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# TOWARDS THE APPLICATION OF THE INTERNATIONAL WATER RELATED ENVIRONMENTAL INDICATORS IN HUNGARY

Paper submitted by the Hungarian Central Statistical Office [1]

**Summary:** The main aim of this paper is to provide an overview on the implementation of the Hungarian application work on the water related environmental indicators.

This paper is based on the water-related indicators of international institutions (Eurostat, EEA and OECD).

The paper presents the first results of the survey on the application of the water related environmental indicators and indices according to the international indicator issues, and summarizes the main directions of the future work.

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## *I. INTRODUCTION*

The environmental threats and the growing interest in sustainable development have urged governments to monitor the state of the environment and detect changes in conditions and courses. The environmental indicators prove to be a necessary tool for helping to present and monitor the trends towards a sustainable future.

In 1996 the Hungarian Government has decreed a developing work on implementation of a so-termed Integrated Environmental and Economic Information System, with special regard to satisfaction of EU and OECD requirements including also the improvement of the environmental indicators. By reason of this decision started an analysis of statistics on water resources, water uses and used water discharges with the final aim to elaborate a database on water management statistics, which is suitable for the EU and OECD statistical standards.

The EU and OECD have developed their statistical data collection system in the 1980's, which give a database for different analyzing, regulating and methodological work with reference to the environment. This statistical data collection system has covered also Hungary since 1990.

## *II. WATER MANAGEMENT AND THE NEED OF ENVIRONMENTAL INDICATORS*

Hungary is situated mostly on plain land in the Carpathian basin. The significant part of the catchment area lies outside the borders of the country, therefore the carried water amount and quality of our rivers, the usability of the renewable water resources, depend mainly on the water management system of upstream countries. The concept of intensive river management takes environment and nature development into consideration, and has regard for sustainable development.

The conditions in upstream countries determine the water quality of our large water streams. With respect to certain components, due to self-purification the level of pollution slightly increases and decreases within the country. About 5% of our surface waters can be made suitable for water utilization purposes, including drinking water production without special expenditures and 90% of them at an acceptable cost.

The Hungarian water base protection program determines the tasks of the preservation of the vulnerable water bases, the elimination of pollution, the remediation of territories and the provision for the protection of prospective water bases.

In the different water utilization areas, measures are taken to elaborate price relationships reflecting the availability of resources. The large-scale development of sewage drainage and purification in communities, cheaper and more efficient water usage solutions, and the introduction of new technical processes are all very important.

In relation to policy-making of water management, water related environmental indicators could be used mainly for the following aims:

- to support priority setting, by determining main factors that cause pressure on the water related environment;
- to supply policy-makers with information on the state of water related environment;
- to control the impacts of policy responses of water management.

## *III. WATER RELATED ENVIRONMENTAL INDICATORS*

Water is necessary for almost all kinds of life, but only a small part of the world's population has access to drinking (tap) water. In areas with a high population density concentrated industrial activity and intensive agriculture, the human activities especially affect the available water resources and water quality.

The water related indicators selected by international water experts give a detailed description of the pressures imposed on quality and quantity of water resources and the responses of the policy-makers of water management to reduce them.

For the year 2000 the Fifth EU Environment Action Programme determined the following key targets:

- the prevention of over-exploitation of ground water and surface water for drinking water or industrial or other purposes;
- the prevention of pollution of ground water from diffuse sources;
- and a better ecological quality of surface and marine water.

In this paper surveyed international water related environmental indicators are more detailed: nutrients (nitrogen, phosphorous), overuse of ground water resources, pesticides, heavy metals and organic matter are listed as the most important pressures on water. Some indicators on waste water treated or water pricing are also included as a measure of the responses of society to protect the water resources and water quality. In the Sixth EU Environment Action Programme (2001-2010) the Commission proposes also strong action to preserve natural resources such as soil, water, air and timber.

In general a water related environmental indicator is a number that is meant to indicate the state or the development of important aspects of the water related environment. An indicator without a unit of measurement is an index, which is often constructed from several indicators weighted together to include the total effect on the state of the environment. In this paper generally an indicator will be presented as a set of numbers, e.g. a time series, but strictly speaking, indicators concern a specific number along the time or space dimension.

The users of water related indicators will obviously differ in their need for information and their ability to understand and make use of a specific type of information provided by indicators. The water related environmental indicators provide in some cases a general, compact description on the water resources and water quality that is easily understandable even without advanced knowledge of ecology, chemistry or biology. So anybody who is concerned with the water resources and water quality might be a potential user of the presented water related environmental indicators, and in some cases a set of water related environmental indicators will not give environmental experts new information.

Many countries and international organizations regularly present 'state of environment' reports or environmental statistics publications, which consists lots of available information on the state and development of the environment including water. Since economic development of society is closely connected with the environmental development, it would be very useful to present the set of internationally comparable environmental indicators in these publications.

In the following this paper presents the first results of the survey on the application of water related environmental indicators based on the methodology of the water related indicators of international institutions (Eurostat, EEA and OECD).

## *IV. OVERVIEW TABLE OF THE SURVEYED WATER RELATED INDICATORS*

The following table provides information on the surveyed water related internationally developed indicators. The table presents the sources of indicators, which determine mainly the applied methodology in this survey.

| Reference code | Sectors / Driving forces Issues | Indicator | DPSIR | Source | Remarks |
|---|---|---|---|---|---|
| AG-3 | Agriculture | Irrigated land, as % of agricultural area | D | EEA [2] | P |
| RD-1 | Resource depletion | Water consumption | P | Eurostat [3] | P |
| TX-4 | Dispersion of toxic chemicals | Index of heavy metal emissions to water | P | | **N** |
| UP-3 | Urban environmental problems | Non-treated waste water | P | | P |
| WP-1 | Water pollution | Nutrient (N + P) use (eutrophication equivalents) | S | | P |
| WP-2 | | Ground water abstraction | P | | P |
| WP-3 | | Pesticides used per hectare of utilized agriculture area | P | | **D** |
| WP-4 | | Nitrogen quantity used per hectare of utilized agriculture area | P | | **D** |
| WP-5 | | Water treated/water collected | R | | P |
| WP-6 | | Emissions of organic matter as BOD | P | | P |
| WN-1 | Water quantity | Water balance | S | EEA [2] | P |
| WN-3 | | Water use by sector | D-P | | **D** |
| WN-4 | | Irrigation water use | D-P | | P |
| WN-5 | | Public water supply | D-P | | P |
| WN-6 | | Water price | R | | **D** |
| E-1a | Eutrophication | Nitrogen source apportionment | P | EEA [2] | **D** |
| E-1b | | Phosphorus source apportionment | P | | **D** |
| E-2 | | Nitrogen balance – N-surplus | P | | **N** |
| E-3a | | P and N in large rivers | S | | P |
| E-3b | | P in lakes | S | | P |
| E-4a | | Status of nitrate in groundwater | S | | P |
| E-8 | | Urban waste water treatment | R | | P |
| E-9 | | Point source emissions of phosphorus | P | | **D** |
| E-10 | | Consumption of phosphorus in detergents per capita | P | | **D** |
| W-7.1 | Waste | Sludge from waste water treatment | P-R | EEA [2] | **N** |
| W-7.2 | | Content of sewage sludge | P-R | | **N** |
| WR | Freshwater resources | Intensity of use of water resources | P | OECD [1], [4] | See: RD-1, WN-1 |
| WQ | Freshwater quality | Waste water treatment connection | R | | See: WP-5, E-8 |

According to the international studies the DPSIR model has been adopted as the most appropriate way to structure environmental information by international organizations dealing with environmental information, such as Eurostat, the European Environment Agency (EEA), and by the OECD since the early 1990s, as PSR model.

