Techneau,
November 2006

# TREND REPORT

*REPORT ON TRENDS IN EASTERN EUROPEAN COUNTRIES*
*Example of the Baltic states*

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**Title**
Techneau Report On Trends In Eastern European Countries (Example of the Baltic states)

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**Quality Assurance**
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**Deliverable number**
D 1.1.3

This report is **PU** = Public

# Executive Summary

**Introduction**
The report presents the study which aimed at the identification and analyses of the possible trends in drinking water supply sector in the Baltic states, a specific part of Eastern European countries, for the next 5-20 years.

**Importance**
Identification of the trends is important because it allows for development of adaptive strategies for the problems which might occur in the region in the future.

**Approach**
The data about socio-cultural, economical, political, technological, ecological, and demographical (SEPTED) aspects were obtained from response of two experts groups to questionnaire, interviews with scientists, public officers, water treatment plant staff and literature (scientific articles, newspapers, internet). The preliminary results were presented at the conference (RTP in Jurmala, Latvia) which was organized specifically for the Baltic region. For the conference experts from all Baltic states were invited.

**Result**
Most important trends identified in the study are the following: decrease of drinking water consumption, investments in water supply infrastructure, deterioration of water distribution networks, decrease of water pollution loads, changes of population density, remaining risk of pollution of individual wells and remaining public ownership of water utilities. Although there were some differences between Latvia, Estonia and Lithuania the results could be generalized to all Baltic states.

**More information**
Results are presented in D. 1.1.3.

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## TECHNEAU Knowledge Integrator (TKI) categorisation
***Categorisation of Knowledge Packages***

*Contains*: Trend analyses
*Constraints*: no

## TKI Categorisation

| Classification | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Supply Chain | | Process Chain | | Process Chain (cont'd) | | Water Quality | | Water Quantity (cont'd) | |
| | | | | | | | | | |
| **Source** | | **Raw water storage** | | **Sludge treatment** | | **Legislation/regulation** | | - Leakage | |
| - Catchment | X | - Supply reservoir | | - Settlement | | - Raw water (source) | | - Recycle | |
| - Groundwater | X | - Bankside storage | | - Thickening | | - Treated water | | | |
| - Surface water | X | **Pretreatment** | | - Dewatering | | **Chemical** | | | |
| - Spring water | X | - Screening | | - Disposal | | - Organic compounds | | | |
| - Storm water | X | - Microstraining | | **Chemical dosing** | | - Inorganic compounds | | | |
| - Brackish/seawater | | **Primary treatment** | | - pH adjustment | X | - Disinfection by-products | X | | |
| - Wastewater | | - Sedimentation | X | - Coagulant | X | - Corrosion | X | | |
| **Raw water storage** | | - Rapid filtration | X | - Polyelectrolyte | | - Scaling | | | |
| - Supply reservoir | | - Slow sand filtration | X | - Disinfectant | | - Chlorine decay | | | |
| - Bankside storage | | - Bank filtration | X | - Lead/plumbosolvency | | **Microbiological** | | | |
| **Water treatment** | | - Dune infiltration | X | **Control/instrumentation** | | - Viruses | X | **Consumers / Risk** | |
| - Pretreatment | X | **Secondary treatment** | | - Flow | X | - Parasites | X | | |
| - Primary treatment | X | - Coagulation/flocculation | X | - Pressure | | - Bacteria | X | **Trust** | |
| - Secondary treatment | X | - Sedimentation | X | - pH | X | - Fungi | X | - In water safety/quality | X |
| - Sludge treatment | X | - Filtration | X | - Chlorine | X | **Aesthetic** | | - In security of supply | |
| **Treated water storage** | | - Dissolved air flotation(DAF) | | - Dosing | | - Hardness / alkalinity | X | - In suppliers | |
| - Service reservoir | X | - Ion exchange | X | - Telemetry | | - pH | X | - In regulations and regulators | |
| **Distribution** | | - Membrane treatment | X | **Analysis** | | - Turbidity | X | **Willingness-to-pay/acceptance** | |
| - Pumps | X | - Adsorption | X | - Chemical | | - Colour | X | - For safety | X |
| - Supply pipe / main | X | - Disinfection | X | - Microbiological | | - Taste | X | - For improved taste/odour | |
| **Tap (Customer)** | | - Dechlorination | | - Physical | | - Odour | X | - For infrastructure | X |
| - Supply (service) pipe | X | **Treated water storage** | | | | | | - For security of supply | X |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| - Internal plumbing | X | - Service reservoir | | | | **Water Quantity** | | **Risk Communication** | |
| - Internal storage | X | **Distribution** | | | | | | - Communication strategies | |
| | | - Disinfection | X | | | **Source** | | - Potential pitfalls | |
| | | - Lead/plumbosolvency | X | | | - Source management | | - Proven techniques | |
| | | - Manganese control | X | | | - Alternative source(s) | | | |
| | | - Biofilm control | X | | | **Management** | | | |
| | | **Tap (Customer)** | | | | - Water balance | X | | |
| | | - Point-of-entry (POE) | X | | | - Demand/supply trend(s) | | | |
| | | - Point-of-use (POU) | X | | | - Demand reduction | | | |

## TKI Categorisation (continued)

| **Contains** | | **Constraints** | | **Meta data** | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Report | | Low cost | | *Author(s)* | | **T. Juhna, J. Sprogis, V. Kurpelis** | | | |
| Database | | Simple technology | | *Organisation(s)* | | **Riga Technical University** | | | |
| Spreadsheet | | No/low skill requirement | | *Contact name* | | **Talis Juhna** | | | |
| Model | | No/low energy requirement | | *Contact email* | | **talisj@bf.rtu.lv** | | | |
| Research | | No/low chemical requirement | | *Quality controller name* | | **Steffen Zuleeg** | | | |
| Literature review | X | No/low sludge production | | *Quality controller organisation* | | **EAWAG** | | | |
| Trend analysis | | Rural location | | Source | | | | | |
| Case study / demonstration | | Developing world location | | *Date prepared* | | **30.11.2006** | | | |
| Financial / organisational | | | | Date submitted (TKI) | | **01.12.2006.** | | | |
| Methodology | | | | Date revised (TKI) | | **31.01.2007** | | | |
| Legislation / regulation | | | | | | | | | |
| Benchmarking | | | | | | | | | |
| | | | | | | | | | |

# Contents

# 1 General Description

The Baltic states refer to Estonia, Latvia and Lithuania. Estonia, Latvia, and Lithuania were controlled by the Soviet Union during 1940-1941 and 1945-1991, and have been members of the European Union and the NATO alliance since 2004. Today the three countries are liberal democracies, parliamentary republics, and very quickly growing market economies.

It is often indicated that Latvia, Lithuania, and Estonia have little else in common than their geographic proximity, similar small size, and to lesser degree, a shared recent history. Estonia aspires in direction of their Finnic brethren and the Nordic countries, while Lithuania focuses on its connection to Poland and Central Europe, and Latvia concentrates on the transit between Russia and the Western countries. Some political scientists consider Lithuania as part of Central Europe, due to its historical focus on the European mainland.

In the Cold War context, the three Baltic States were considered a part of Eastern Europe, but culturally and historically, it is more appropriate to view Estonia and parts of Latvia as part of Northern Europe, Lithuania and parts of Latvia as part of Central Europe, where the historical impact of the Hanseatic League, the Polish-Lithuanian Commonwealth, the Russian Empire, and the German Empire have been of crucial importance. For Latvia and Estonia, historical connections to Denmark and Sweden have also been important.

The term "state" is used as a synonym of "sovereign country", which is distinct from non-sovereign states (the kind to be found in federations and confederations). Before the fall of the Soviet Union, the term "Baltic state" was used by some English speakers to hint that the three countries were under Soviet influence or occupation.

The Baltic states are the only three former Soviet Republics that are not affiliated in any way with the Common wealth of Independent States.

History of water supply in the Baltic states dates back to medieval times. Cultural and trade links between cities around the Baltic Sea allowed to keep high technological standards also in the Baltic states. For example, the first water pumping station in Riga, now the capital of Latvia, was built already in the seventeenth century. During industrial revolution the development continued in drinking water sector however environment problems were disregarded and many of the water sources were extensively polluted. Environmental issues have not received necessary attention also during Soviet time. Water sources were extensively exploited while the water supply services were of low quality. Significant changes both economically, politically and technologically were occurring in water supply sector after regain of independence in 1991.

Due to common recent history the situation in all Baltic states are similar. This also refers to water supply sector. The following trends were identified as the most important for water supply industry in Baltic states for the next 5-20 years.

*1. Decrease of drinking water consumption*
Due to decrease of the population number, increase of water price, implementation of water saving policies and recession of industry the water consumption has decreased more than twice. Now this tendency is slowing down.

*2. Investments in water supply infrastructure*
During the last decade environmental issues, including water sector, have received significant attention in political and public arena. As a result large financial resources (loans, donations) are invested in rehabilitation of old and construction of new infrastructure in the water sector.

*3. Deterioration of water quality in distribution networks*
The distribution network is outdated, although replacement of pipes is taking place, in the following years the problems with water quality in distribution networks will aggravate.

*4. Decrease of water pollution loads*
Due to recession of industrial activities and stricter environmental policies the pollution loads into environment are decreasing, this lowers risk of pollution of centralized water supplies.

*5. Remaining risk of pollution of individual wells*
Although environmental situation is improving, still due to lack of water quality control the individual wells remain threat for human health.

*6. Changes of population density*
New villages are established at the outskirts of large cities and along the sea line. As in most cases these villages are willing to use centralized water supply, the expansions of distribution networks is expected.

