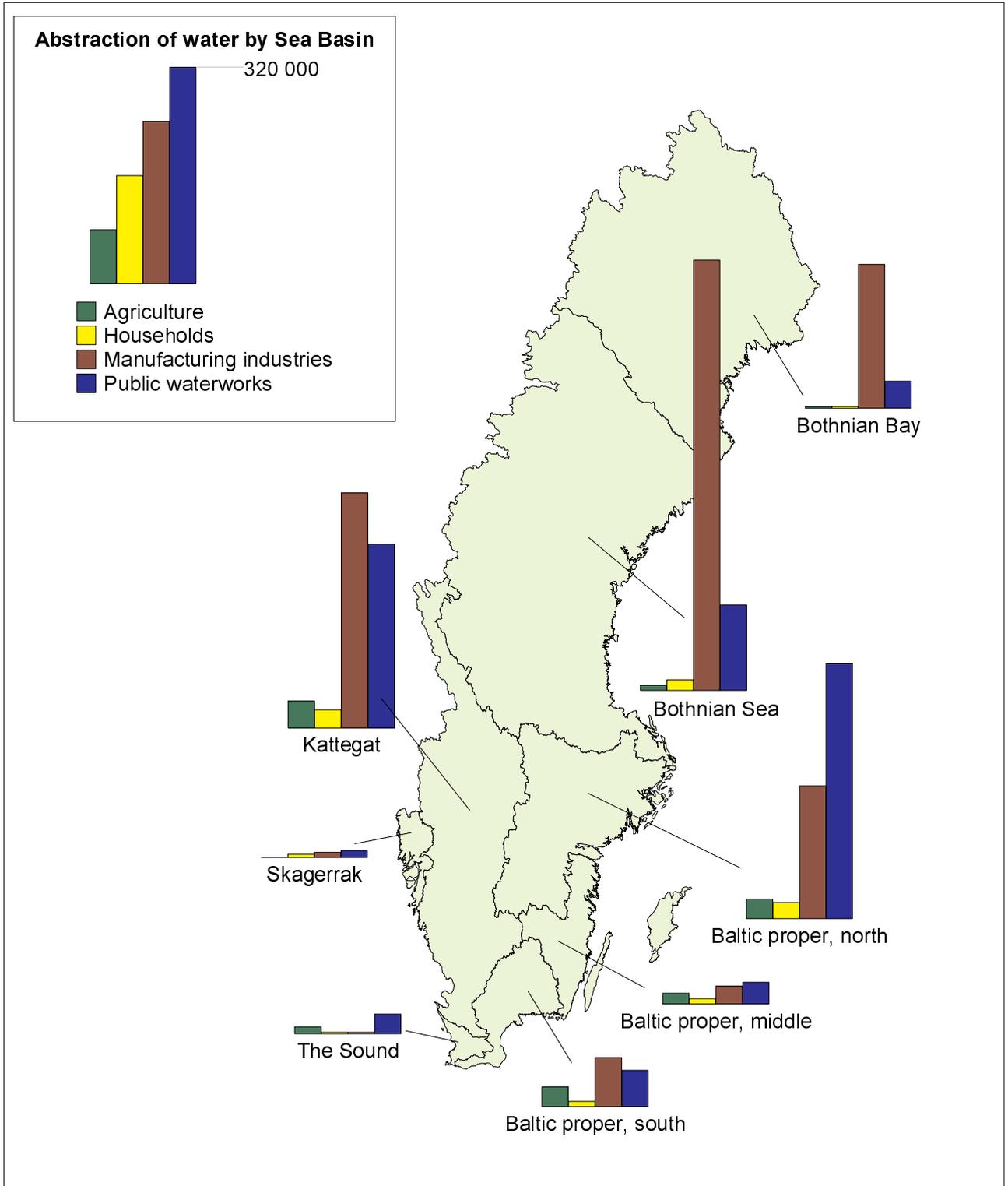
Map 4 shows the abstraction by sea basins.

Of the total abstraction of freshwater, 784 million m³ or 29 per cent was made in the Bothnian Sea. There are several large-scale, water-intensive plants, such as the pulp and paper mills, situated on the Bothnian Sea.

The abstraction by public waterworks amounted to 378 million m³ in the Baltic proper, north and 272 million m³ in Kattegat. The main part of the distributed water is used by households. Thirty-eight per cent of the total population live in the Baltic proper north region, where Stockholm and other rather large municipalities are situated. Twenty-four per cent of the total population live in the Kattegat region, where Gothenburg is situated.

⁹ Data is missing for self-supply of water for NACE 45- 99

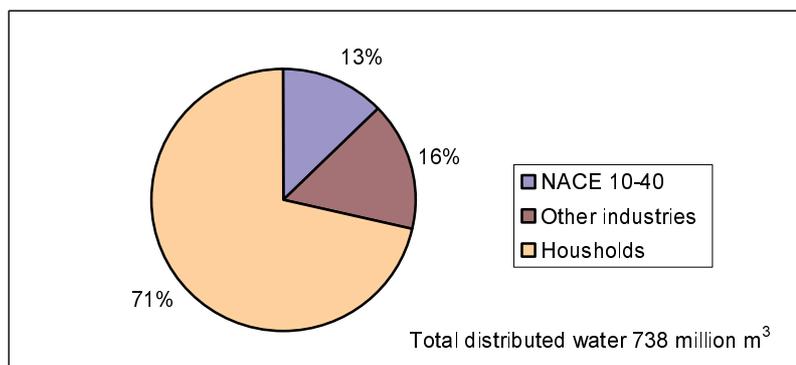
Map 5 Abstraction of fresh water in 2000 by Sea basin



4.2 Water use

It is mainly households that use the distributed water. Industries in NACE 10-40 only used 13 per cent of the total distributed water and other industries used 16 per cent.

Use of distributed water in 2000



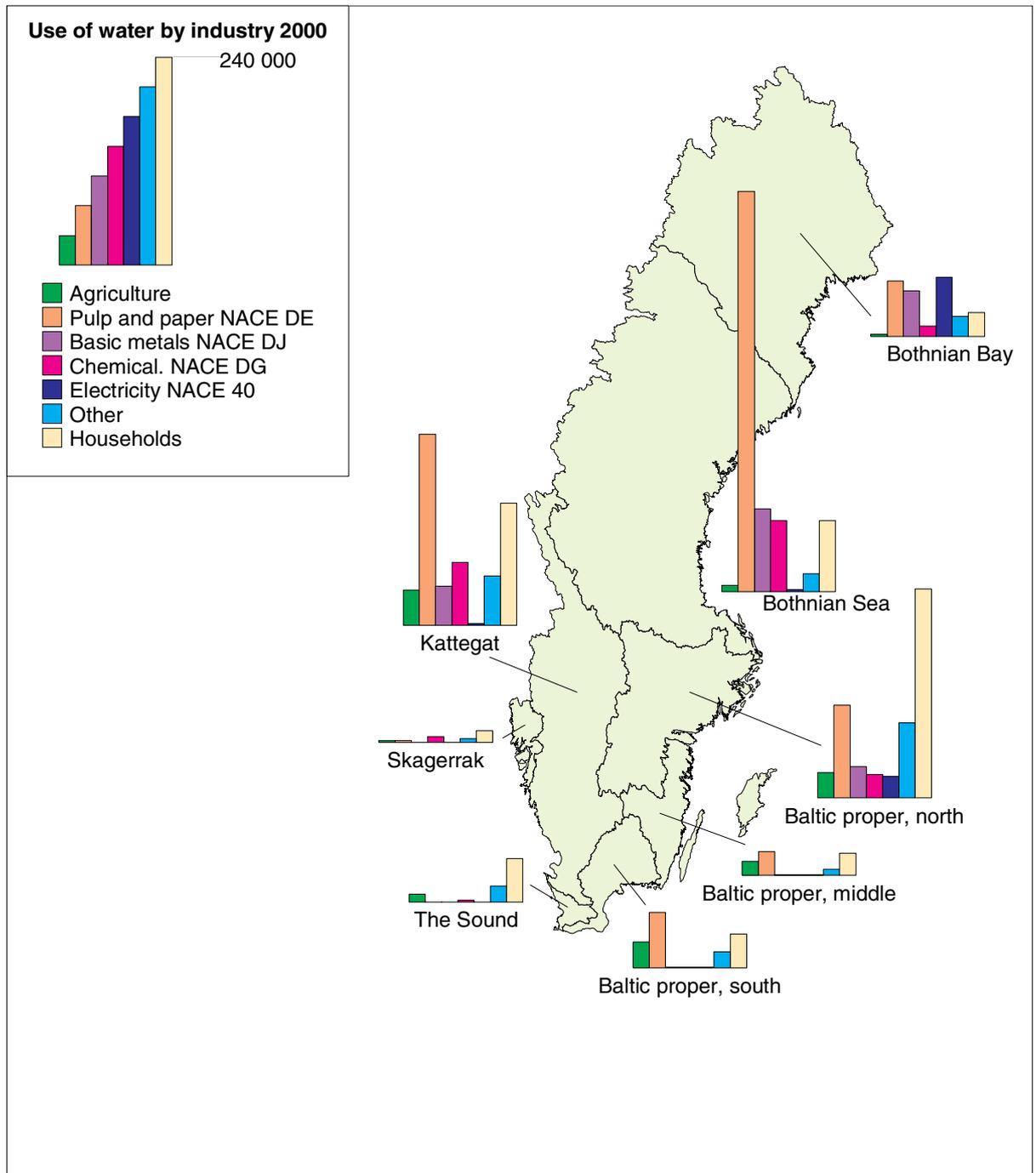
In the industries in NACE 10-40, only 6 per cent of the total use of water is distributed water, the rest is from self-supply. In table B, the total use of fresh water by industry is shown. In Sweden, there are three industries that together use more than 50 per cent of all fresh water; these are the pulp and paper industry, the manufacturing of basic metals and the manufacturing of chemicals.