The locations of the indicators in the DPSIR framework are indicated in the overview table according to the following structure:

- **D** Driving forces: basic sectorial trends, e.g. agriculture, tourism, energy, transport, industry;
- **P** Pressure: human activities directly affecting the environment e.g. waste water emissions;
- **S** State: observable changes of the environment, e.g. changes of water quality in lakes;
- **I** Impact: effects of a changed environment, e.g. decrease in water resources, floods;
- **R** Response: response of society to solve the problem, e.g. waste water treatment, water prices;

The P, F and N letters in the remarks column categorize the results of the survey of each indicator into three categories:

- **P** Indicator **p**resented in the Annex;
- **D** Indicator is presented in Annex, but it is needed to **d**evelop the methodology;
- **N** Indicator is **n**ot available yet (lack of data or methodology etc.).

At the same time this categorization points out the main direction of the further work on the adaptation of the international water related indicators too.

## *V. CONCLUSIONS AND FURTHER WORK*

The Hungarian experience on application of water related international indicators shows that environmental indicators are cost effective and powerful tools for observing and describing environmental progress and measuring environmental performance. However, experience also shows significant lags between the demand for and the supply of water related environmental indicators.

In general terms further efforts should be done to:

- improve the quality and comparability of existing data ;
- further develop concepts and estimation methods;
- cover also the sectoral water related indicators (industry, energy, agriculture, tourism);
- force the co-operation of national institutions in the developing work;
- link the indicators more closely to national goals and international commitments;
- complement our publication policy with environmental indicators.

The development of an EU and OECD-compatible statistics of indicators is important from the point of view of EU enlargement's conditions, but a good water related indicator statistics is very important for protection of our water resources and environment in Hungary too.

## *VI. REFERENCES*

**[1] OECD:** Environmental indicators, OECD core set, Paris 1994

**[2] European Environment Agency (EEA):** Environmental signals 1999, Indicator fact sheets for the EEA, Yearly indicator report (For review), Copenhagen 1999

**[3] Eurostat:** Towards environmental pressure indicators for the EU, First edition, Luxembourg 1999

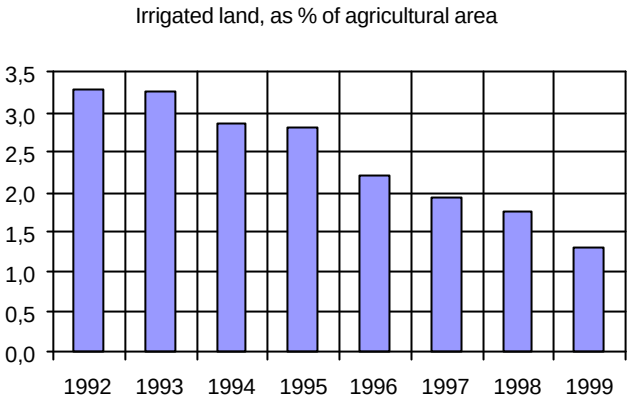
**[4] OECD:** Ten indicators for the Environment (Draft), Paris 2001

## *ANNEX*

## *PRESENTATION OF SOME WATER RELATED INDICATORS IN HUNGARY*

### AG–3 Irrigated land, as % of agricultural area

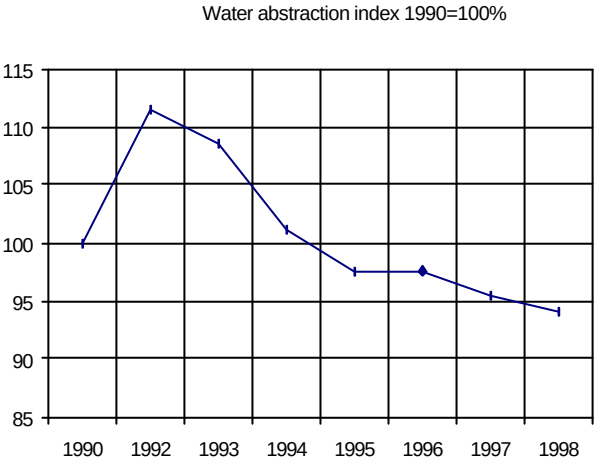
| Year | Agricultural area, 1000 ha | Irrigated area, 1000 ha | % of agricultural area |
|---|---|---|---|
| 1992 | 6 135,7 | 201,2 | 3,3 |
| 1993 | 6 129,1 | 199,9 | 3,3 |
| 1994 | 6 122,0 | 175,4 | 2,9 |
| 1995 | 6 179,3 | 173,4 | 2,8 |
| 1996 | 6 184,5 | 135,6 | 2,2 |
| 1997 | 6 194,6 | 119,0 | 1,9 |
| 1998 | 6 192,7 | 108,4 | 1,8 |
| 1999 | 6 186,3 | 81,0 | 1,3 |

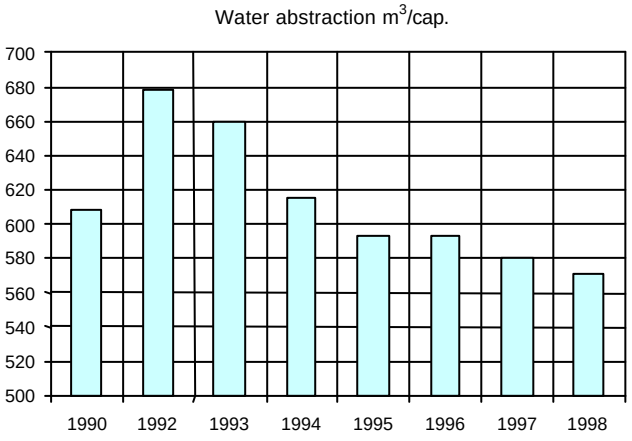



Source: HCSO; Ministry of Transport and Water Management.

### RD–1 Water consumption, fresh ground and surface water consumption

| Year | Water abstr., million $m^3$ | Population (at the end of the year), cap. | Water abstr. $m^3$/cap | Water abstr. index, % |
|---|---|---|---|---|
| 1990 | 6 294,8 | 10 354 842 | 608 | 100 |
| 1992 | 6 988,5 | 10 310 179 | 678 | 112 |
| 1993 | 6 781,0 | 10 276 968 | 660 | 109 |
| 1994 | 6 296,6 | 10 245 677 | 615 | 101 |
| 1995 | 6 054,4 | 10 212 300 | 593 | 98 |
| 1996 | 6 035,4 | 10 174 442 | 593 | 98 |
| 1997 | 5 878,0 | 10 135 358 | 580 | 95 |
| 1998 | 5 771,4 | 10 091 789 | 572 | 94 |

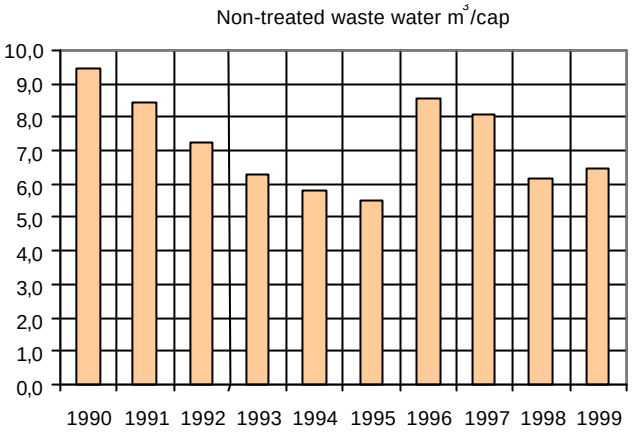



Source: HCSO; Ministry of Transport and Water Management.