*7. Water supplies remain public owned utilities*
Water sector consists of many small water works and treatment plants. This is causing problems because administrative costs are high, qualified staff is lacking and costs for providing trained operators are too high and water quality control is difficult. However water suppliers remain reluctant towards privatization or merging into larger enterprises.

# 2 Summary of the questionnaire

SEPTED analyses were carried out for all Baltic states, while the questionnaires were produced for Estonia and Latvia. For Latvia the data were largely obtained from interviews with experts and surveys, because data in literature were largely missing. In case of Estonia there were more data available on internet.

Water consumption is decreasing in all countries. There are differences in water use among countries. In Estonia large amount of water is used for energy production (from shale-oil) while in Latvia major water use is for domestic consumption. In Lithuania energy production industry (nuclear station) is the main water consumer.

Privatization is not likely to occur in near future. Estonia is more prone to privatization than Latvia and Lithuania. Water sector consists of many small water works and treatment plants. This is causing problems because

- administrative costs are high;
- qualified staff is lacking and costs for providing trained operators are too high
- water quality control is difficult (individual wells have highest water quality noncompliance rate)
- the cost of providing operator training is a serious challenge

However, there is not any measure taken for merging of waterworks into larger enterprises.

Energy issue is back on agenda. The Baltic states are planning to build a new nuclear station to be more economically independent from external sources (e.g. gas, oil) and provide sufficient energy in the future. Water sectors consume only a small amount of total energy needed for the countries.

Large investments are implemented in water sectors, this tendency will continue for at least the next 10 years. Intermediaries from government and private sectors are playing a significant role in the decision making process also for investments in drinking water infrastructure. Application of new technologies (e.g. membrane technologies) is not widespread in the countries.

Environment situation has improved; however, locally there are groundwater pollution problems. Due to lack of protection, the private wells are especially affected. People are becoming more aware of environmental problems including drinking water issues. However information about influence of emerging pollutants on drinking water are missing. Drinking of tap water is not commonly practiced, while consumption of bottled water is increasing.

Groundwater is a major raw water source. Iron is the most important problem in groundwater. High level of fluoride is a problem in some parts of Estonia and Lithuania.

Climate change has been studied in Estonia, while data for Latvia are missing. Several scientific reports showed that climate changes are affecting water resources (sea level is changing), however it will not have a significant effect on drinking water production in terms of quantity. Risk of floods and droughts is increasing.

# 3 Top seven trends

## 3.1 Decrease of water consumption

### *3.1.1 Introduction*

During the period of Baltic states within Soviet Union (1945-1991) the price of water was determined according to flat tariff rates. At the time, the price for water was low compared to relative water prices today and therefore water consumption was high. There were also many industrial enterprises with high water demand. Water consumption was in a range of 250-400 l/d.capita. After collapse of the Soviet Union, due to installation of water meters, decreasing population and recession of industry, the drinking water consumption has dropped below 120 l/d.capita.

In SEPTED dimensions this trend can be regarded as Social and Economical.

### *3.1.2 Definitions*

The decrease of water consumption over the period of the last 10 years is shown by the example of Riga (Figure 1)

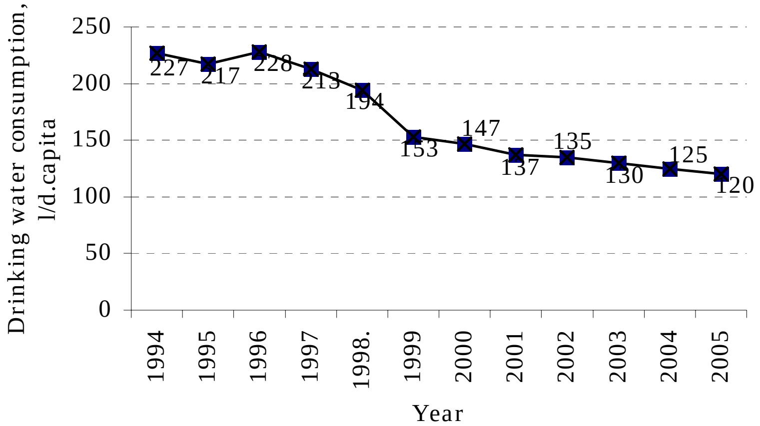



*Figure 1. Water consumption changes in Riga, Latvia (with courtesy of Riga Water)*

*Trend:* Water consumption is decreasing.
*Counter-trend:* Water consumption will increase or remains the same.

### *3.1.3 Driving Forces*

*Trend:* The installation of water meters is continuing. The water leakage detection and the control of distribution networks are receiving more attention. Water saving devices and water recycling in industry may become more widely used because the prices for drinking water supply and waste water discharge are continuing to increase.

*Counter-trend:* Boosting of industry in the country may create need for more water. Improved economical situation may encourage people to use more water.

### 3.1.4 General Implications

No significant general implications.

### 3.1.5 Implications for the water industry

The following implications for the water industry were observed.

*Additional financial restraints for water supply companies*
Due to water consumption decrease the revenue of water supply companies is going down. This creates financial restrain for operation and maintenance, and for development.

*Deterioration of water quality in distribution networks*
Water distribution networks were designed for larger flows. The decrease of water consumption has decreased water flow velocities and increased water retention time in the pipes. This in turn deteriorates water quality in the distribution networks.

*Closure of water intakes*
Decrease of water amount required for the population has created a need to close down some of the drinking water intakes and quality monitoring laboratories. This results in social problems.

*Increased problems of water metering*
Infrastructure inside houses is not designed for installation of water meters. The water meters are installed improperly and often function under the nominal flow. This increases inaccuracy of measurements.

### 3.1.6 Adaptive Strategies

According the TECHNEAU project description (see Annex 1 to the TECHNEAU project) the adapted strategies will be developed in WP 1.2 during the period 12-18 month. Adapted strategies will be reported in deliverable D 1 2.1 on month 18. RTU is not participating in this WP.

However, suggested strategy for the moment would be to improve assets management within the companies.

### 3.1.7 *Conclusion*

The analyses of trends and counter-trend showed that decrease or stabilization of water consumption is more likely than increase of water consumption. It is because even if industries will start to develop in the countries most likely they will implement water recycling technologies due to relatively high prices for drinking water supply and waste water discharge. It is likely that people will use more water in the future; however this increase will be compensated by the application of more water saving devices (this potential is not being exploited yet).

## 3.2 Investments in water supply infrastructure

### 3.2.1 *Introduction*

The water supply infrastructure after 1991 was outdated and not able to provide high level quality and security. In the pre-accession period to the EU all Baltic states have started to receive loans and donations from the European Council and other sources for the improvement of drinking water and wastewater infrastructure.  This trend most likely will continue for next 10 years.

In SEPTED dimensions this trend can be regarded as Political.

### 3.2.2 *Definitions*

Example of investment in drinking water sector in Estonia is presented in Figure 2.

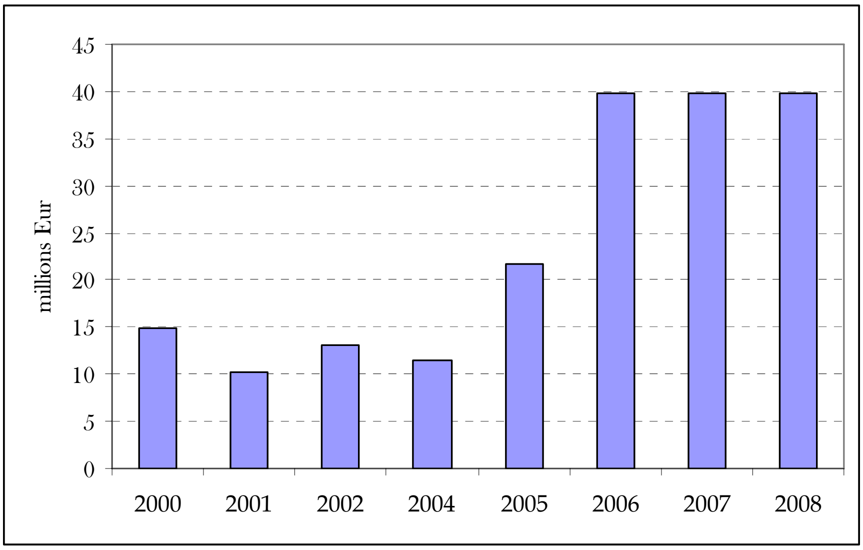



*Figure 2. Past and future investments in water sector in Estonia (source: Leena Albreht from Health Protection Inspectorate of Estonia)*

*Trend:* Investment in drinking water infrastructure will continue.
*Counter-trend:* There will be no further investments in drinking water sector.

### *3.2.3 Driving Forces*

*Trend:* EU policy considers providing support for new EU member states for several years. The public requires higher standards of services from drinking water supplies.

*Counter-trend:* The Baltic countries decide to withdraw from EU.

### *3.2.4 General Implications*

The life quality is increasing, because they have access to safer water and to more advanced, less labor-intensive technologies.

### *3.2.5 Implications for the water industry*

The following implications for the water industry were observed.

*Increase of water quality and safety*
Because, the modern materials and technologies are used in construction of water supply systems water quality and safety is increasing, and often are higher than in other European countries.

*Increase of price for water*
The negative side of this trend is that water utilities will have to increase the price for water to pay back the loans.

*Increase of percentage of unpaid water*
Higher prices may even increase the percentage of unpaid water. This will create additional financial restraints for water supply companies. Especially this will be a problem for small water supplies and decentralized systems.