Table B Total use of fresh water by industry 2000, 1000 m³

	Total received distributed water	of which		Total
		Self-used for supply	cooling	freshwater
A 01 Agriculture,		134 906		134 906
B Fishing				
CA Mining and quarrying of energy producing materials	11	1 348	1 320	1 359
CB Mining and quarrying, except energy producing materials	911	21 076	96	21 987
DA M. of food products, beverages and tobacco	27 407	14 416	8 488	41 823
DB M. of textiles and textiles products	1 423	3 980	71	5 403
DC M. of leather and leather products	40	0	0	40
DD M. of wood and wood products	1 453	829	62	2 282
DE M. of pulp, paper, publishing and printing	6 260	934 069	303 169	940 329
DF M. of coke, refined petroleum and nuclear fuel	1 667	3 792	110	5 459
DG M. of chemicals, man-made fibres	17 226	187 309	170 112	204 535
DH M. of rubber and plastic products	2 967	7 021	5 076	9 988
DI M. of other non-metallic mineral products	2 196	14 833	14 134	17 029
DJ M. of basic metals and fabricated metal products	17 941	213 371	190 577	231 312
DK M. of machinery and equipment n.e.c	4 107	0	0	4 107
DL M. of electrical and optical equipment	3 073	0	0	3 073
DM M. of transport equipment	4 100	2 314	2 265	6 414
DN Manufacturing n.e.c	630	0	0	630
40 Electricity, gas, steam and hot water supply	2 964	97 035	83 905	99 999
Other industries	117 454	n.a		117 454
Households	526 112	89 385		615 497
Total	737 942	1 725 684	779 385	2 463 626

In map 5, the use of water by sea basin and industry is shown. In the Bothnian Bay, the main users are industries with 89 per cent of the total use. Two industries dominate: electricity, gas, steam and hot water supply and pulp and paper industry. In the Bothnian Bay, the pulp and paper industry is the largest user with 61 per cent of the total use. In the Baltic proper north, 44 per cent is used by households, 19 per cent by the pulp and paper industry and 16 per cent by other industries.

Map 6 Use of water by Sea basin and industry 2000



4.3 Wastewater

The discharges to water from municipal wastewater treatment plants in 2000 totalled 424 tons of phosphorus, 19 000 tons of nitrogen, just under 10 000 tonnes of BOD₇ (biochemical oxygen demand) and 60 000 tonnes of COD_{Cr} (chemical oxygen demand). Since 1998, when the previous survey was made, the discharges of nitrogen have decreased by 11 per cent and BOD₇ by 13 per cent.

Table C. Discharges to water from municipal wastewater treatment plants in 2000 by major drainage areas, tonnes

Major drainage area		Tot-P	Tot-N	NH-N	BOD ₇	COD _{Cr}
Bothnian Bay		21	1 176	820	839	2 752
Bothnian Sea		69	3 212	2 317	2 003	8 579
Baltic proper		145	8 080	3 413	3 156	24 359
The Sound		32	1 058	273	792	4 609
Kattegat		148	5 069	2 925	2 813	15 585
Skagerack		9	382	206	182	1 586
Total	2000	424	18 977	9 954	9 784	57 472
Total	1998	430	21 376	..	11 270	58 463
Total ¹	1995	470	25 940	..	13 060	66 840
Total ²	1995	415	25 430	..	11 670	63 030
	1992	470	25 310	..	12 205	62 190
	1990	655	26 200	..	14 050	69 150
	1987	1 050	25 600	..	16 700	66 300

1) Includes temporary large emissions from a plant located on the Kattegatt, due to reconstruction.

2) Excluding the above-mentioned temporary emission.

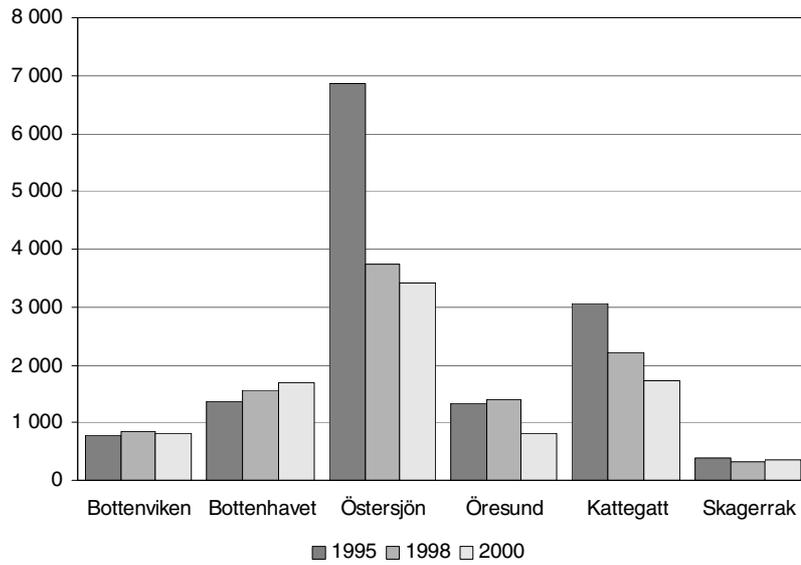
Table D Discharges to water from municipal wastewater treatment plants in 2000 on the coast, by major drainage areas, tonnes

Major drainage area		Tot-P	Tot-N	NH-N	BOD ₇	COD _{Cr}
Bothnian Bay		13	821	588	527	1 786
Bothnian Sea		39	1 698	1 274	960	4 161
Baltic proper		77	3 426	1 202	1 466	12 255
The Sound		28	800	183	686	3 750
Kattegat		79	1 725	748	1 243	6 601
Skagerack		8	346	183	164	1 494
Total 2000		244	8 815	4 179	5 046	30 046
1998		243	10 093	..	5 906	31 304
1995 ¹		295	13 820	..	7 880	38 135
1995 ²		240	13 310	..	6 490	34 325

1) Includes temporary large emissions from a plant on the Kattegatt, due to reconstruction.

2) Excluding the above-mentioned temporary emission.

Nitrogen discharges to water from Swedish municipal waste water treatment plants in 2000 by coastal areas, tonnes



The average treatment efficiency with respect to phosphorus, nitrogen and BOD₇ was 94, 47 and 95 per cent respectively. These numbers include overflow water at the plants, which was estimated at less than 2 per cent of the normally treated volume.