## UP–3 Urban environmental problems, non treated waste water from public sewerage

| Year | Non-treated waste water[a], million $m^3$ | Population (at the end of the year), cap. | Non-treated waste water $m^3$/cap |
|---|---|---|---|
| 1990 | 97,8 | 10 354 842 | 9,4 |
| 1991 | 87,5 | 10 337 236 | 8,5 |
| 1992 | 74,6 | 10 310 179 | 7,2 |
| 1993 | 64,9 | 10 276 968 | 6,3 |
| 1994 | 59,2 | 10 245 677 | 5,8 |
| 1995 | 56,3 | 10 212 300 | 5,5 |
| 1996 | 87,4 | 10 174 442 | 8,6 |
| 1997 | 81,8 | 10 135 358 | 8,1 |
| 1998 | 62,1 | 10 091 789 | 6,2 |
| 1999 | 65,2 | 10 043 224 | 6,5 |

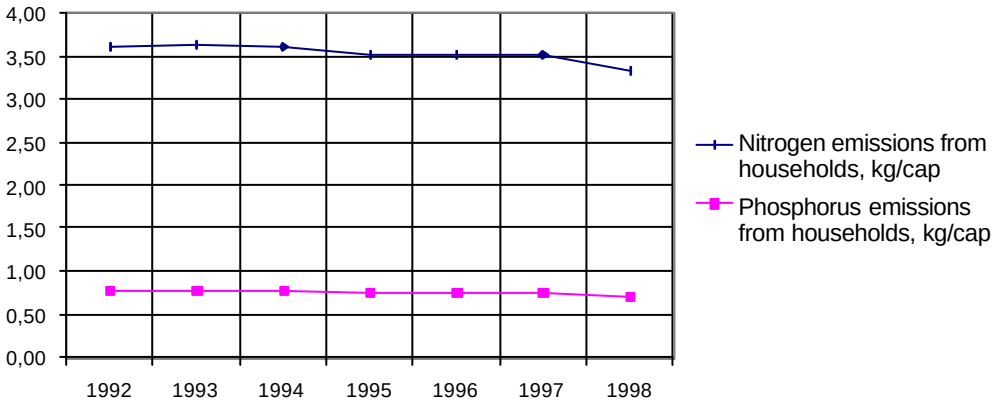



a) Conducted by public sewerage.
Source: HCSO.

## WP–1 Nutrient (N+P) use (eutrophication equivalents)
## N+P emissions from households, after treatment

| Year | Population connected to the[a] | | | Population (at the end of the year), cap. | Nitrogen emissions coefficient kg/cap | Phos-phorus emissions coefficient kg/cap | Nitrogen emissions from house-holds, kg/cap | Phos-phorus emissions from house-holds, kg/cap |
|---|---|---|---|---|---|---|---|---|
| | primary waste water treatment, % | secondary waste water treatment, % | tertiary waste water treatment, % | | | | | |
| 1992 | 4,4 | 11,0 | 0,9 | 10 310 179 | 4,4 | 1 | 3,61 | 0,77 |
| 1993 | 5,1 | 14,3 | 0,9 | 10 276 968 | 4,4 | 1 | 3,62 | 0,78 |
| 1994 | 4,3 | 15,7 | 0,9 | 10 245 677 | 4,4 | 1 | 3,59 | 0,77 |
| 1995 | 2,7 | 16,9 | 0,9 | 10 212 300 | 4,4 | 1 | 3,52 | 0,75 |
| 1996 | 3,0 | 17,7 | 1,1 | 10 174 442 | 4,4 | 1 | 3,51 | 0,75 |
| 1997 | 2,7 | 19,8 | 1,0 | 10 135 358 | 4,4 | 1 | 3,51 | 0,75 |
| 1998 | 2,6 | 20,1 | 2,8 | 10 091 789 | 4,4 | 1 | 3,32 | 0,71 |

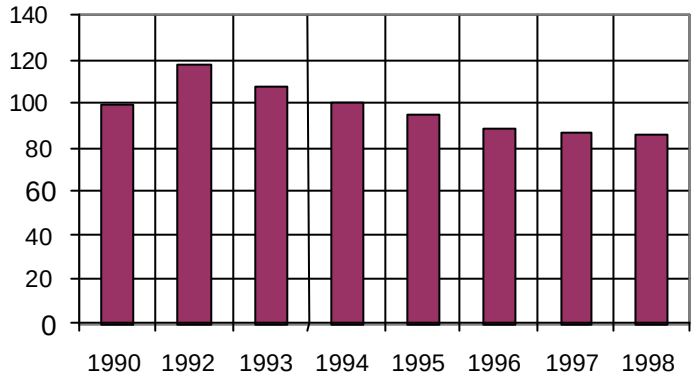
a) Estimated data.
Source: HCSO; Ministry for Environment



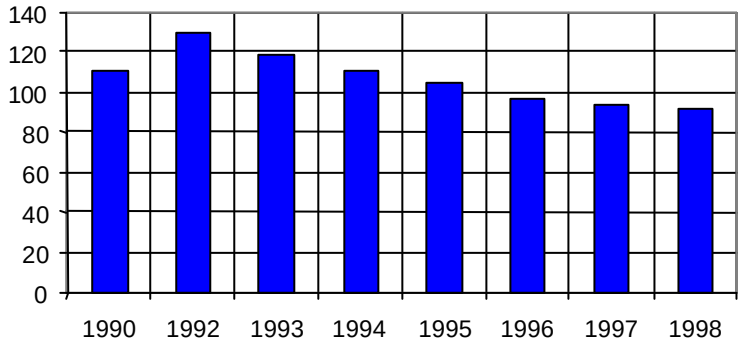
## WP 2 Ground water abstraction

| Year | Fresh ground water abstrac-tion, million $m^3$ | Area, ha | Fresh ground water abstraction per surface area, $m^3$ per ha | Population (at the end of the year), cap. | Fresh ground water abstrac-tion, $m^3$ per capita |
|---|---|---|---|---|---|
| 1990 | 1 028,4 | 9 303 000 | 111 | 10 354 842 | 99 |
| 1992 | 1 207,1 | 9 303 000 | 130 | 10 310 179 | 117 |
| 1993 | 1 108,0 | 9 303 000 | 119 | 10 276 968 | 108 |
| 1994 | 1 021,8 | 9 303 000 | 110 | 10 245 677 | 100 |
| 1995 | 968,7 | 9 303 000 | 104 | 10 212 300 | 95 |
| 1996 | 899,3 | 9 303 000 | 97 | 10 174 442 | 88 |
| 1997 | 873,4 | 9 303 000 | 94 | 10 135 358 | 86 |
| 1998 | 857,7 | 9 303 000 | 92 | 10 091 789 | 85 |