### *3.2.6 Adaptive Strategies*

According the TECHNEAU project description (see Annex 1 to the project) the adapted strategies will be developed in WP 1.2 during the period 12-18 month. Adapted strategies will be reported in deliverable D 1 2.1 on month 18. RTU is not participating in this WP.

However, suggested adaptive strategy for the moment would be to make a better balance between short- and long-term investments. For example, currently installed technologies in Latvia are only addressing the problem with iron, whereas issues of chemical stability, biological stability and additional safety barriers against chemical and bacteriological pollution are not being addressed.

### 3.2.7 *Conclusion*

Counter-trend is not likely to occur therefore it is highly possible that investments in water supply infrastructure will continue.

## 3.3 Deterioration of water in distribution networks

### 3.3.1 *Introduction*

Most of the pipes of water distribution networks are more than 60 years old and made of cast iron. Due to corrosion and long residence (see trend in section 3.1) water quality is deteriorating.

In SEPTED dimensions this trend can be regarded as Technological.

### 3.3.2 *Definitions*

In 2005 more than 50% of drinking water samples from the network in Latvia did not meet quality standards in respect of iron and turbidity. The major reason for noncompliance is water quality deterioration in the networks.

*Trend:* Rate of pipe breakage is high. Water quality deteriorates in the networks.
*Counter-trend:* Deterioration of water quality in distribution networks is not occurring.

### 3.3.3 *Driving Forces*

*Trend:* Aging of pipes. Water quality is not chemically or biologically stabilized before distribution.

*Counter-trend:* Water enterprises will do research how to decrease deterioration of water quality in distribution networks. Companies will replace pipes or use in-line methods to rehabilitate pipes.

### 3.3.4 *General Implications*

No significant general implications.

### 3.3.5 *Implications for the water industry*

*Leakage in the networks*
Due to corrosion (brakes occur almost every day) there are water leakages from the networks. Although there is no accurate estimate for actual water losses in distribution networks, the leakage might contribute to 20% of unbilled water.

*Complaints about water quality from costumers*
Costumers and industry are complaining about occasionally high turbidity of drinking water.

### 3.3.6 *Adaptive Strategies*

According the TECHNEAU project description (see Annex 1 to the project) the adapted strategies will be developed in WP 1.2 during the period 12-18 month. Adapted strategies will be reported in deliverable D 1 2.1 on month 18. RTU is not participating in this WP.

However suggested adapted strategy for the moment is to introduce chemical and bacterial stabilization steps at the treatment plants.

### 3.3.7 *Conclusion*

Water quality deterioration problems at the tap are observed in water supply systems with iron removal plants. Hence, the source of the pollution, most likely, is the corrosion of the iron pipes in the networks. Due to the financial situation and other factors there will be no investment in research which would allow to mitigate problems in the networks. So most likely water quality deterioration in the network will continue.

## 3.4 Decrease of water pollution loads

### 3.4.1 *Introduction*

From Soviet Union the Baltic states inherited huge environmental problems. After 1991, due to closing of industrial waste discharges and implementation of environmental protection policies pollution loads into environment have been decreased.

In SEPTED dimensions this trend can be regarded as Environmental.

### 3.4.2 *Definitions*

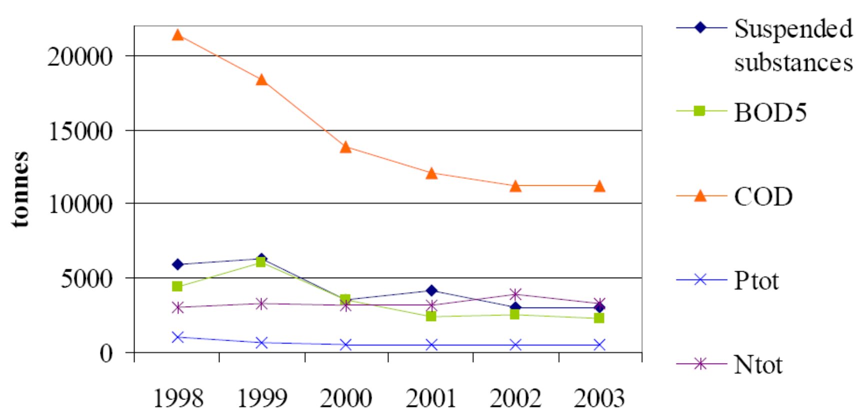



*Figure 3. Pollutant load of waste water in Latvia from 1998-2003*

*Trend:* Organic (as COD), phosphorus and nitrogen loads from waste water are decreasing (Figure 3).

*Counter-trend:* The decrease of pollution loads is not significant.

### *3.4.3 Driving Forces*

*Trend:* Many new wastewater treatment plants are constructed. Most of the industries (pulp production) are closed down.

*Counter-trend:* Waste water treatment plants are not operating at optimal regime, thus pollution load decrease is not significant. The monitoring of waste water discharge is formal, thus actual situation is not as good as it is presented in official publications. The industry will develop further, thus causing new and increasing burdens to environment.

### *3.4.4 General Implications*

*Trend:* Environmental situation and public health is improving.

### *3.4.5 Implications for the water industry*

*Increased safety of water supply*
Decrease of pollution loads improves raw water sources quality. This decreases the risk of drinking water pollution.

*Higher cost for wastewater disposal*
The companies have to pay more for wastewater discharge. So far private companies did not pay much for waste water discharging into environment. Now with strengthening of environmental policies, they have to construct new waste water treatment plants or to introduce water recycling technologies.

*Balance between environmental protection and economical development*
Often there is a negative attitude in society towards establishing of new industry, because it may create risk of environmental pollution. This may slow down economical development.

### *3.4.6 Adaptive Strategies*

According the TECHNEAU project description (see Annex 1 to the project) the adapted strategies will be developed in WP 1.2 during the period 12-18 month. Adapted strategies will be reported in deliverable D 1 2.1 on month 18. RTU is not participating in this WP.

### 3.4.7 *Conclusion*

Establishing of new environment-polluting industries is not likely. The environmental protection control will be strengthened. Therefore, it is more likely that loads into environment will continue to decrease.

## 3.5 Remaining risk of pollution of individual wells

### 3.5.1 *Introduction*

Small drinking water suppliers have neither the laboratories nor the means to perform monitoring on individual wells. Thus, there is a high risk of pollution of private wells with sewerage from latrines and agricultural activities.

In SEPTED dimensions this trend can be regarded as Environmental.

### 3.5.2 *Definitions*

*Trend:* In Lithuania 30% of private wells exceed nitrate and 50% microbial standards. In Latvia between 2001 and 2003 outbreaks of Shigellosis and Rotaviral enteritis (between 5 and 140 cases) are caused by private wells. In Estonia (e.g. Tartu) 87% of curbed wells are bacteriologically contaminated, 63% contain nitrate above the permissible level.

*Counter-trend:* Pollution of private wells is not an issue.

### 3.5.3 *Driving Forces*

*Trend:* Insufficient control over local sewerage disposal.
*Counter-trend:* More and more households will install small size waste water treatment units.

### 3.5.4 *General Implications*

Public health is compromised.

### 3.5.5 *Implications for the water industry*

Increasing number of water borne outbreaks, thus the monitoring will be improved and considerably more small waste water treatment units will be required and installed.

### 3.5.6 *Adaptive Strategies*

According the TECHNEAU project description (see Annex 1 to the project) the adapted strategies will be developed in WP 1.2 during the period 12-18 month. Adapted strategies will be reported in deliverable D 1 2.1 on month 18. RTU is not participating in this WP.

However, suggested adaptive strategy for the moment is to improve monitoring of private wells.

### 3.5.7 *Conclusion*

Although households are installing waste water treatment units, the rate of this development is too low to decrease pollution of individual wells in near future. Thus, risk of pollution of individual wells will remain a problem.

## 3.6 Changes of population density

### 3.6.1 *Introduction*

In the last decade the settlement structure of the Baltic states was characterized by a trend: the population of rural municipalities located in the vicinity of larger cities increased, while that of peripheral areas and small towns shrunk.
Due to economical development more settlement is being established along the Baltic Sea shore line.

In SEPTED dimensions this trend can be regarded as Demographical.

### 3.6.2 *Definitions*

*Trend:* Establishment of settlements around the large cities.
*Counter-trend:* Movement of people away from the towns to county sides.

### 3.6.3 *Driving Forces*

*Trend:* The cities attract more labor, while the living standards are increasing and people prefer to live rather in private houses close to the cities than in apartment buildings inside the cities. The current situation is largely the result of the restructuring of the agricultural sector and the fact that towns have been more successful than rural areas in adapting to the changed economic environment. Rich people tend to build their houses outside the cities, preferably close to the sea.

*Counter-trend:* Ruralization is not likely in the countries.

### 3.6.4 *General Implications*

Changes of population density affect almost every economical sector.

### 3.6.5 *Implications for the water industry*

*Restructure of water supply networks*
As the number of settlements on the outskirts of the cities is increasing the distribution networks are expanding outwards. Water supplies have to adjust operation of the plants and networks to these changes. The expansion of networks along the sea line is particularly challenging.

*Increase of water consumption*
In contrast to overall tendency the water consumption in some villages is increasing, because they are populated with rich and middle class individuals, which are using water extensively (e.g. watering of gardens).

### 3.6.6 *Adaptive Strategies*

According the TECHNEAU project description (see Annex 1 to the project) the adapted strategies will be developed in WP 1.2 during the period 12-18 month. Adapted strategies will be reported in deliverable D 1 2.1 on month 18. RTU is not participating in this WP.

### 3.6.7 *Conclusion*

Changes of population density are likely to continue; however this tendency has reached its culmination, so in the future this trend will not be pronounced.