Discharges of oxygen-demanding substances from the pulp and paper industry amounted to 63 000 tons, which was around 10 per cent lower than 1998. This industry also contributed 350 tons of phosphorus and 3 200 tons of nitrogen. Around two thirds of these emissions took place at the coast. Only marginal contributions of oxygen-demanding substances were made by other coastal industries but some phosphorus and nitrogen was discharged by the chemical and steel industries.

4.4 Expenditure for distributed water and wastewater treatment

4.4.1 Municipal waterworks and wastewater treatment

Information about the costs for the supply of tap-water and wastewater treatment service can be obtained from the municipal accounts supplemented by information from the business statistics, (see data sources). In the municipal accounts, there is no division of the costs for water abstraction/distribution and wastewater service. To separate costs for water and wastewater in the project, we have used information from the municipal tariff statistics where there is information on the percentage of the tariff, which refer to water and to wastewater.

Table E Total costs for supply of water and wastewater treatment from municipal plants and municipally owned companies 2000

	SEK- Million	%
Municipal plants	9 690	83 %
Municipally owned companies	1 945	17 %
Total(basic prices)	11 635	100 %
Taxes on products	1 394	
Operating surplus	26	
Total purchasers' price	13 055	

Municipally owned companies account for 17 per cent of the total costs for water and wastewater treatment, but provide nearly 25 per cent of the quantities of delivered water. So there is probably an underestimation of the total cost for the supply of tap-water.

Using the information from the municipal tariff statistics and division of NACE-codes for the municipally owned companies, the following division of costs for tap-water and wastewater treatment is obtained.

Table F Cost for supply divided into costs for of water and costs for wastewater treatment 2000, in million SEK

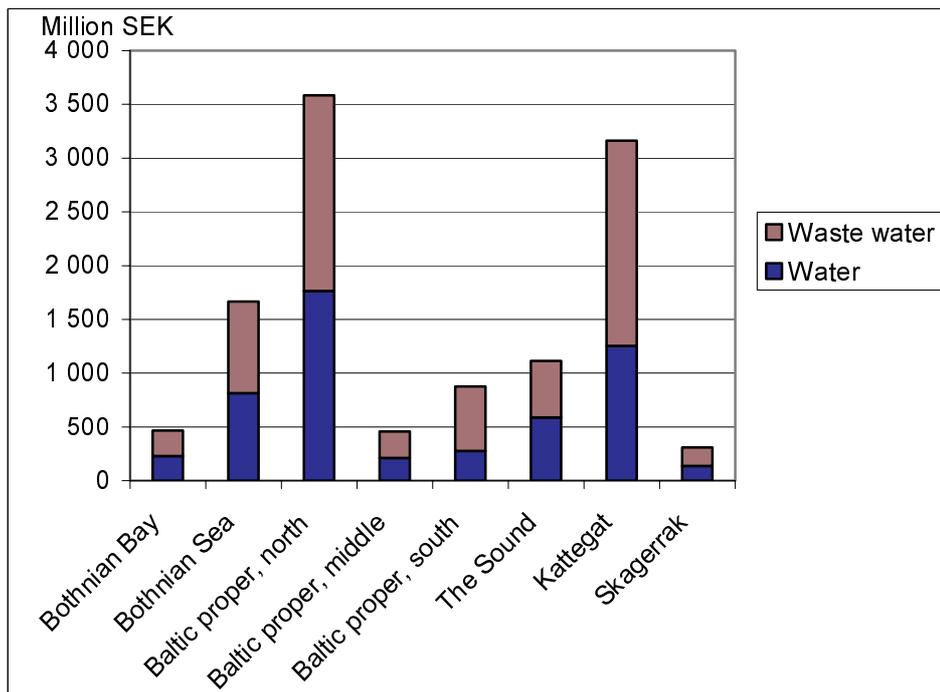
	Water	Wastewater	Total	Thereof wastewater
Municipal plants	4 165	5 525	9 690	57 %
Municipally owned companies	1 106	839	1 945	43 %
Total(basic prices)	5 271	6 364	11 635	55 %
Taxes on products	641	753	1 394	
Operating surplus			26	
Total purchasers' price	5 912	7 117	13 055	55 %

For municipal plants, wastewater treatment accounts for 57 per cent of the total costs. For municipally owned companies, wastewater accounts for only 43 per cent of the total costs. Since we already assume there is an underestimation of the total

costs for municipally owned companies, there is probably a greater underestimation for NACE 90001 than NACE 41.

The figure below shows the total costs for the eight sea basins. The Baltic proper, north and Kattegat are the two largest basins. These are also the basins with the largest populations, Stockholm being in the Baltic proper, north basin and Gothenburg in the Kattegat basin.

Cost for supply divided into costs for water and costs for wastewater treatment 2000 by sea basin, in million SEK



In Sweden, the pricing system for freshwater and wastewater services is combined into one price for both services. Enterprises and households are normally charged one fee related to the amount of water they use, in that fee the price for wastewater management is included. In almost all municipalities, (with a few exceptions), there are meters for both households and industries.

There are no basic statistics showing how much different users pay for water and wastewater treatment (see data sources). There is only information on total revenues for municipal plants and municipal owned companies. We have tried two different methods to estimate expenditure for households and industry. The expenditure for the user can be estimated using information on tariffs for households and quantities of water or just quantities of water. The two methods produce different results. Method 2 probably overestimates the expenditure for households. Results from the two methods are presented below.

The total revenues divided into water and wastewater are compiled using the information from the tariff statistics where each municipality states the share of the tariff that refers to water and wastewater respectively. For the municipally owned

companies, the revenues for water and wastewater respectively are estimated using the NACE code. As already pointed out, there is probably an underestimation of information regarding municipally owned companies.

The total revenues amounted to 13 055 million SEK, of these 7062 million SEK is estimated for wastewater.

Table G Total revenues for water and wastewater in 2000 by Sea basin, million SEK

Sea Basin	Water	Waste water	Total
Bothnian Bay	249	255	504
Bothnian Sea	882	905	1 788
Baltic proper, north	2 105	2 068	4 174
Baltic proper, middle	237	277	513
Baltic proper, south	324	706	1 030
The Sound	718	583	1 301
Kattegat	1 335	2 087	3 422
Skagerrak	143	180	323
Total	5 993	7 062	13 055

Method 1 Using merely information on the volumes of used water

This method is based on the use of water by different users only, which implies that all bodies, households as well as different industries pay the same price per m³. Of the total expenditure, 54 per cent relates to wastewater. For the country as a whole, 71 per cent is paid by the households, with relatively small differences between the different sea basins.

Table H Total expenditure for water and wastewater treatment for households and industry 2000, in million SEK

	Water	Waste water	Total	Of which waste water
Industries	1 570	1 864	3 434	54 %
Households	4 423	5 198	9 621	54 %
Total	5 993	7 062	13 055	54 %

Table I Total expenditure for households and industry by sea basin 2000, in million SEK

	Industry	Households	Total	Thereof households
Bothnian Bay	121	383	504	76%
Bothnian Sea	439	1 348	1 788	75%
Baltic proper, north	1 050	3 124	4 174	75%
Baltic proper, middle	143	370	513	72%
Baltic proper, south	244	786	1 030	76%
The Sound	337	963	1 301	74%
Kattegat	980	2 442	3 422	71%
Skagerrak	119	204	323	63%
Total	3 434	9 621	13 055	74%

Method 2 Using information on municipal tariffs

For households, there is information available which enables a good estimation of how much water households use during one year in each municipality. Together with municipal tariff statistics from The Swedish Water & Waste water Association, it is possible to calculate how much of the total revenues that come from households (volume multiplied by variable cost and number of meters multiplied by fixed cost). Industries pay different tariffs depending on different factors in different municipalities such as the size of the meter, pollutant content, etc., so it is at present not possible to estimate the expenditure for different industries. Since information about total revenues and households' share of the revenues is available, it is also possible to calculate how much "Other sectors or total intermediate consumption of industries" account for (Subtract payments from households from total revenues to obtain payments from other sectors). This method gives the result in table J and K.

Table J Total expenditure for water and wastewater treatment 2000, in million SEK

	Water	Wastewater	Total	% for wastewater
Industries	2 012	1 558	3 570	44 %
Households	3 981	5 503	9 484	58 %
Total	5 993	7 062	13 055	54 %

Using this method, households pay an estimated 73 per cent of the total revenues and industry pays 27 per cent.