Fresh ground water abstraction, $m^3$ per capita




Fresh ground water abstraction per surface area, $m^3$ per hectare

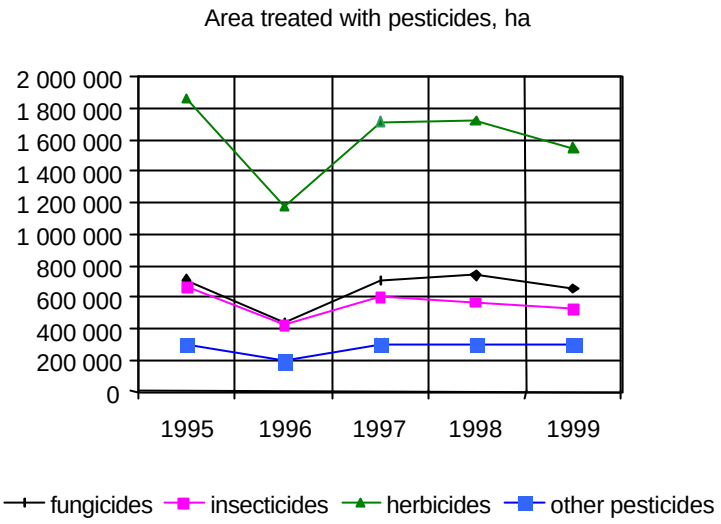



Source: HCSO; Ministry of Transport and Water Management.

## WP–3 Pesticides used per hectare of utilized agriculture area
## Area treated with pesticides, ha

ha

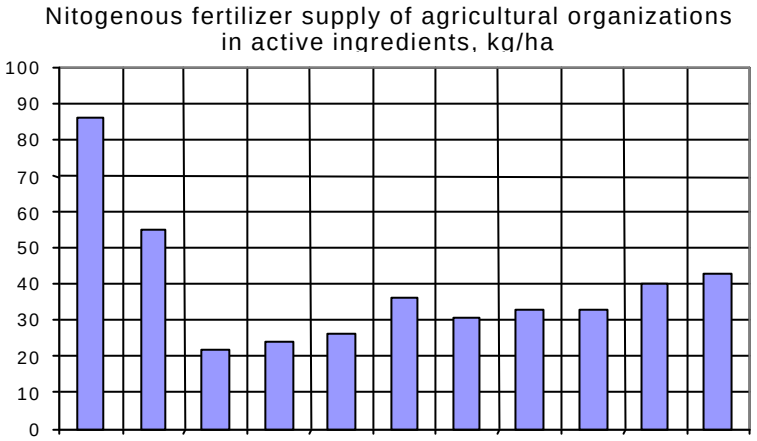
| Year | Area treated with | | | |
|---|---|---|---|---|
| | fungicides | insec-ticides | herbicides | other pesticides |
| 1995 | 711 241 | 669 849 | 1 859 123 | 296 102 |
| 1996 | 437 982 | 423 205 | 1 174 865 | 195 850 |
| 1997 | 704 490 | 605 340 | 1 709 086 | 306 254 |
| 1998 | 742 239 | 566 446 | 1 723 233 | 296 504 |
| 1999 | 656 955 | 529 541 | 1 546 481 | 300 799 |

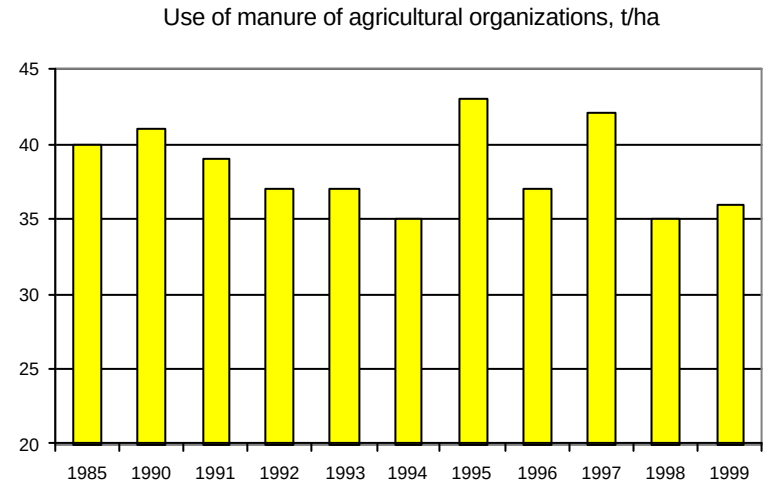



Source: HCSO.

## WP–4 Nitrogen quantity used per hectare of utilized agricultural area

| Year | Nitroge-nous fertilizer supply of agricul-tural organiza-tions in active in-gredients, kg/ha | Use of manure of agricultural organiza-tions, t/ha |
|---|---|---|
| 1985 | 86 | 40 |
| 1990 | 55 | 41 |
| 1991 | 22 | 39 |
| 1992 | 24 | 37 |
| 1993 | 26 | 37 |
| 1994 | 36 | 35 |
| 1995 | 31 | 43 |
| 1996 | 33 | 37 |
| 1997 | 33 | 42 |
| 1998 | 40 | 35 |
| 1999 | 43 | 36 |

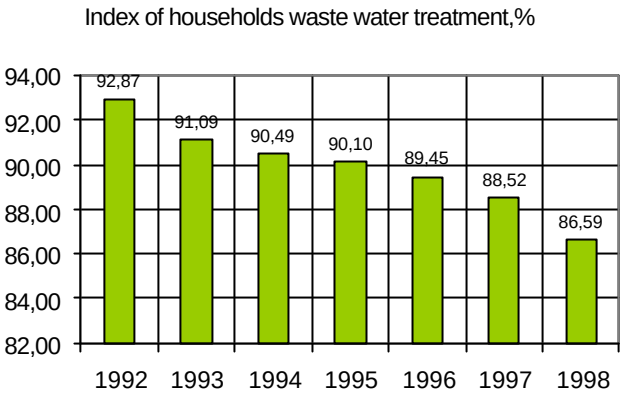



Source: HCSO.

## WP–5 Water treated/water collected
## Index of municipal waste water treatment, (0,00%=BAT)

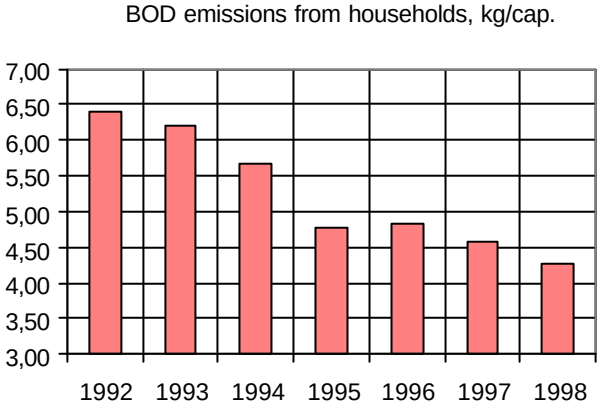
| Year | Population connected to the[a] | | | Population without[a] | Index of households |
|---|---|---|---|---|---|
| | primary | secondary | tertiary | | |
| | waste water treatment,% | | | | |
| 1992 | 4,4 | 11 | 0,9 | 83,7 | 92,87 |
| 1993 | 5,1 | 14,3 | 0,9 | 79,7 | 91,09 |
| 1994 | 4,3 | 15,7 | 0,9 | 79,1 | 90,49 |
| 1995 | 2,7 | 16,9 | 0,9 | 79,5 | 90,10 |
| 1996 | 3,0 | 17,7 | 1,1 | 78,2 | 89,45 |
| 1997 | 2,7 | 19,8 | 1,0 | 76,5 | 88,52 |
| 1998 | 2,6 | 20,1 | 2,8 | 74,5 | 86,59 |




a) Estimated data.
Source: HCSO; Ministry for Environment.