## 3.7 Water supplies remain public owned utilities

### 3.7.1 *Introduction*

In the early 1990s the water sector was state owned but the ownership was transferred to municipal enterprises after a decision to privatize state owned enterprises. Now the municipal enterprises are public limited companies and will remain so.

In SEPTED dimensions this trend can be regarded as Political.

### 3.7.2 *Definitions*

*Trend:* No water supply enterprises have been privatized in Latvia and Lithuania.
*Counter-trend:* Privatization of Tallin Water is the first example which will be followed by others.

### 3.7.3 *Driving Forces*

*Trend:* There are old traditions of state and municipally owned water enterprises which provide relatively good service and moderate water prices. *Counter-trend:* Liberal policy in the countries may force the privatization also in the water sector.

### 3.7.4 *General Implications*

No.

### 3.7.5 *Implications for the water industry*

Asset management within the enterprises will not be very effective.
Merging of small enterprises is not likely.
Water prices will increase but slowly.

### 3.7.6 *Adaptive Strategies*

According the TECHNEAU project description (see Annex 1 to the project) the adapted strategies will be developed in WP 1.2 during the period 12-18 month. Adapted strategies will be reported in deliverable D 1 2.1 on month 18. RTU is not participating in this WP.

### 3.7.7 *Conclusion*

There is one case of delegating ownership from the municipality to a private company in the capital of Estonia, Tallin. This case is not considered particularly successful, because the price for water increased. Long traditions of water suppliers to be state owned and municipal enterprises are difficult to change. Thus, most likely water supply enterprises will remain public owned in Latvia and Lithuania, while this is not so clear in case of Estonia.

# 4 Conclusions

Seven trends for the water sector were identified based on SEPTED analyses. They were weighted against counter-trends. The trends are listed in order of likeliness of their occurring:

- *Investments in water supply infrastructure*
- *Decrease of drinking water consumption*
- *Remaining risk of pollution of individual wells*
- *Deterioration of water in distribution networks*
- *Decrease of water pollution loads*
- *Water supplies remain public owned utilities*
- *Changes of population density*

# 5 Appendix : Questionnaire 1

## 5.1 Matrix of Factors

### 5.1.1 General information

| | |
|---|---|
| **Region** | **Baltic states** |
| **Covering countries** | **Estonia** |
| **Population** | **1.35 million** |

### 5.1.2 Socio-cultural factors

| **Willingness to pay for drinking water** | Source |
|---|---|
| Is drinking water an important part of the budget in general? How will this change and will this be accepted? | |
| Costs for water and wastewater are 0.42 and 0.56 Euro, respectively. Cost of water and sewerage contributes about 0.9% of average wage. The fact that people are saving water (water consumption of drinking water is as low a 98 l/d.capita) may indicate that water costs are a significant part of the family budget. Price for water differs among different municipalities. The highest costs (about twice more) are in Tallinn which is the only private (International Water: a USA-Italian owned and British-run company) water supply enterprise in the Baltic states. | [7] |

| **Level of information of the consumer with regard to drinking water** | |
|---|---|
| Are people getting more educated or do they lose interest? This aspect is partially coupled with the demographic aspect of level of education | |
| Wide information about environmental situation including drinking water is available in internet (about 50% of population has access to internet). There are organized training courses and seminars for drinking water producers and waste water treatment plant operators. Information is disseminated and shared at domestic and international level (including government publications, forums, etc.) via proceedings, CD-ROMs and the Web site of the Statistical Office of Estonia as well as via other sources (projects reports, proceedings of the Ministry of Environment and Ministry of Economic Affairs, etc.). The involvement of minorities (Russian speaking population) in public discussion on drinking water issues is not always sufficient. There is a problem of disseminating water monitoring information to people, for whom it is not from daily interest but would probably benefit from this information as well. Estonian legal | [20]<br>[22] |

| | |
|---|---|
| regulation and practice enables effective public participation only in the final stage of the decision-making process. | |

| **The appreciation of drinking water** | |
|---|---|
| For example, water can be a life style product; especially this seems to be the case for bottled water. | |
| Bottled water consumption is increasing in Estonia. No more detailed data is available. | [9] |

| **Ecological Awareness** | |
|---|---|
| Also awareness regarding emerging pollutants. Are trends visible? | |
| This information was requested from Hedy Klasen at the Water Department, Ministry of the Environment (Estonia). As there were no responses, the data is missing. | |

| **Other Socio-Cultural Aspects** | |
|---|---|
| Not in particular. | |

## 5.1.3 Economical factors

| **Financing models** | Source |
|---|---|
| Privately owned, fully state-owned and different participation models exist. What trends can be observed? | |
| There are 31 public water supply companies belonging to the Association of Water Works providing water services to more than 30 bigger settlements. The first privatized and only one (to my knowledge) water supply enterprise was Tallinn Water where a controlling share was sold in December 2000. After the privatization the enterprise has received critics at international level for inducing a financial pressure on water consumer by seeking for unreasonable profit. This created critical attitude towards privatization. However need for investments and better management is driving force for partnership with private companies. Thus, privatization is still an option (legally it is possible), however other models are possible: connecting small water companies and delegating management to large companies. | [14]<br>[11]<br>[15] |

| **Maintenance / renovation of infrastructure** | |
|---|---|
| E.g. it is claimed sometimes that the renovation of e.g. distribution systems will require huge capital in the future | |
| Several towns have become severely indebted (in mid-1995 they developed their infrastructure and therefore they took up heavy loans from abroad) and have problems to afford further renovation and maintenance. | [15] |

| **Energy costs and energy consumption** | |
|---|---|
| Which trends in energy prices are expected and how will this affect the drinking water situation? | |

| | |
|---|---|
| Energy consumption in water sector is relatively low (<10%) compared to other economic sectors, however it may affect it indirectly due to increase of financial pressure on consumers from other more energy consuming sectors. Estonian rivers are relatively waterless and with low tilting which makes energy potential moderate. However, Estonia is rich in fossil (oil shale, peat) fuels and wood. Thus, 90% of Estonian energy is produced by combustion of fossil fuel. Currently used oil shale based electricity production is the source of relatively cheap electricity, which, from the point of view of health and environment, gives the biggest share of hazardous waste, acid sediments, water pollution and extraction and $CO_2$ emissions. In light of International agreements (Estonia signed the Kyoto Protocol to the United Nations Framework Convention on Climate Change on 3 December 1998, the Protocol was ratified by the Estonian Parliament on 3 September 2002) and the fact that energy consumption is constantly increasing by 200-400 GWh a year (5892 GWh in 2004), there will be need for alternative energy sources. Deployment of renewable energy sources, especially biomass and wind, will play an increasing role at mitigating the impact of the energy sector on environment in Estonia. By 2010 the share of renewable electricity is planned to reach the level of at least 5.1% of the gross consumption. Currently a project about a jointly (Latvia, Estonia, Lithuania and perhaps Poland) building nuclear power station in Lithuania is under discussion which may change the situation significantly. | [18]<br>[2]<br>[17] |

| **The role of decentralized systems** | |
|---|---|
| How will this affect the costs distribution? | |
| There are 1377 water companies in Estonia. Today the water sector consists of many small water works and treatment plants. This is causing problems because<br>- administrative costs are high;<br>- qualified staff is lacking and costs for providing trained operators are too high<br>- water quality control is difficult (individual wells have highest water quality noncompliance rate)<br>In general, many water supply companies are too small to be able to cope with the maintenance and development of the water supply systems. There is a need for small companies to merge or to facilitate the cooperation in management practices. | [15]<br>[21]<br>[22] |

| **Other Economical Aspects** | |
|---|---|
| Not in particular. | |

## 5.1.4. Political factors

| **Decision making process for innovations / investments** | Source |
|---|---|
| Are trends visible in this process? | |
| As major investments/loans in water sector are related to Estonia accession to EU, the government plays major role in decision making. Local governments have also the right to issue regulations and other legal rules that have the power within the borders of their county. Most common of these are specific regulations to regulate the water and wastewater services, waste collection services and procedures to determine the water supplying and wastewater collection service providers. Water related legislation covers about 20 legal acts and regulations that are directly regulating the water protection and use. | [14] |

| **The role of NGO's and lobby organizations** | |
|---|---|
| In Eastern European countries intermediaries are playing a significant role in decision making process. This could also be a case for Estonia, but more research is needed to identify the particular intermediaries. | [15] |

| **Administrative procedures** | |
|---|---|
| e.g. approvement of new technologies for application in drinking water | |
| Product quality and reliability, warranty conditions, availability of after-sales service, lowest possible costs outlay in achieving the required standards, previous experiences with suppliers and good references are determining factors when making purchasing choices. Additionally, preferential credit or financing schemes from the supplier significantly increases the chances of product sale. As a rule, new technologies cannot fulfill all of these requirements. | [24] |

| **The role of political parties** | |
|---|---|
| E.g. the Greens. These situations can change quickly, but are also more general trends visible? | |
| No data available. | |

| **Changes in water quality standards** | |
|---|---|
| E.g. bathing water standards are prepared in different countries, which will affect the resource water quality. Also effluent quality standards are changing (?) for industry as well as community. | |
| Regulations (e.g. "polluter pays principle") have a significant impact on water quality and quality. Over last ten years amount of water consumption and pollution load has decreased as the output of expenses and efficient taxing system. | |