Table K shows the results for the eight sea basins.

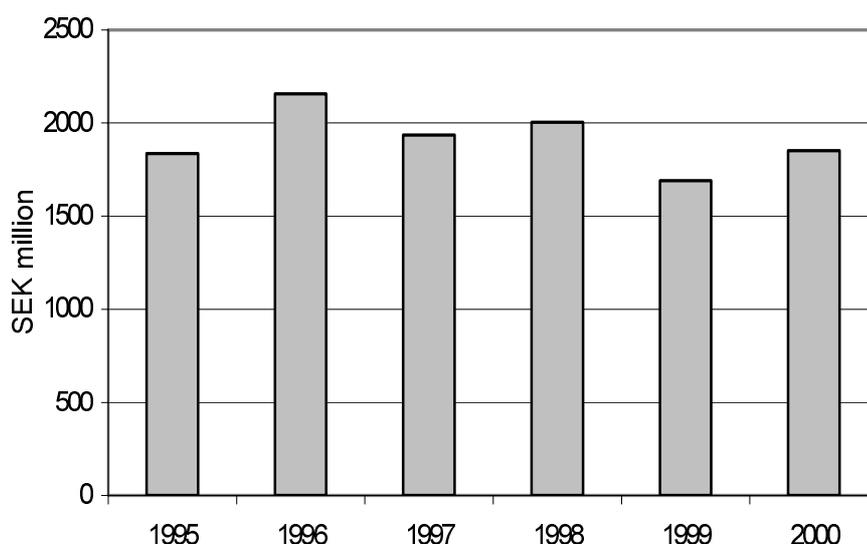
Table K Total expenditure by sea basin for water and wastewater treatment 2000, in million SEK

Sea basin	Industry	Households	Total	of which households
Bothnian Bay	61	443	504	88 %
Bothnian Sea	368	1 424	1 788	80 %
Baltic proper, north	739	3 435	4 174	82 %
Baltic proper, middle	71	442	513	86 %
Baltic proper, south	301	729	1 030	71 %
The Sound	675	625	1 301	48 %
Kattegat	1 284	2 138	3 422	62 %
Skagerrak	75	248	323	77 %
Total	3 570	9 484	13 055	73 %

4.4.2 Investments within public waterworks and MWWTPs

In the municipal accounts, information is available on the yearly gross investments of public waterworks and MWWTPs. In this report, statistics for gross investments for public waterworks and MWWTPs are presented from 1995 to 2000 (see figure below). Total investments in public waterworks and MWWTPs totalled 1 852 SEK million during 2000.

Gross investments in waterworks and waste water treatment plants



Since 1999, it is also possible to obtain gross investments for each municipality, which enables us to divide the data into eight sea basins, see table L. The information in the municipal accounts is however not structured so as to allow a division of the investments for public waterworks and MWWTPs separately.

Table L Gross investments in public waterworks and MWWTPs, SEK million, 2000

Sea basin	Million SEK
Bothnian Bay	84
Bothnian Sea	162
Baltic proper, north	529
Baltic proper, middle	144
Baltic proper, south	167
The Sound	210
Kattegat	500
Skagerrak	56
Total	1 852

4.4.3 Environmental protection expenditure in the manufacturing industry

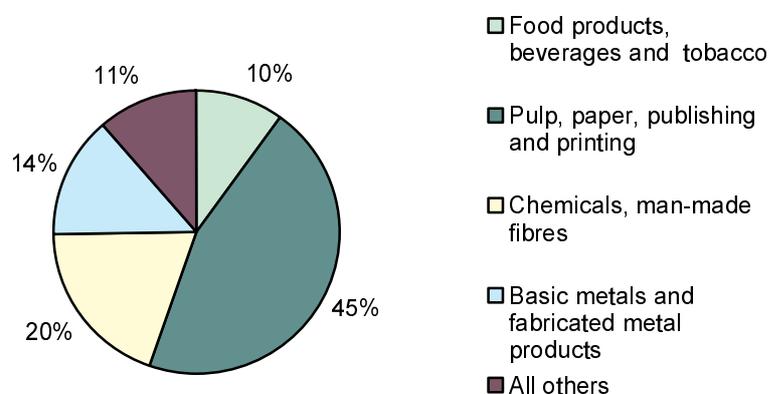
Many enterprises/households provide water and wastewater treatment by themselves. They invest in equipment and operating costs for these facilities, as far as companies are concerned, are included in their internal costs for production (ancillary activities). The information that is available is information from the survey of the manufacturing industry on investments and current expenditure for environmental protection. In 1999, total current expenditure for wastewater amounted to 737 million SEK, of which 45 per cent was in the pulp, paper, publishing and printing industry. The total investments amounted to 791 million SEK, of which more than 50 per cent was in the pulp, paper, publishing and printing industry.

Table M Environmental protection expenditure for wastewater treatment 1999

	NACE	Industry	Current expenditure SEK million	Investments SEK million
C	10-14	Mining and quarrying	14	4
DA	15-16	Food products, beverages and tobacco	74	42
DB-				
DC	17-19	Textiles and textiles products, leather and leather products	11	9
DD	20	Wood and wood products	2	6
DE	21-22	Pulp, paper, publishing and printing	333	433
DF	23	Coke, refined petroleum and nuclear fuel	11	0
DG	24	Chemicals, man-made fibres	144	83
DH	25	Rubber and plastic products	1	3
DI	26	Other non-metallic mineral products	6	5
DJ	27-28	Basic metals and fabricated metal products	103	67
DK	29	Machinery and equipment n.e.c	8	26
DL	30-33	Electrical and optical equipment	4	7
DM	34-35	Transport equipment	22	14
DN	36-37	Manufacturing n.e.c	3	0
E	40-41	Electricity, gas, steam and hot water supply, Collection, purification and distribution of water	1	92
		Total	737	791

In the figure below, the relative distribution of current expenditure for wastewater treatment for some major industries is shown.

Environmental protection expenditure for wastewater treatment 1999, percentage of total



In table N, the total current expenditure and investments are shown by sea basin. The largest current expenditure is in the Bothnian Sea and Kattegat, while the largest investments were made in the Bothnian Bay and Kattegat.

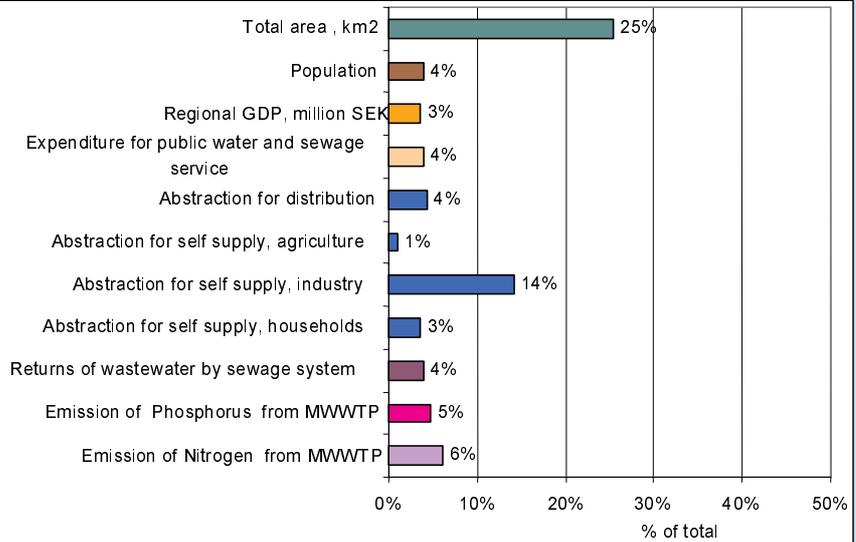
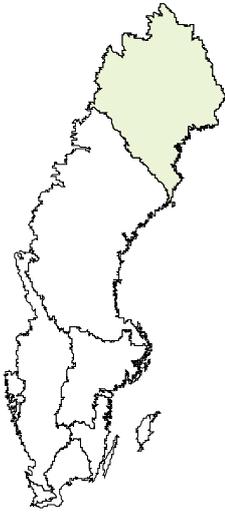
Table N. Environmental protection expenditure for wastewater treatment 1999, SEK million, by sea basin

Sea basin	Total	Current ex-	
		penditure	Investments
Bothnian Bay	305	65	241
Bothnian Sea	315	223	92
Baltic proper, north	237	106	130
Baltic proper, middle	49	15	34
Baltic proper, south	132	63	69
The Sound	48	29	20
Kattegat	315	156	159
Skagerrack	127	81	46
Totalt	1 528	737	791

5. Results, Sea basins

In the following pages some basic data is shown for the eight sea basins.