## WP–6 Water pollution, Emissions of organic matter as BOD
## BOD emissions from households, after treatment

| Year | Population connected to the[a] | | | Population (at the end of the year), cap. | BOD emissions from households[b], kg/cap |
|---|---|---|---|---|---|
| | primary | secondary | tertiary | | |
| | waste water treatment, % | | | | |
| 1992 | 4,4 | 11 | 0,9 | 10 310 179 | 6,42 |
| 1993 | 5,1 | 14,3 | 0,9 | 10 276 968 | 6,21 |
| 1994 | 4,3 | 15,7 | 0,9 | 10 245 677 | 5,67 |
| 1995 | 2,7 | 16,9 | 0,9 | 10 212 300 | 4,78 |
| 1996 | 3,0 | 17,7 | 1,1 | 10 174 442 | 4,83 |
| 1997 | 2,7 | 19,8 | 1,0 | 10 135 358 | 4,58 |
| 1998 | 2,6 | 20,1 | 2,8 | 10 091 789 | 4,27 |




a) Estimated data.
b) BOD emissions coefficient, 60 g/cap/day.
Source: HCSO; Ministry for Environment.

## WN1 Water balance

| Year | Land area $10^3$ km$^2$ | Population (at the end of the year) | Precipitation | Evoptranspiration | Internal resource | Available resource m$^3$/inh. | Total abstraction mio. m$^3$ | Abstraction m$^3$/inh. | Abs. In% of runoff % |
|---|---|---|---|---|---|---|---|---|---|
| | | | million m$^3$ | | | | | | |
| 1995 | 93,0 | 10 212 300 | 64 300,0 | 59 300,0 | 5 000,0 | 489,6 | 6 054,4 | 592,9 | 121,1 |
| 1996 | 93,0 | 10 174 442 | 63 500,0 | 54 600,0 | 8 900,0 | 874,7 | 6 035,4 | 593,2 | 67,8 |
| 1997 | 93,0 | 10 135 358 | 49 700,0 | 46 000,0 | 3 700,0 | 365,1 | 5 878,0 | 579,9 | 158,9 |
| 1998 | 93,0 | 10 091 789 | 68 100,0 | 54 100,0 | 14 000,0 | 1 387,3 | 5 771,4 | 571,9 | 41,2 |

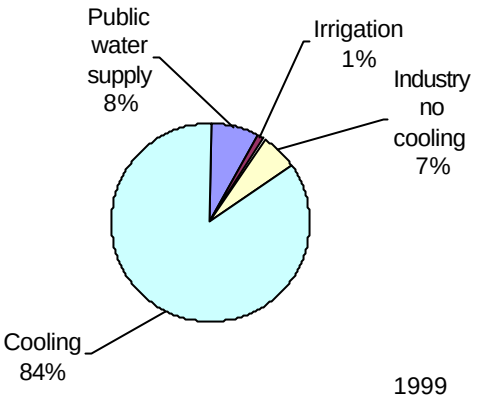
Source: HCSO, Water Resources Research Centre PLC Hydrological Institute.

## WN3 Water use by sectors

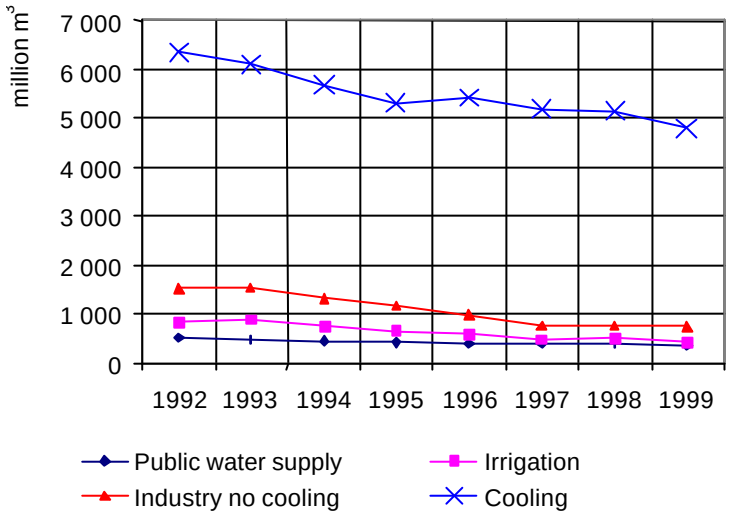
million $m^3$

| Year | Public water supply | Irrigation | Industry no cooling | Cooling | Total |
|---|---|---|---|---|---|
| 1992 | 511,9 | 325,5 | 685,9 | 4 827,4 | 6 350,7 |
| 1993 | 474,3 | 426,9 | 650,5 | 4 564,5 | 6 116,2 |
| 1994 | 444,8 | 290,1 | 575,5 | 4 368,1 | 5 678,5 |
| 1995 | 421,4 | 227,3 | 507,5 | 4 146,3 | 5 302,5 |
| 1996 | 396,3 | 192,0 | 402,0 | 4 417,6 | 5 407,9 |
| 1997 | 380,3 | 92,5 | 305,6 | 4 409,8 | 5 188,2 |
| 1998 | 377,2 | 115,6 | 281,3 | 4 364,5 | 5 138,6 |
| 1999 | 368,7 | 55,5 | 312,1 | 4 059,7 | 4 796,0 |

Source: HCSO; Ministry of Transport and Water Management.

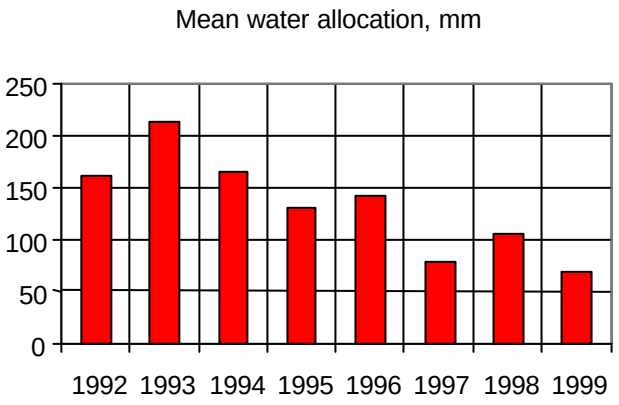



1999




## WN4 Irrigation water use

| Year | Irrigated area 1000 ha | Irrigation water $10^6$ $m^3$ | Mean water allocation, mm |
|---|---|---|---|
| 1992 | 201,2 | 325,5 | 161,8 |
| 1993 | 199,9 | 426,9 | 213,6 |
| 1994 | 175,4 | 290,1 | 165,4 |
| 1995 | 173,4 | 227,3 | 131,1 |
| 1996 | 135,6 | 192,0 | 141,6 |
| 1997 | 119,0 | 92,5 | 77,7 |
| 1998 | 108,4 | 115,6 | 106,6 |
| 1999 | 81,0 | 55,5 | 68,5 |