| **Other Political Aspects** | |
|---|---|
| Not in particular. | |

## 5.1.5 Technical factors

| Which breakthrough technologies are expected to be introduced in to practice in the time frame of 10-20 years? | Source |
|---|---|
| | |
| Iron and fluorine are considered as major contaminants causing water quality problems in Estonia. However, it also observed that groundwater contains a high level of humic substances, boron and barium. New technologies for handling this pollution shall be introduced in the future.<br>Groundwater in Estonia is usually aggressive to water distribution pipes (causes corrosion). This has been largely neglected. Because network deterioration becomes a problem most likely water stabilization technologies (to decrease deterioration of water quality in the network) shall be introduced.<br>Demand is expected to grow for instrumentation/process control/software and for the construction of supply networks. | [16] |

| **Which technologies are emerging?** | |
|---|---|
| Some relations with ecological factors may exist - water quality deterioration and emerging pollutants | |
| Research about different technologies using advanced oxidation and catalytical processes is carried out in Estonia. Some of the methods (oxidation of iron-humic complexes with ozone) may be introduced in the future in Estonia. Some technologies have already been successfully tested in Estonia e.g. AQUASTEL (for disinfection), GDT (for degasification). | [16] |

| **Point of use systems** | |
|---|---|
| Current expansion of point-of-use systems (?), trends in their efficiency, quality and control | |
| No statistical data available. However, point-of use systems would be useful for individual suppliers where high percentage of compliance was observed in Estonia. | |

| **Water recycling systems** | |
|---|---|
| Most of extracted water in Estonia is used for cooling in the energy sector. The recycling of this and other industrial waters should be increased in future. | |

| **Water saving technologies** | |
|---|---|
| E.g. rainwater harvesting | |
| Water resources in Estonia are sufficient, whereas the consumption for domestic need is low (due to introduction of water saving policies in the 90ties), so wide application of water saving technologies is not likely. | |

| **Other Technological Aspects** | |
|---|---|

| | |
|---|---|
| New technologies sometimes are difficult to install in systems constructed in Soviet Union period (e.g. water meters), which results in their malfunction. | |

## 5.1.6 Ecological factors

| **Emerging pollutants**<br>Governmental monitoring already exists? | Source |
|---|---|
| Past pollution sites cause drinking water resources (surface as well as underground) to be contaminated locally with petroleum products. Drinking water sources can also be contaminated by nitrogen compounds that result from past overuse of fertilizers that are slowly released from soils. There are no data concerning the content of agricultural pesticides in water, but there are likely to be consequences from their overuse during the Soviet period.<br>The activities of the food industry or pulp and paper industry have decreased considerably. However, in recent years some of this industries have restarted their activities, often without new environmental investments. For example, drainage water pumped out of oil-shale mines and pits, which contains sulphates, nitrates and suspended solids, is discharged directly into water bodies. | [19]<br>[25] |

| **Accumulation of pollutants in the environment** | |
|---|---|
| Estonia has local water quality problems due to past pollution (particularly caused by Soviet Army), intensive land use or natural peculiarities. The human impact on groundwater resources has resulted in increased concentration of nitrates in uppermost aquifers. The natural $NO_3$ concentration in Estonian groundwater should be mostly less than 1 mg/l, but about a half of Estonian territory has a $NO_3$ concentration in the uppermost aquifer of at least 10–30 mg/l. The most affected is the S–O aquifer, but also Quaternary and Devonian groundwater in South Estonia has high $NO_3$ concentrations. In addition, the groundwater quality is threatened by pesticides use, past pollution, deterioration of sewerage etc. In the North-East of Estonia (the area of oil-shale mines) $SO_4$ contamination is a serious problem. Due to the excavation works the water table is lowered and oxidation of pyrite causes the increase of $SO_4$ concentration in ground water up to 500 mg/l (naturally 20 mg/l) | [3] |

| **The effect of more stringent thresholds and pollution control** | |
|---|---|
| Decrease of pollution load in the beginning of 1990s is caused by decrease of industrial production. Production of pulp, superphosphate, nitrogen fertilizers etc. was stopped. Production of food industry decreased. Many industries have been restored in later years, but stoppages still occur.<br>Further decrease of pollution has been achieved with implementation and/or renovation of treatment plants. Essential role has been played by intentions of companies to reduce pollution charge by reducing the amount of water as well as implementation of cleaner technology. | |

| | |
|---|---|
| Nitrogen removal at wastewater treatment is expensive and still not widespread. New treatment plants are designed with the removal of nitrogen.<br>One of the biggest rare metal and rare earth metal producers in Europe - Silmet - used a lot of nitrogen in its technical processes. There were no direct outlets but a considerable amount of nitrogen leaked from the waste storage. For example, the nitrogen load of the plant calculated indirectly was in 1995 equal to the load of Tallinn. In the last years some changes were made to improve the technology. Instead of ammonium bicarbonate sodium carbonate is used. The amount of the used reagent decreased. Since 1998 the amount of nitrogen leaked from waste deposit was added to the total sum of nitrogen load from Estonia. There was no increase of nitrogen because added amount was compensated with better removal of nitrogen in other places around the state. | |

| **General quality / composition changes in water resources, e.g. due to climate changes** | |
|---|---|
| Groundwater is naturally buffered (high carbonate levels) with a relatively high level of iron. At some locations fluorine concentration is high.<br>Estonia has acceded to the UN Framework Convention on Climate Change, country ratified the convention in 1994. Estonia is located in the humid zone where precipitation usually exceeds evaporation. However, due to very high variability of precipitation drought periods as well as excessive wet periods occur. Water resources are sensitive to climate changes and studies on this topic are of great importance. Possible climate warming can cause significant changes in the hydrological regime and water resources. A lot of studies have been carried out on this subject. | |

| **Region-specific contaminants?** | |
|---|---|
| E.g. Arsenic, Cadmium, Radioactive elements | |
| Health hazards may also be caused by boron (reproductive disorders), barium (cardiovascular diseases), nickel (allergy) and carcinogenic by-products of chlorination (chloroform, bromoform, MX compounds, etc). However, the existent data are insufficient for the evaluation of these risks.<br>The radiation background in some areas of Estonia is already higher than natural. The higher level of radioactivity is explained by the processing of slightly radioactive oil shale. | [10] |

| **Influence of water framework directive** | |
|---|---|
| For complying with the Water Framework Directive Estonia will be divided into 6 basin areas (water management areas) and 8 sub-areas. The 6 basin areas are chosen because they are of an optimum size. Having in mind the size of Estonia, it is possible to distinguish these 6 areas based on water bodies and water management problems. They are related to coastal sea and it is better to handle coastal sea | |

| | |
|---|---|
| and river water protection problems together. The six area borders fit quite well in economical and geographical borders, in the 6 areas there are administrative regional centers and in these regional centers multifunctional environmental institutions are located. County Councils under the Ministry of Environment will be the competent authorities to administrate. | |

| **Other Ecological Aspects** | |
|---|---|
| No specific. | |

**Subfactor: Resources**

| **Trends in resource water** | Source |
|---|---|
| Due to Political factors | |
| E.g. NL: less groundwater use due to regulation on wetlands | |
| No data. | |
| Due to other factors | |
| E.g. climate change, river restoration projects | |
| No data. | |

| **How does Agricultural use of water influence resources?** | |
|---|---|
| E.g. overexploitation of resources or expansion of bio-technologies? | |
| Agriculture uses less than 5% of water withdrawal, which is not significant to affect drinking water resources. | |

| **Industry in general: increase / decrease** | |
|---|---|
| E.g. heavy industry moving out of W-Europe | |
| Decrease significantly after 1991. | |

| **Wastewater treatment in general: influence on surface water quality** | |
|---|---|
| | |
| Due to investment in waste water treatment the water quality has improved. | |

## 5.1.7 Demographical factors

| Distribution of population (Rural areas / cities) | Source |
|---|---|
| Trends in rural-urban migration of population: rich people are moving out of the cities, young people - in? | |
| In the last decade the settlement structure of Estonia was characterised by a distinct well-developed trend: the population of rural municipalities located in the vicinity of larger cities increased, while that of peripheral areas and small towns shrunk. Estonia has got good historical prerequisites for achieving a balanced settlement system. In the era of Soviet planned economy, the previously relatively strong and homogeneous settlement network was weakened by aimed monofunctionality, which has had unpleasant consequences after the restitution of independence. This, combined with the extremely rapid development of Tallinn, the capital, under the conditions of liberal market economy of the 1990ies has led to the formation of a settlement model centered on the region of the capital. | [26] |

| Absolute growth of population | |
|---|---|
| Population of the country will continue to decrease (see Fig. 1 in Additional Report). | [2] |

| Age distribution / life expectancy | |
|---|---|
| E.g. older persons are more sensitive to water contaminants | |
| It is expected that the number of young people decreases and the number of old people increases.<br>Now the life expectancy in Estonia is one of the lowest in Europe. It is expected to increase in the future (see Fig.3. in Additional Report) | [2] |

| Education level | |
|---|---|
| In the 1990ies there was a significant change in the trends that characterise the acquisition of education by young people in Estonia. The share of basic school graduates continuing their studies in upper secondary schools continuously increased, causing a decrease in the number of entrants to institutions of vocational education. | [26] |

| Health-related issues | |
|---|---|
| Increase in immunocompromised persons | |
| Number of AIDS patients will remain constant but their cumulative number constantly will increase (Fig. 5 in Additional Report). | [4] [5] |
| AIDS patients in certain regions strongly increasing (e.g. Africa?) | |
| See above. | |
| In Western part of Estonia due to high level of fluoride (more than 1.5 mg/l) frequency of dental fluorosis is increased (especially among schoolchildren). Consumption of water with high level of iron in long-term results in alimentary iron overload, which leads to a positive serum iron balance, which, in turn, yields an increased oxidative stress and risk of many diseases (tumor, arthritis). | [8] |