Bothnian Bay

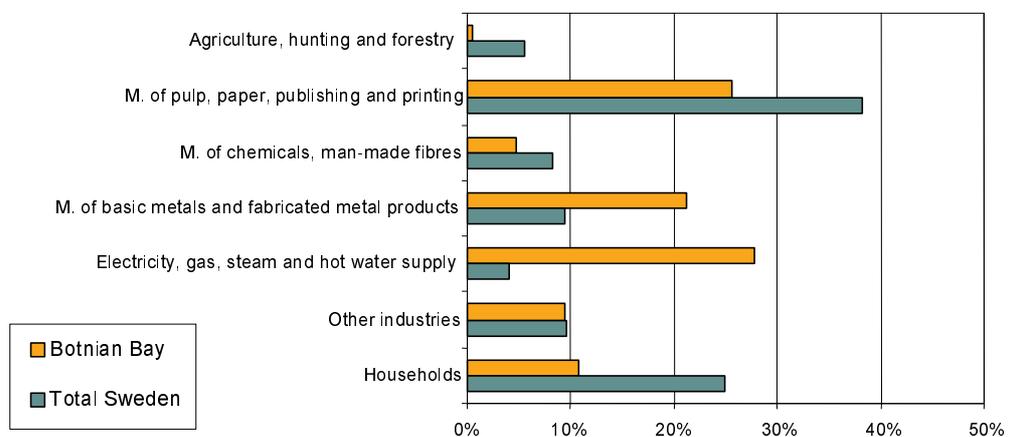


	Use of distributed water, 1000 m ³	Self supply, 1000 m ³	Total use, 1000 m ³
A* Agriculture, hunting and forestry		1 446	1 446
DE: M. of pulp, paper, publishing and printing	320	63 390	63 710
DG: M. of chemicals, man-made fibres	236	11 500	11 736
M. of basic metals and fabricated metal			
DJ products	2 318	50 678	52 996
40 Electricity, gas, steam and hot water supply	299	68 719	69 018
Other industries	5 320	18 203	23 523
Total industries	8 493	213 936	222 429
Households	23 556	3 097	26 653
Total	32 049	217 033	249 082

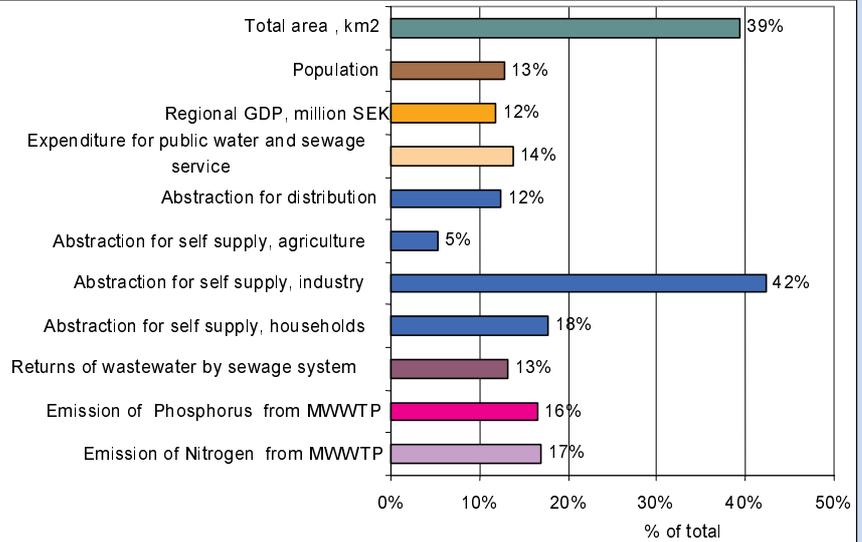
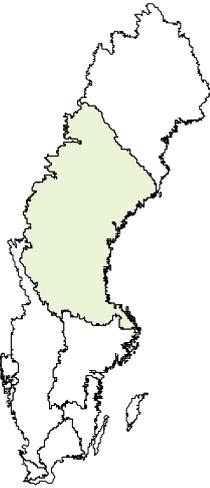
Total expenditure for distributed water: 504 Million SEK.

Waste water treatment service in the manufacturing industry:
Current exp.: 65 million SEK
Investments: 241 million SEK

Total use of water



Bothnian Sea

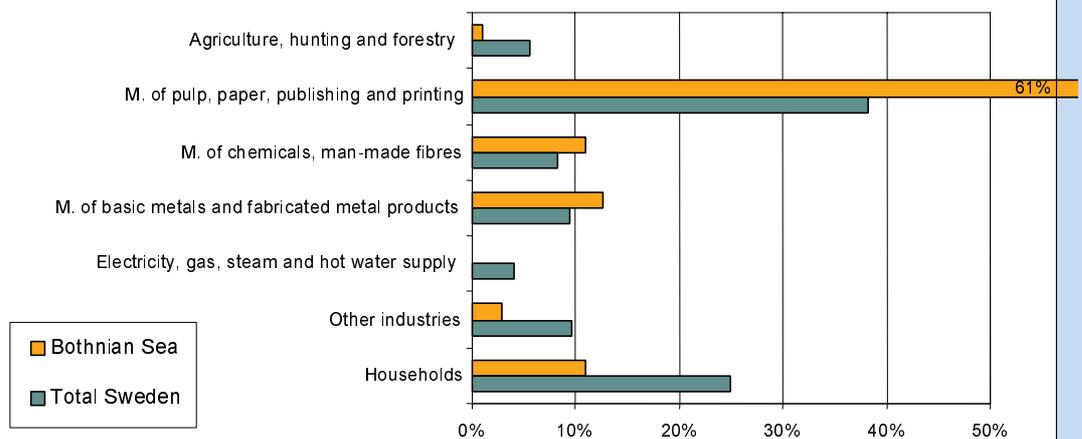


	Use of distributed water 1000 m ³	Self supply 1000 m ³	Total use, 1000 m ³
A* Agriculture, hunting and forestry		7 076	7 076
DE M. of pulp, paper, publishing and printing	1 102	458 398	459 500
DG M. of chemicals, man-made fibres	581	81 967	82 548
DJ M. of basic metals and fabricated metal products	4 786	90 292	95 078
40 Electricity, gas, steam and hot water supply	352	1 222	1 574
Other industries	17 941	3 448	21 389
Total industries	24 762	642 403	667 165
Households	66 714	15 882	82 596
Total	91 476	658 285	749 761

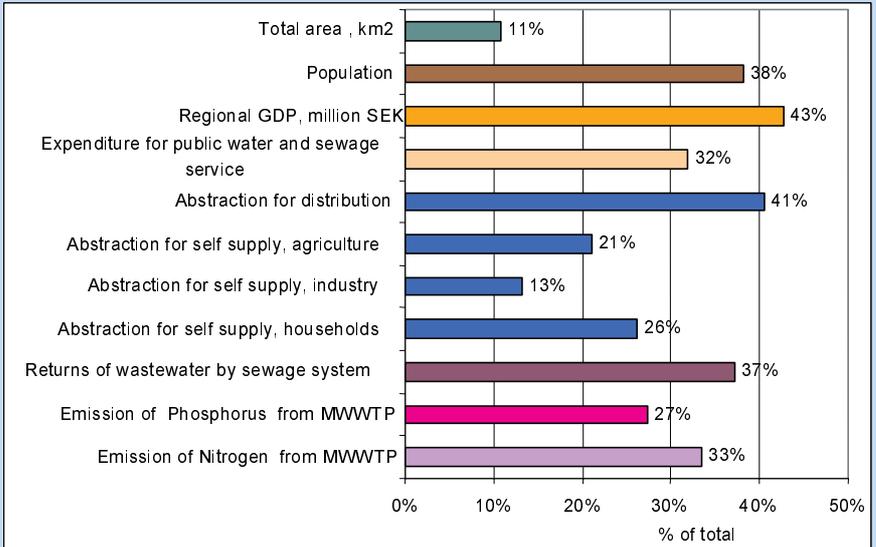
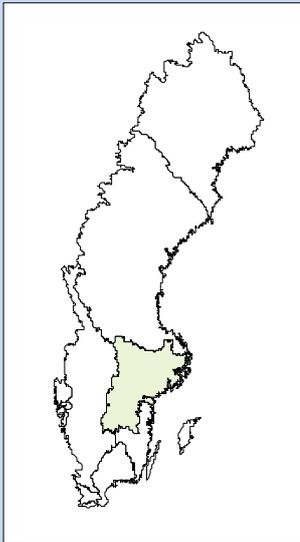
Total expenditure for distributed water: 1788 million SEK.