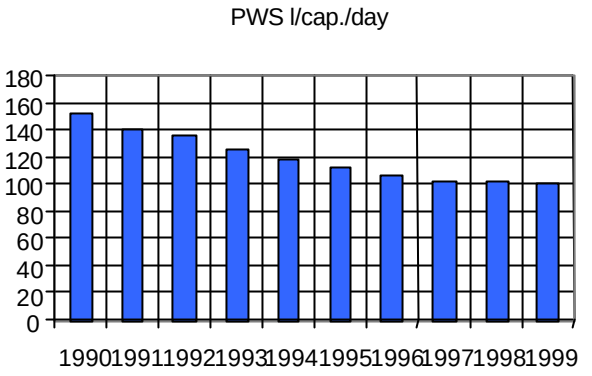


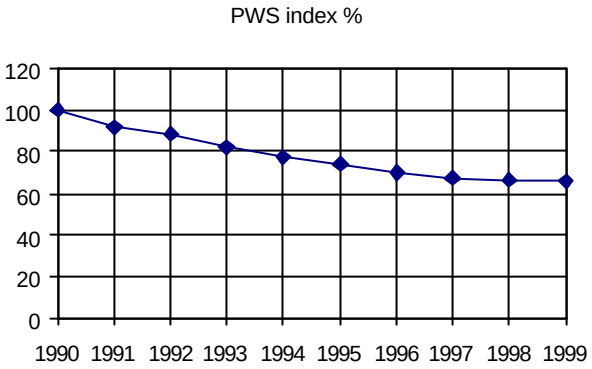

Source: Ministry of Transport and Water Management.

## WN5 Public water supply (PWS)

| Year | PWS million $m^3$ | Population (at the end of the year), cap. | PWS l/cap./day | PWS index, % |
|---|---|---|---|---|
| 1990 | 579,29 | 10 354 842 | 153 | 100 |
| 1991 | 530,11 | 10 337 236 | 140 | 92 |
| 1992 | 511,91 | 10 310 179 | 136 | 89 |
| 1993 | 474,28 | 10 276 968 | 126 | 82 |
| 1994 | 444,83 | 10 245 677 | 119 | 78 |
| 1995 | 421,39 | 10 212 300 | 113 | 74 |
| 1996 | 396,30 | 10 174 442 | 107 | 70 |
| 1997 | 380,28 | 10 135 358 | 103 | 67 |
| 1998 | 377,21 | 10 091 789 | 102 | 67 |
| 1999 | 368,73 | 10 043 224 | 101 | 66 |

Source: HCSO.

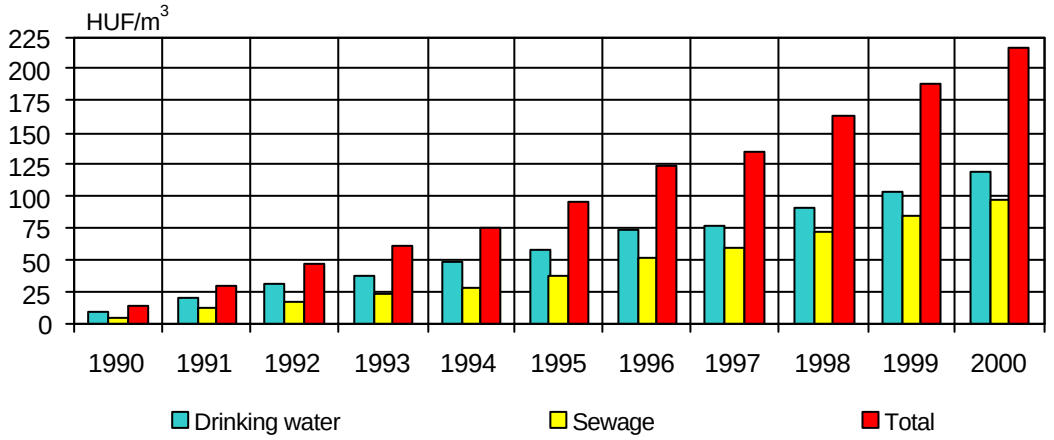



## WN6 Water and sewage costs paid by inhabitants

**Average costs paid by inhabitants, HUF/$m^3$ (without VAT)**

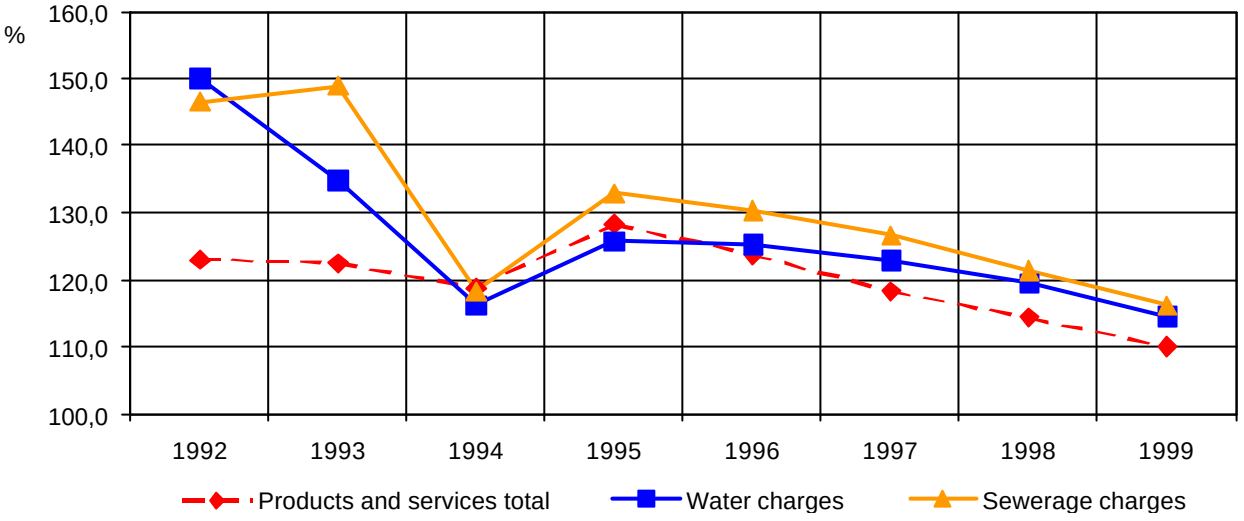
| Denomination | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Drinking water | 9,1 | 19,2 | 31,0 | 37,7 | 47,6 | 57,6 | 72,4 | 77,3 | 91,1 | 103,9 | 118,6 |
| Sewage | 4,3 | 11,1 | 16,4 | 22,9 | 28,2 | 38,4 | 51,6 | 58,2 | 70,9 | 84,4 | 96,9 |
| Total | 13,4 | 30,3 | 47,3 | 60,6 | 75,7 | 95,9 | 124,0 | 135,5 | 162,0 | 188,3 | 215,5 |




Source: HCSO.