| | |
|---|---|
| No data available. | |

| Other Demographical Aspects | |
|---|---|
| No. | |

## 5.1.8 Organizational factors

| Privatization (different models) | Source |
|---|---|
| After the privatization of the first water enterprise (Tallinn) there is some hesitation. Among the Baltic states Estonia seems to be the most progressive towards privatizing. However, the future trend is difficult to predict. | [14] |

| Centralization / Regionalization | |
|---|---|
| Is not forecasted in near future. | |

| Other Organizational Aspects | |
|---|---|
| Not in particular. | |

## 5.1.9 Risk- related factors

| Risk of terror attacks | Source |
|---|---|
| (MEKOROT is also involved in this item within WA-4) | |
| No data. | |

| Risk of technical failure: one-step versus multi-barrier systems | |
|---|---|
| Optimisation of (Risk/Cost) factor | |
| Multi-barrier principle is increasingly used for water treatment. | |

| Optimisation of Risk versus Water Quality | |
|---|---|
| For example, chlorine is added to the distribution net to anticipate to possible microbiological terrorist attacks, which deteriorates water quality.. | |
| Chlorine is added to protect water from pollution during the distribution. | |

| Risk of water availability / drought / climate change | |
|---|---|
| Also changes in water salinity | |
| Estonia is located in humid zone (precipitation exceeds evaporation) thus water resources have sufficient quantities (total available water resources from 5 exploited groundwater aquifers are 1.5 million $m^3$/day from which about 3-4% are used for drinking water production, cooling water for industry etc.), however wet and droughts periods occurs occasionally, thus water resources can be sensitive to climate changes.<br>The water resources and groundwater regime analyses, using the climate change scenarios, show that the problems concerning the water resources management do not serve as a limiting factor for | [27] |

| | |
|---|---|
| socio-economic development in Estonia. Natural variability of precipitation and their infiltration into the ground exceeds all calculated changes caused by the climate warming.<br>Future dangers in the utilization of groundwater may be caused rather by negative changes in the groundwater quality than by the decrease in quantity. At the present water consumption level, the reserves of the Estonian groundwater aquifers will be sufficient enough for hundreds of years. Despite this, it is very important to address both the quantity and quality aspects to the future designs of the water supply management. The present analysis makes it possible to conclude that the average sea level rise of 1.0 m would result in considerable changes in coastal ecosystems, and lead to remarkable economic hazards. However, saltwater intrusions, in general, would not provide a problem for Estonia. Freshwater consumption by the people does not depend on the upper layers of the groundwater. Drinking water is usually pumped up from very deep aquifers of the Vendian, Ordovician and Silurian sedimentary rocks, which would not be affected by sea level rise and saltwater intrusions. The only problem would come from salinization of coastal soils and plant communities. The climate warming would not cause any problems with water supply. The results of water supply and demand analysis indicate that possible climate change has no particular effect on water management in Estonia. | |

| **Other Risk-related Aspects** | |
|---|---|
| Water consumption is decreasing, this posses risk of water quality changes during distribution.<br><br>In Estonia most small water systems use groundwater as their source. The utilities are focused on the end result, i.e., meeting European Union standards for drinking water. How the water supplier decides to meet the EU standards is not an issue for regulators; the end results are the concern. | |

# 5.2. Additional Report

## 5.2.1 General information about water supply in Estonia [6]

Percentage of inhabitants served: 77
Specific household consumption in litre per person and day: 100
Total production of drinking water in million litre: -
Origin of drinking water %: surface water 35, groundwater 65, spring water 0.

Estonia is a country well supplied with drinking-water. Water from communal supplies is used by about 75% of the inhabitants over-all, but the differences between city and country, and among regions, are great. Communal water systems exist in all 47 cities and towns. Sindi has the smallest percentage of inhabitants (10%) supplied with water from a communal water system. The rest of the population of Estonia uses individually owned wells, shallow artesian or pit wells. Surface water is used for the communal water works which supply 90% of the inhabitants of Tallinn and Narva; other communal water systems use ground water. Water is processed in surface water systems in Tallinn and Narva and in 23 groundwater systems elsewhere.
Changes in the quality of ground water are monitored nationwide through a system of 163 observation wells, run by the Ministry of the Environment.
Water processing plants must guarantee the quality of drinking water in accordance with standards, which requires regular water testing.
State inspection of drinking water quality is carried out by the Health Protection Inspectorate. To accomplish the compliance with health protection requirements drinking water quality is assessed regularly and thousands of water samples are tested. In 1996 10.0% of communal water systems and 31.4% of individual wells (53.1% of pit wells) failed to meet health protection requirements. The most frequent reasons for failure were lack of a sanitary protection zone, and poor condition of processing or disinfection facilities.
In 1996 the Health Protection services performed 9,562 chemical and 16,515 microbiological tests on drinking water; of these, 23.7% and 9.7% respectively did not meet the requirements of standards. The quality of water differs considerably among cities and among counties. The number of water samples which did not meet chemical standards was only in Tallinn below 10%, while e.g. in Valga county and Pärnu this actually exceeded 50%. Failure to meet microbiological standards mostly ranged between 3% and 13% (19% in Rapla County). Actual water quality is probably better than these percentages suggest, due to the fact that tests by the health protection offices are performed primarily at those places where the quality of water is poor.
The quality of water is considerably better at communal water works than in private wells. Of communal waterworks samples tested in 1996, 3.9% did not meet requirements with respect to microbiological indicators and 14.6% with respect to chemical indicators; the respective percentages for private wells were 28.5 and 40.4. The content of nitrates in the water of pit wells is often

high. For instance, in the city of Tartu nitrates exceeded the permitted level in 63% of the cases, often being several times higher. In rural areas the nitrate levels in drinking water have decreased considerably during the past few years.

An important problem is aging of water supply piping, which often mandates rebuilding of the entire system or its total replacement in places. As much as 30-35% of the water in a network may be lost to frequent piping breakdowns and bad plumbing equipment. The condition of shallow individual wells is poor both from a technical standpoint and from that of water quality. Although pit wells should be cleaned and disinfected at least once a year, as a rule neither is done.

The occurrence of algae toxins in drinking water is only possible in unprocessed water taken from the open water reservoirs in Tallinn and Narva.

The available data do not give information on how many and what types of parameters were determined in water samples, for which parameters the tested drinking water did not meet requirements, and how many people used the water and for how long. Therefore it is not possible, on the basis of this information, to assess the health risk that low-quality drinking water poses to the Estonian population. It is possible to state approximately that about 9,000 persons use water from shallow individual wells which fails at least one parameter of quality, and 150,000 persons use drinking water from communal water supplies which fails at least one parameter.

As a result of administrative reforms within the Health Protection Inspectorate (43% of employees lost their jobs) it has not been possible to increase the number of people working on inspection of drinking water. Surveillance has actually decreased considerably compared to 1980, and does not meet the requirements posed by the EU for drinking water surveillance.

Excessive levels of chemicals in water derive from two different sources. Natural conditions may cause harder water than standards permit, in many places consisting of excessive iron, chlorides, fluorine, boron, or hydrogen sulphide. The chloride content exceeds permissible limits in the coastal areas of Western Estonia and the islands. Fluoride in excess of 1.5 mg/l occurs primarily in ground water in Western Estonia (where it may be as high as 7 mg/l); fluoride levels below 0.5 mg/l occur primarily in ground water in the South-East. In fluoride-rich water the content of boron may be increased frequently too.

In some regions of Estonia the surface and ground water is contaminated with phenols and petroleum products as well as an excess of heavy metals. Water that is very close to the surface is often contaminated with nitrogen compounds (ammonium, nitrites and nitrates), which originate from agricultural activities and are mostly caused by misuse of fertilizers and dung. An excess of iron in the drinking water can also be caused by old iron piping in water systems.