Waste water treatment service in the manufacturing industry:
Current exp.: 223 million SEK
Investments: 92 million SEK

Total use of water



Baltic proper, north

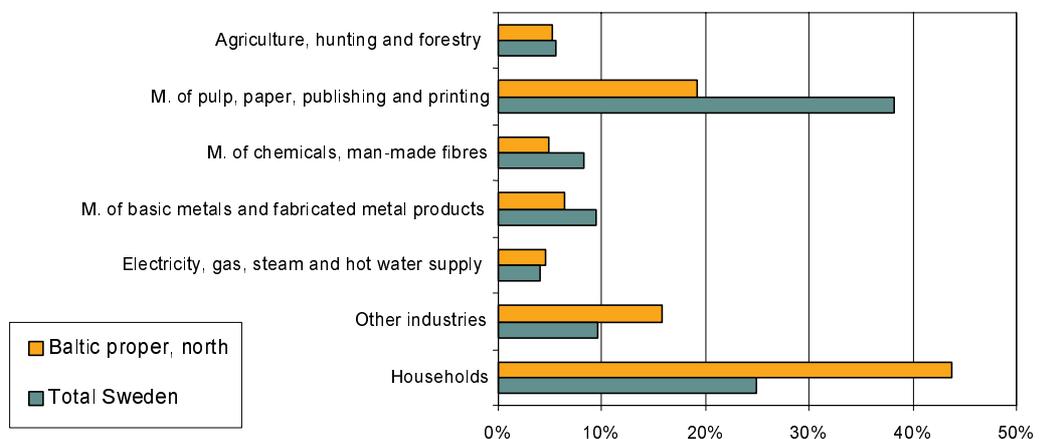


	Use of distributed water, 1000 m ³	Self supply, 1000 m ³	Total use, 1000 m ³
A* Agriculture, hunting and forestry		28 452	28 452
DE M. of pulp, paper, publishing and printing	1 665	103 631	105 296
DG M. of chemicals, man-made fibres	8 190	18 371	26 561
DJ M. of basic metals and fabricated metal products	5 702	29 597	35 299
40 Electricity, gas, steam and hot water supply	1 628	23 730	25 358
Other industries	65 827	21 294	87 121
Total industries	83 012	225 075	308 087
Households	216 914	23 315	240 229
Total	299 926	248 390	548 316

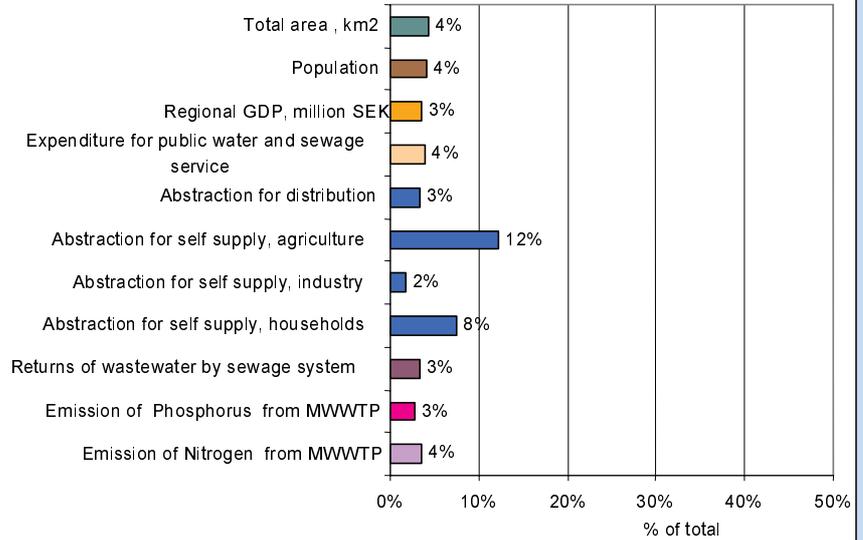
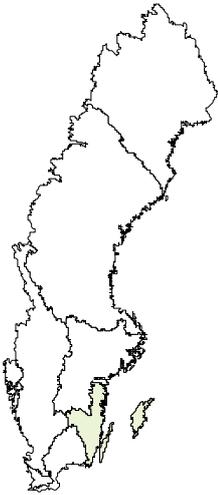
Total expenditure for distributed water: 4174 Million SEK.

Waste water treatment service in the manufacturing industry:
Current exp.: 106 million SEK
Investments: 130 million SEK

Total use of water



Baltic proper, middle

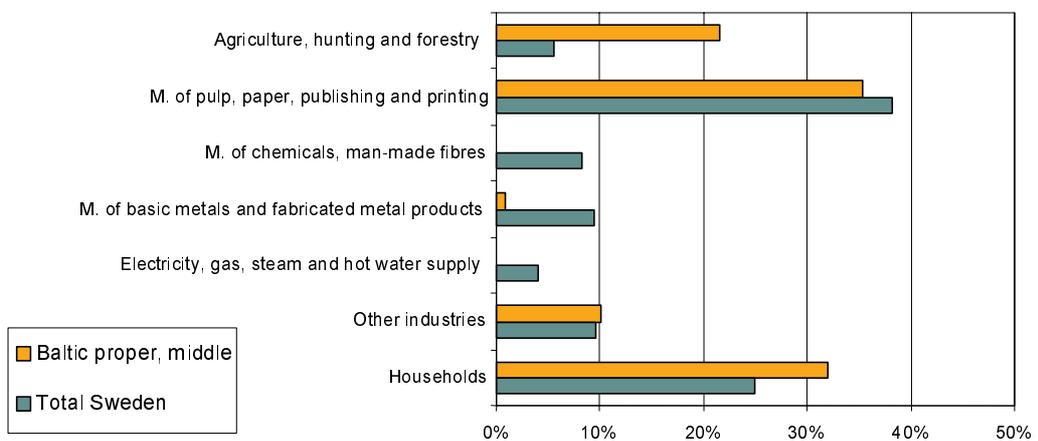


	Use of distributed water, 1000 m ³	Self supply, 1000 m ³	Total use, 1000 m ³
A* Agriculture, hunting and forestry		16 463	16 463
DE M. of pulp, paper, publishing and printing	680	26 319	26 999
DG M. of chemicals, man-made fibres	25		25
DJ M. of basic metals and fabricated metal products	339	323	662
40 Electricity, gas, steam and hot water supply	24		24
Other industries	6 699	990	7 689
Total industries	7 767	44 095	51 862
Households	17 587	6 747	24 334
Total	25 354	50 842	76 196