**Changes in consumer price indexes, as a percentage of previous year**

| Denomination | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|
| Products and services total | 123,0 | 122,5 | 118,8 | 128,2 | 123,6 | 118,3 | 114,3 | 110,0 |
| Water charges | 150,0 | 134,7 | 116,3 | 125,6 | 125,3 | 122,9 | 119,4 | 114,6 |
| Sewerage charges | 146,6 | 148,9 | 118,2 | 133,0 | 130,3 | 126,7 | 121,4 | 116,2 |

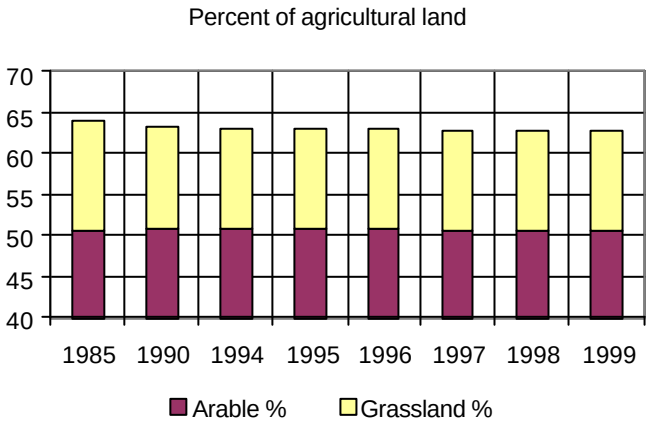



Source: HCSO.

**E1a Nitrogen source apportionment**
**% of land area which are arable and grassland**
**Fertilizer application rates kg N,P/ha**

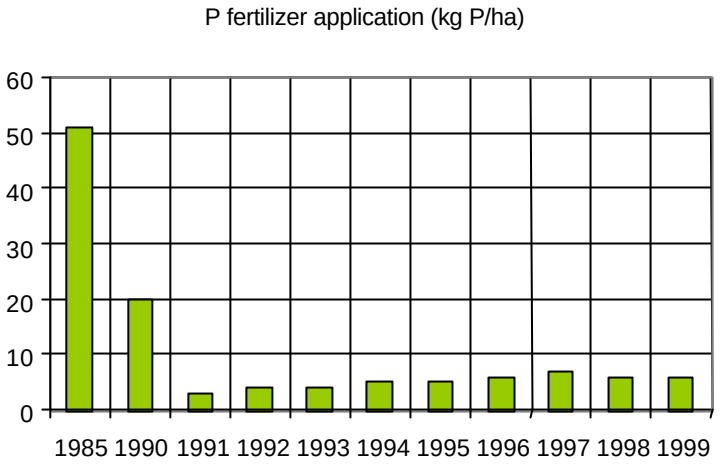
| Year | Arable % | Grassland % |
|---|---|---|
| 1985 | 50,50 | 13,4 |
| 1990 | 50,7 | 12,7 |
| 1994 | 50,7 | 12,3 |
| 1995 | 50,7 | 12,3 |
| 1996 | 50,7 | 12,3 |
| 1997 | 50,6 | 12,3 |
| 1998 | 50,6 | 12,3 |
| 1999 | 50,6 | 12,3 |

Source: HCSO.



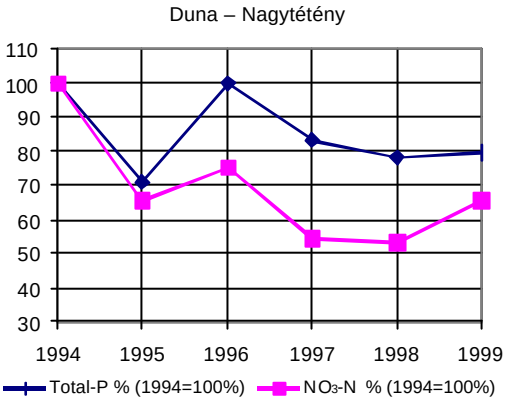
| Year | N fertilizer application kg N/ha[a)] | P fertilizer application kg P/ha[a)] |
|---|---|---|
| 1985 | 86 | 51 |
| 1990 | 55 | 20 |
| 1991 | 22 | 3 |
| 1992 | 24 | 4 |
| 1993 | 26 | 4 |
| 1994 | 36 | 5 |
| 1995 | 31 | 5 |
| 1996 | 33 | 6 |
| 1997 | 33 | 7 |
| 1998 | 40 | 6 |
| 1999 | 43 | 6 |

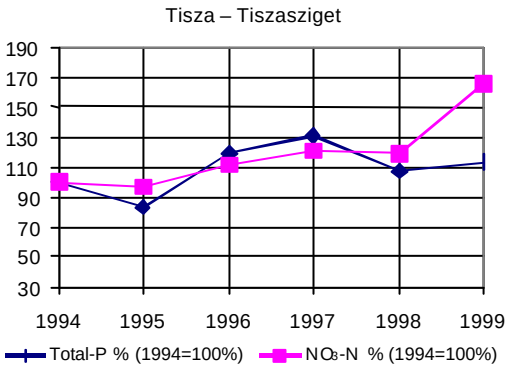
a) In kg of active ingredients.
Source: HCSO.




## E3a P and N in large rivers

| Year | Total-P µg/l | $NO_3$-N mg/l | Total-P% (1994=100%) | $NO_3$–N% (1994=100%) |
|---|---|---|---|---|
| **Duna** – Nagytétény | | | | |
| 1994 | 183 | 3,51 | 100 | 100 |
| 1995 | 130 | 2,29 | 71 | 65 |
| 1996 | 183 | 2,64 | 100 | 75 |
| 1997 | 152 | 1,90 | 83 | 54 |
| 1998 | 143 | 1,86 | 78 | 53 |
| 1999 | 145 | 2,30 | 79 | 66 |
| **Tisza** – Tiszasziget | | | | |
| 1994 | 183 | 1,27 | 100 | 100 |
| 1995 | 152 | 1,23 | 83 | 97 |
| 1996 | 219 | 1,42 | 120 | 112 |
| 1997 | 240 | 1,54 | 131 | 121 |
| 1998 | 198 | 1,52 | 108 | 120 |
| 1999 | 207 | 2,10 | 113 | 165 |




Source: Institute for Environmental Protection.

## E3b P in lakes

| Year | Total-P µg/l | Total-P % (1996=100%) |
|---|---|---|
| **Balaton** – Keszthelyi-öböl | | |
| 1996 | 20,5 | 100 |
| 1997 | 11,1 | 54 |
| 1998 | 11,1 | 54 |
| **Velencei-tó** – Fürdetõ-medencerész | | |
| 1996 | 16,2 | 100 |
| 1997 | 14,8 | 91 |
| 1998 | 14,8 | 91 |
| **Tisza-tó** – Tiszavalki-medence | | |
| 1996 | 145 | 100 |
| 1997 | 210 | 145 |
| 1998 | 210 | 145 |

Source: Institute for Environmental Protection.