## 5.2.2 Figures

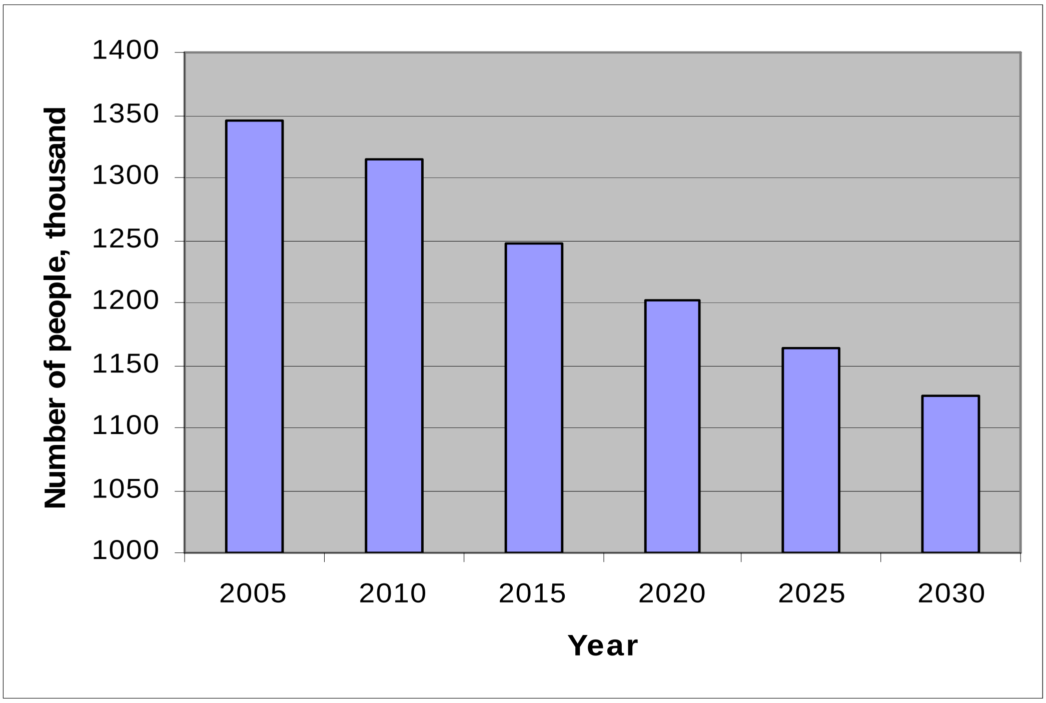



**Fig. 1. Forecast about population changes in Estonia from 2005-2050** [2].

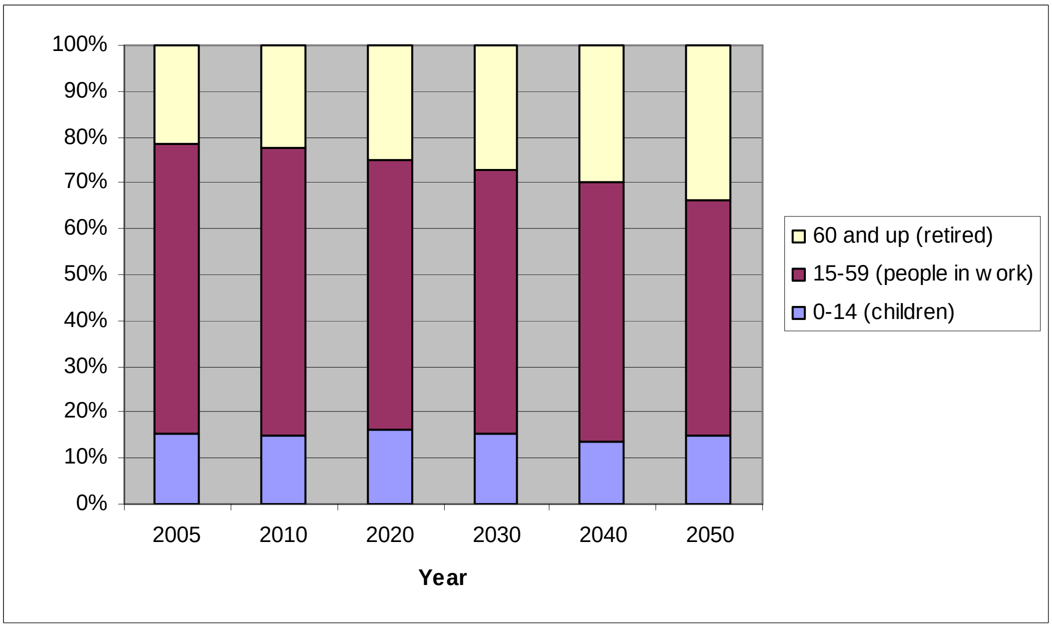



**Fig. 2. Forecast about population changes in Estonia from 2005-2050** [2]
Remarks: The percentage was obtained by calculation using the information on absolute population number in each age group and in total which was available on the home page of „Eurostat".

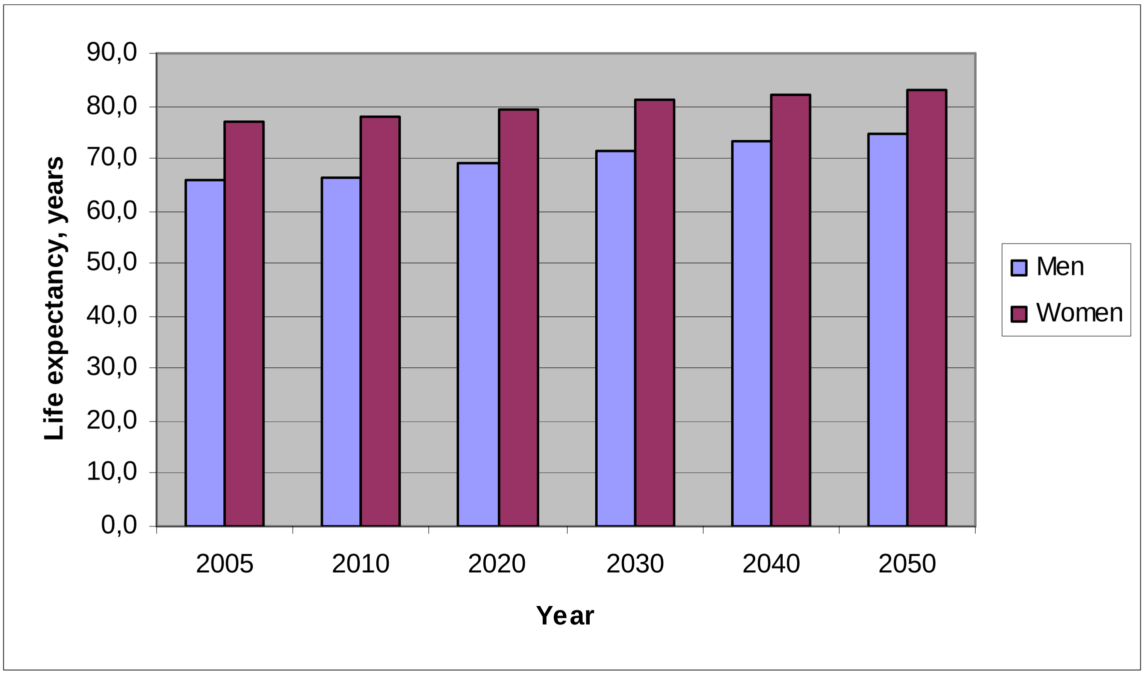



**Fig. 3. Forecast lifespan in Estonia from 2005-2050** [2].

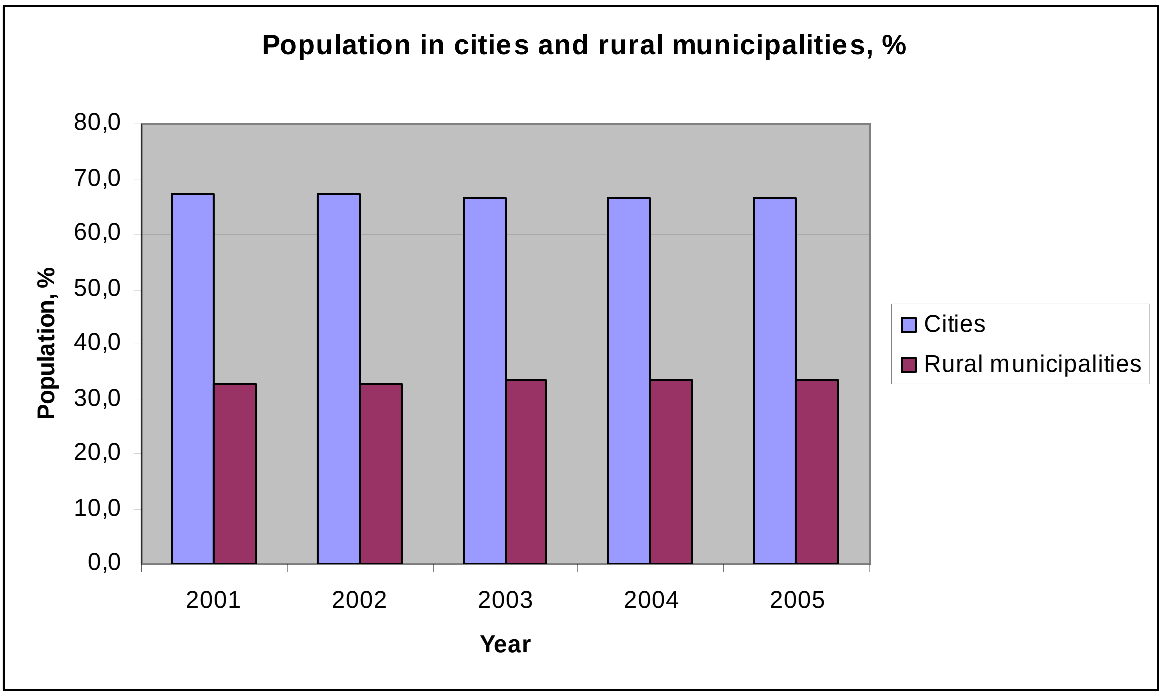
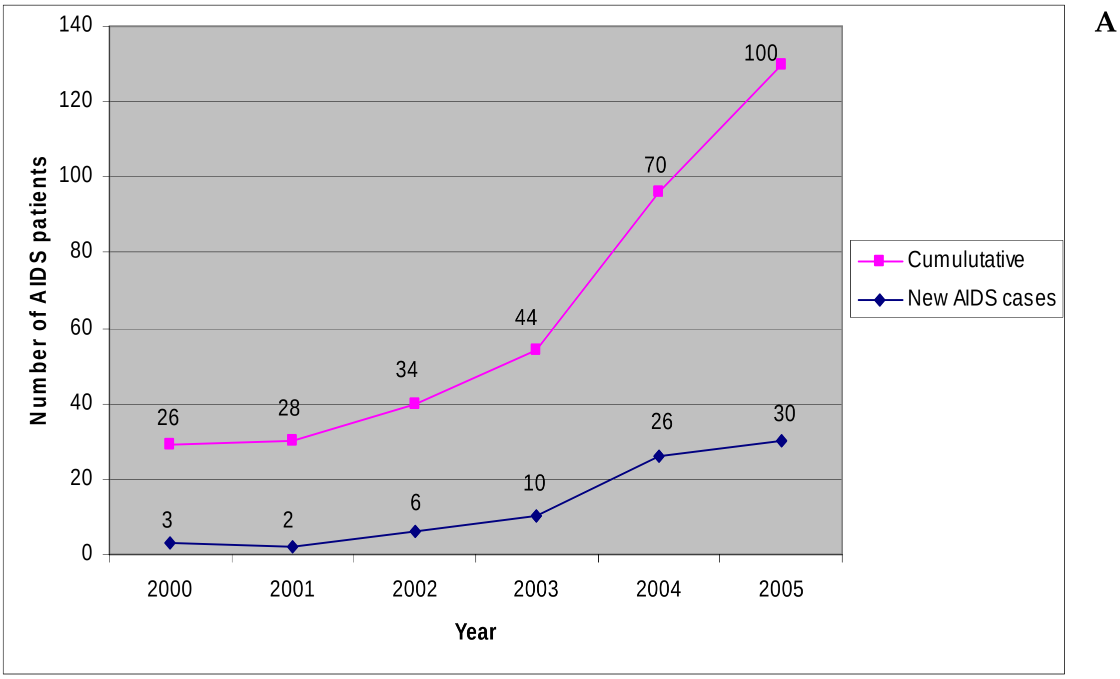