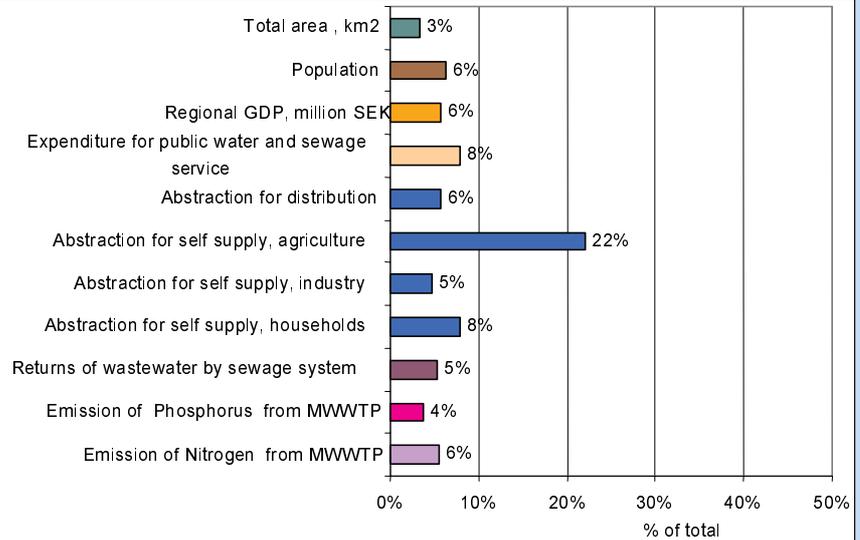
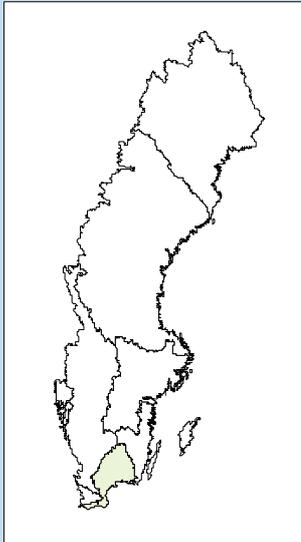
Total expenditure for distributed water: 513 Million SEK.

Waste water treatment service in the manufacturing industry:
Current exp.: 15 million SEK
Investments: 34 million SEK

Total use of water



Baltic proper, south

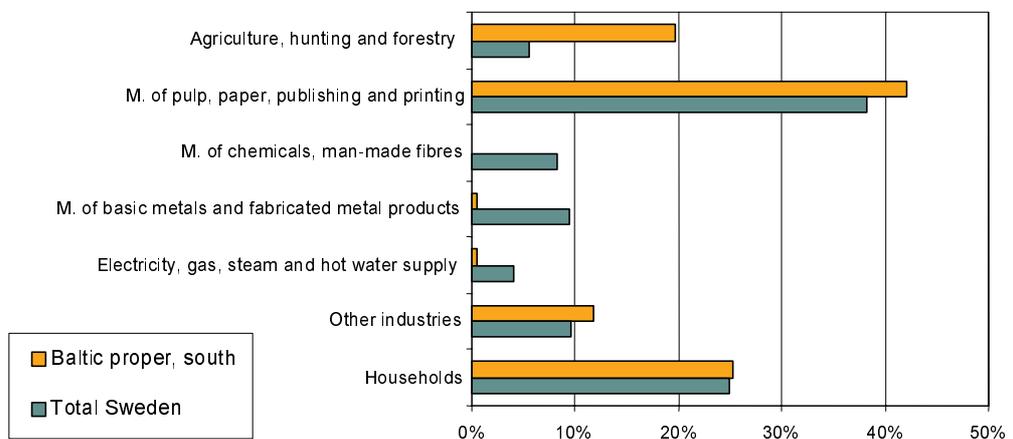


	Use of distributed water, 1000 m ³	Self supply, 1000 m ³	Total use, 1000 m ³
A* Agriculture, hunting and forestry		29 622	29 622
DE M. of pulp, paper, publishing and printing	141	63 433	63 574
DG M. of chemicals, man-made fibres	79	301	380
DJ M. of basic metals and fabricated metal products	250	437	687
40 Electricity, gas, steam and hot water supply	85	693	778
Other industries	10 468	7 199	17 667
Total industries	11 023	101 685	112 708
Households	31 225	7 004	38 229
Total	42 248	108 689	150 937

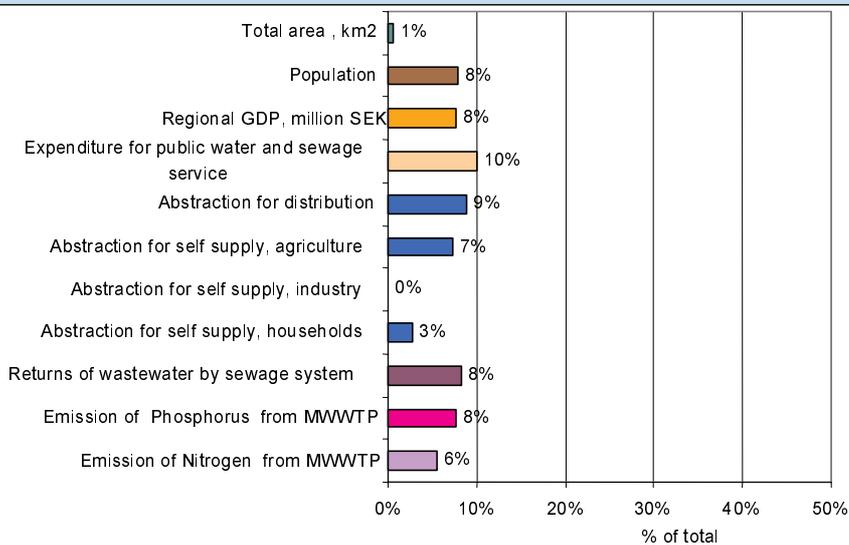
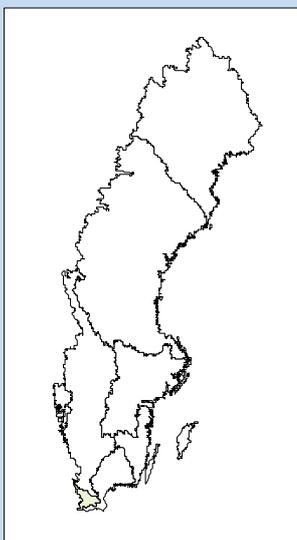
Total expenditure for distributed water: 1030 Million SEK.

Waste water treatment service in the manufacturing industry:
Current exp.: 132 million SEK
Investments: 63 million SEK

Total use of water



The Sound

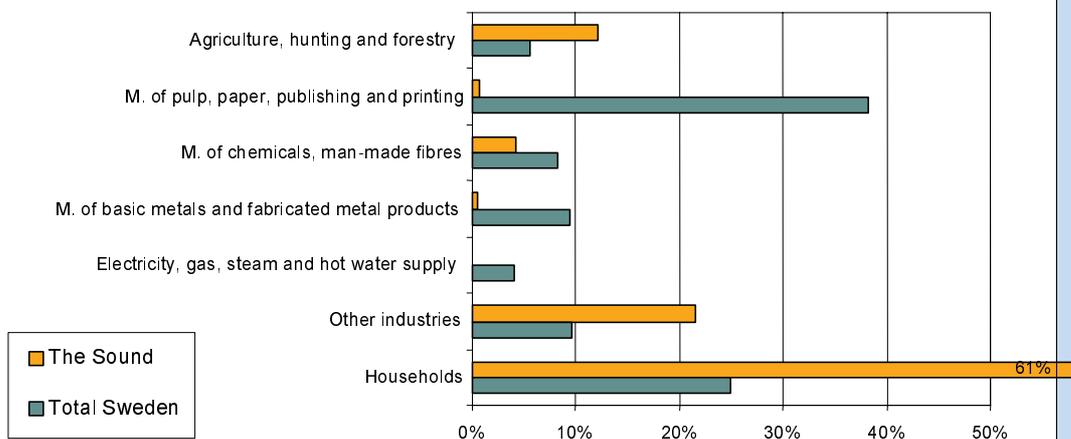


	Use of distributed water, 1000 m ³	Self supply, 1000 m ³	Total use, 1000 m ³
A* Agriculture, hunting and forestry		9 831	9 831
DE M. of pulp, paper, publishing and printing	532		532
DG M. of chemicals, man-made fibres	3 188	144	3 332
DJ M. of basic metals and fabricated metal products	461		461
40 Electricity, gas, steam and hot water supply	101		101
Other industries	14 303	3 065	17 368
Total industries	18 585	13 040	31 625
Households	46 644	2 438	49 082
Total	65 229	15 478	80 707