## E4a Status of nitrate in groundwater

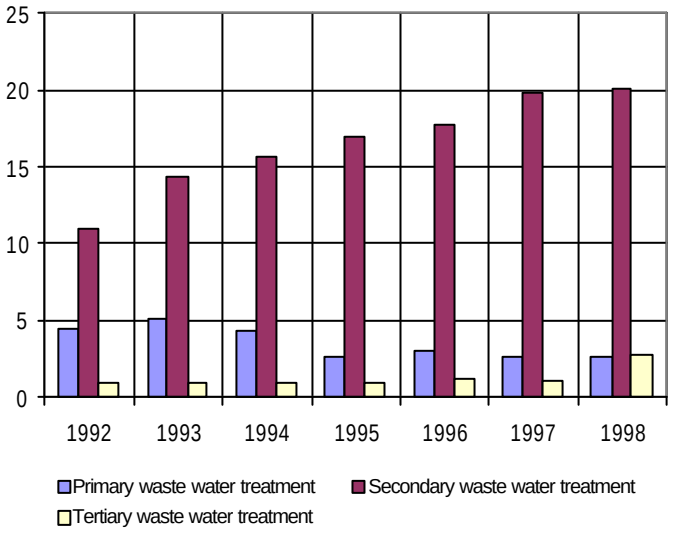
| Watertype [a] | Min. | Max. | Average |
|---|---|---|---|
| | $NO_3$ mg/l [b] | | |
| K (karstic) | 0,00 | 175,43 | 15,84 |
| B (bank filtered) | 0,00 | 163,00 | 18,00 |
| S1 (20–50m) | 0,00 | 70,00 | 4,63 |
| S2 (50–100m) | 0,00 | 26,00 | 1,56 |
| S3 (100–200m) | 0,00 | 60,00 | 0,83 |
| S4 (200–500m) | 0,00 | 1,00 | 0,17 |
| S5 (>500m) | 0,00 | 0,50 | 0,19 |
| G (ground water) | 0,00 | 98,80 | 15,35 |

a) S1, S2, S3, S4, S5: Stratum water with depths.
b) Data refer to 1997.

Source: Water Resources Research Center PLC
Hydrological Institute.

## E8 Urban waste water treatment

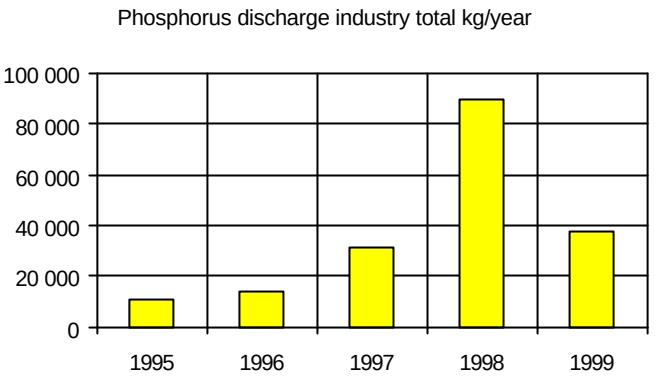
| Year | Percent of population which is connected to the [a] | | | |
|---|---|---|---|---|
| | primary | secondary | tertiary | total |
| | waste water treatment | | | |
| 1992 | 4,4 | 11,0 | 0,9 | 16,3 |
| 1993 | 5,1 | 14,3 | 0,9 | 20,3 |
| 1994 | 4,3 | 15,7 | 0,9 | 20,9 |
| 1995 | 2,7 | 16,9 | 0,9 | 20,5 |
| 1996 | 3,0 | 17,7 | 1,1 | 21,8 |
| 1997 | 2,7 | 19,8 | 1,0 | 23,5 |
| 1998 | 2,6 | 20,1 | 2,8 | 25,5 |

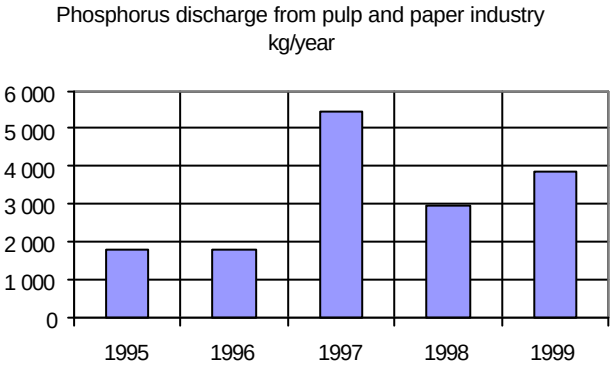


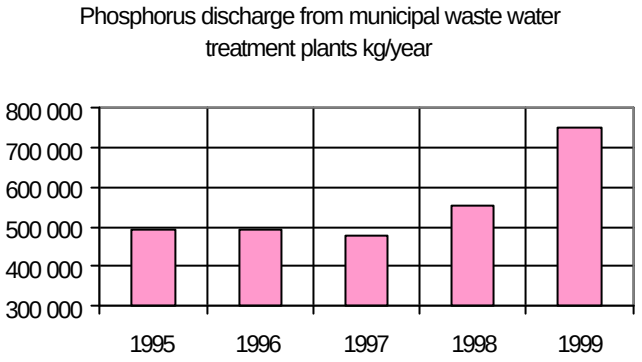

a) Estimated data.
Source: HCSO; Ministry for Environment.

## E9 Point source emissions of phosphorus

| Year | Phosphorus discharge | | |
|---|---|---|---|
| | industry total | from pulp and paper industry | from municipal waste water treatment plants |
| | kg/year | | |
| 1995 | 10 939,6 | 1 762,0 | 494 932,8 |
| 1996 | 14 384,0 | 1 775,0 | 489 567,0 |
| 1997 | 30 756,0 | 5 428,0 | 479 554,1 |
| 1998 | 89 551,0 | 2 963,0 | 552 946,0 |
| 1999 | 37 830,0 | 3 891,0 | 750 472,0 |



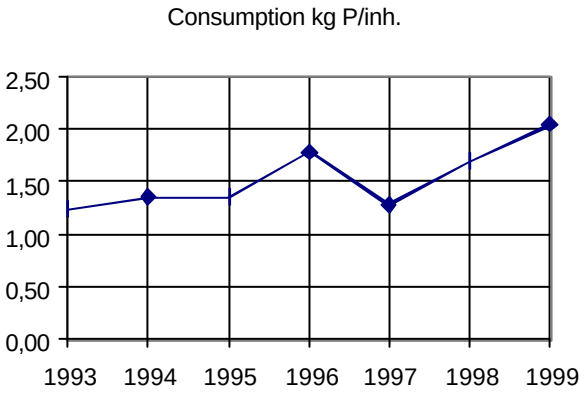




Source: Ministry for Environment.

## E10 Consumption of phosphorus in detergents per capita

| Year | Detergents (total sales), t | Population (at the end of the year), cap. | Consumption[a], kg P/inh. |
|---|---|---|---|
| 1993 | 63 660 | 10 276 968 | 1,24 |
| 1994 | 69 126 | 10 245 677 | 1,35 |
| 1995 | 69 302 | 10 212 300 | 1,36 |
| 1996 | 90 853 | 10 174 442 | 1,79 |
| 1997 | 64 916 | 10 135 358 | 1,28 |
| 1998 | 85 550 | 10 091 789 | 1,70 |
| 1999 | 102 401 | 10 043 224 | 2,04 |




a) Estimated data from total sales and 20% average content of phosphorus.
Source: HCSO.