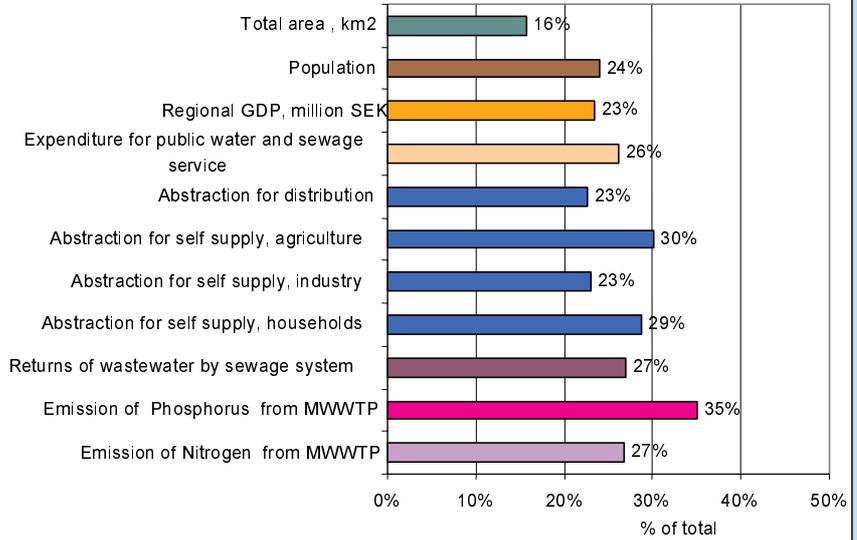
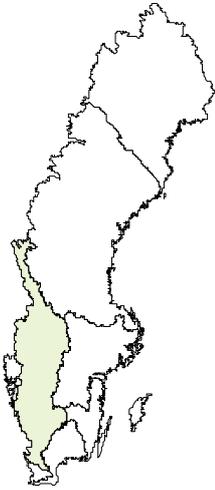
Total expenditure for distributed water: 1301 Million SEK.

Waste water treatment service in the manufacturing industry:
Current exp.: 48 million SEK
Investments: 29 million SEK

Total use of water



Kattegat

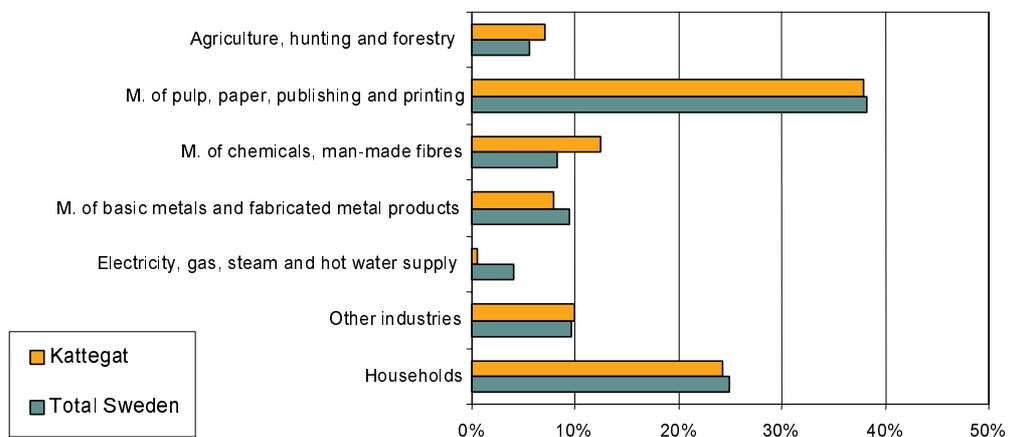


	Use of distributed water, 1000 m ³	Self supply, 1000 m ³	Total use, 1000 m ³
A* Agriculture, hunting and forestry		40 734	40 734
DE M. of pulp, paper, publishing and printing	1 806	217 609	219 415
DG M. of chemicals, man-made fibres	1 826	70 741	72 567
DJ M. of basic metals and fabricated metal products	4 035	42 044	46 079
40 Electricity, gas, steam and hot water supply	474	2 671	3 145
Other industries	44 357	12 920	57 277
Total industries	52 498	386 719	439 217
Households	114 917	25 619	140 536
Total	167 415	412 338	579 753

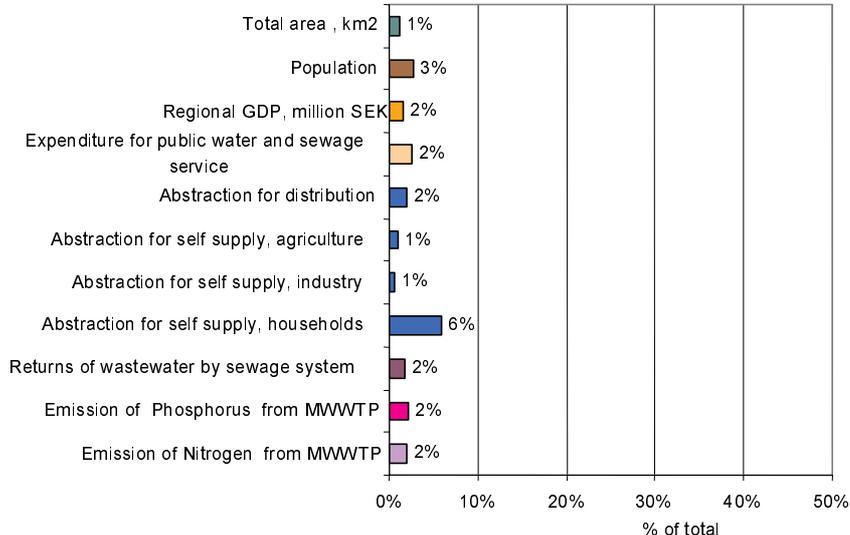
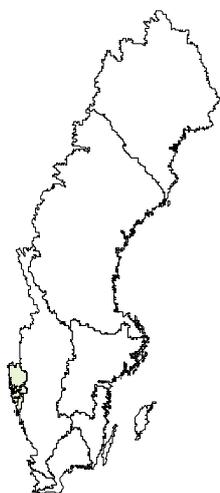
Total expenditure for distributed water: 3422 Million SEK.

Waste water treatment service in the manufacturing industry:
Current exp.: 315 million SEK
Investments: 156 million SEK

Total use of water



Skagerrak

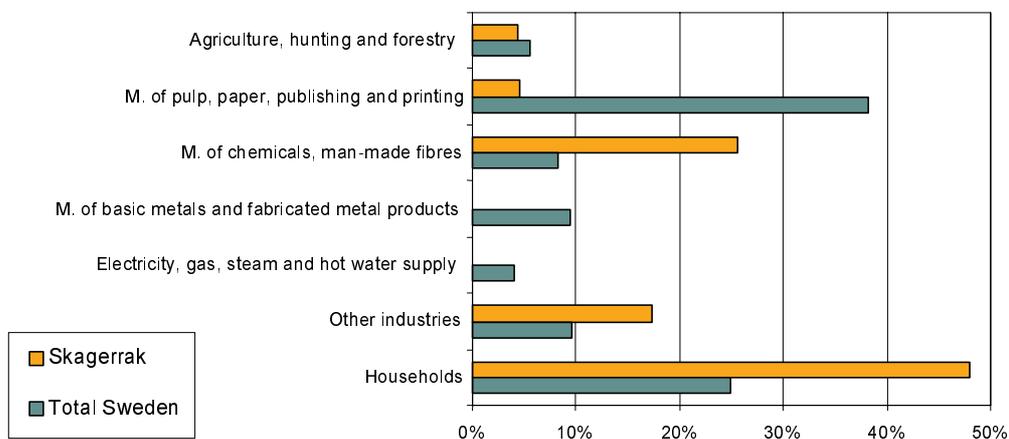


	Use of distributed water, 1000 m ³	Self supply, 1000 m ³	Total use, 1000 m ³
A* Agriculture, hunting and forestry		1 280	1 280
DE M. of pulp, paper, publishing and printing	14	1 290	1 304
DG M. of chemicals, man-made fibres	3 102	4 287	7 389
DJ M. of basic metals and fabricated metal products	49		49
40 Electricity, gas, steam and hot water supply	1		1
Other industries	2 525	2 488	5 013
Total industries	5 691	9 345	15 036
Households	8 555	5 269	13 824
Total	14 246	14 614	28 860

Total expenditure for distributed water: 323 Million SEK.

Waste water treatment service in the manufacturing industry:
Current exp.: 127 million SEK
Investments: 81 Million SEK

Total use of water



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