**Fig. 4. Distribution of population (Rural areas / cities)** [1]



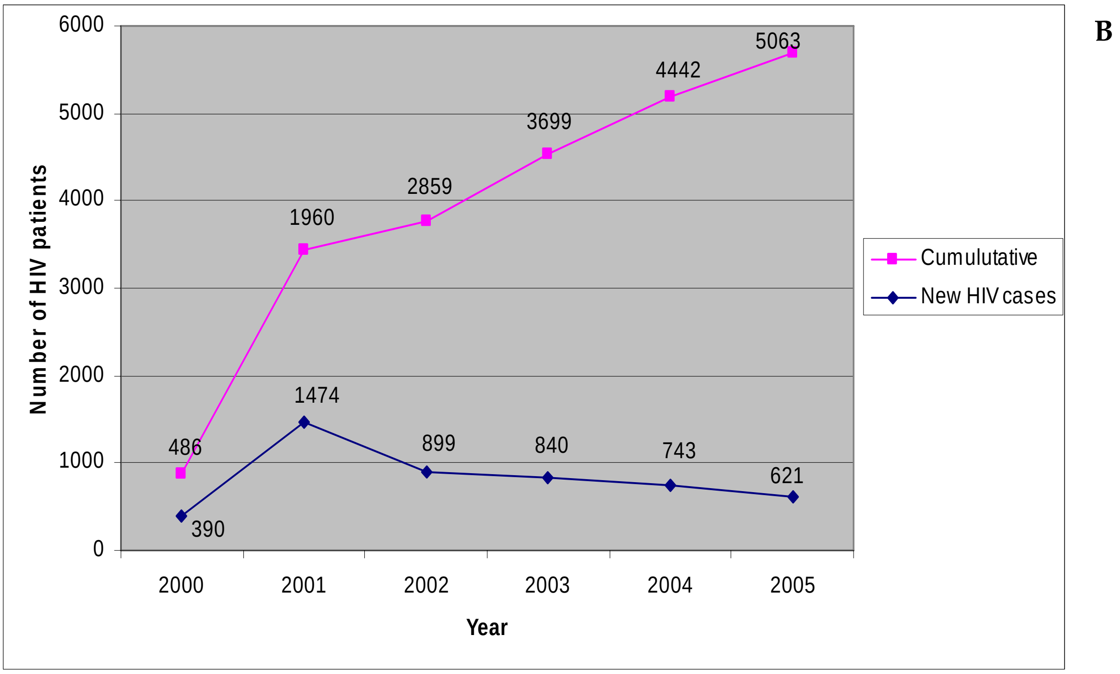




**Fig. 5. Current number of AIDS (A) and HIV (B) patients** [4; 5]

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# 6 Appendix : Questionnaire 2

## 6.1 Matrix of Factors

### 6.1.1 General information

| | |
|---|---|
| **Region** | **Baltic States** |
| **Covering countries** | **Latvia** |
| **Population** | **2.3 million** |

### 6.1.2 Socio-cultural factors

| **Willingness to pay for drinking water** | Source |
|---|---|
| Is drinking water an important part of the budget in general? How will this change and will this be accepted? | |
| Costs of water and sewerage contribute about 0.74 % of average wage. The fact that people are saving water (water consumption of drinking water is often below 100 l/d.capita) may indicate that water costs are a significant part of the family budget. Price for water varies among different municipalities from 0.59 (Cesis Municipalities) to 1.23 Euro (the price without 5% VAT). This is the total price including drinking water and sewage disposal. Roughly the price for drinking water amounts 50% of total, e.g. in Riga 1 $m^3$ of drinking water costs 0.34 Euro (5% VAT not included) and sewage disposal costs 0.34 Euro, too (data on 1 of July, 2006).<br>Prices for water are regulated by Public Utilities Regulator (PUR). There is an opinion in the public that PUR accepts changes in tariff too easily. | [1]<br>[13] |

| **Level of information of the consumer with regard to drinking water** | |
|---|---|
| Are people getting more educated or do they lose interest? This aspect is partially coupled with the demographic aspect of level of education | |
| No statistical data available. However increasing number of visitors to the homepage of Latvian Health Agency and more and more questions regarding drinking water (about 20% of all questions) indicate that interest in drinking water is increasing. | [26] |
| **The appreciation of drinking water** | |
| | |
| No statistical data available about percentage of people drinking tap water. In general, many people consider that tap water should be boiled before drinking. No tap water is served in restaurants or bars. | |

| Ecological Awareness | |
|---|---|
| Also awareness regarding emerging pollutants. Are trends visible? | |
| Although economical awareness both in politics and public sector is increasing compared to Soviet Period, still in many decisions the economical interests often dominate. Interviewed experts also agreed that current environmental policy is "too soft" against violation of environmental laws. In many cases there the penalties are not adequate to harm caused to environment. | |

## 6.1.3 Economical factors

| Financing models | Source |
|---|---|
| Privately owned, fully state-owned and different participation models exist. What trends can be observed? | |
| The constructions and buildings of drinking water supply system are the property of municipalities. The maintenance and running of properties is insured by a company owned by each municipality. Privatization of water enterprises is being discussed time to time at some municipalities but has not received significant support in public yet [9][10]. | [9][10] |

| Maintenance / renovation of infrastructure | |
|---|---|
| E.g. it is claimed sometimes that the renovation of e.g. distribution systems will require huge capital in the future | |
| After 1992 Latvia is receiving significant financial support from PHARE, ISPA and Cohesion Funds for renovation of water treatment plants and distribution networks [11]. So the investment in renovation of water supplies is not expected to increase in near future.<br>There is no data about how much of the distribution are rehabilitated and replaced every year in Latvia. Information is available about some cities. For example Riga City renovates about 1-2% of their distribution networks per year. | [11]<br>[27]<br>[28] |

| Energy costs and energy consumption | |
|---|---|
| Which trends in energy prices are expected and how will this affect the drinking water situation? | |
| During next 20 years consumption of energy will be increasing. Consumption of electrical energy will increase 1.5 to 2.5 times depending on development of industry in Latvia [12] (see Figure 2. in Additional Report). Neither the Ministry of Economics nor the joint stock company "Latvenergo" which is a subordinated organization of the Ministry are giving any information on forecasts regarding the price soaring.<br>There was no agreement among interviewed experts. Some claimed that increase of energy prices most likely will not significantly effect drinking water sector providing that economical development in | [12]<br>[9][10] |

| | |
|---|---|
| the country continues [9][10].Others claimed that :"…the energy prices increase has a strong effect on all economical sectors, because it is slowing down economical development. The most sensitive are social groups with low income. Due to increase of energy price their debts level to water sectors will increase, which in turn slows down development of this sector.<br>Expert from Riga Water said, that about 10% of the expenses (third largest expense, after equipment amortization and personnel costs) of their expenses are due to energy consumption, thus an increase of energy prices in the case of Riga has a significant impact on water prices. | [28] |

| **The role of decentralized systems** | |
|---|---|
| How will this affect the costs distribution? | |
| The small number of inhabitants per square kilometre, particularly in rural areas renders the centralization of water supply systems economically unfeasible [13][9][10]. There are around 750 settlements, where the number of inhabitants is (much) lower than 2 000 and where around one third of Latvia's population lives. The majority of these settlements are located on the Baltic Sea coast, along the banks of rivers and lakes that are potential tourist places. Small population numbers, employment problems and the absence of the entrepreneurship have a considerable impact on municipal budgets and are limiting their ability to improve the water services [4].<br>In private wells iron removal is often combined with softening. However many families are not able to afford such a system (personal opinion). Earlier most of the small communities were supplied from groundwater without water treatment, now iron treatment is being introduced in many places. | [13]<br>[9][10]<br>[4] |

| **Other Economical Aspects** | |
|---|---|
| Not in particular. | |

## 6.1.4 Political factors

| **Financing models** | Source |
|---|---|
| Privately owned, fully state-owned and different participation models exist. What trends can be observed? | |
| All municipally owned and operated, privatization is been discussed but has not received significant support in public yet. Expert opinions about need for privatization were dividing. | |

| **Decision making process for innovations / investments** | Source |
|---|---|
| Are trends visible in this process? | |
| Money is invested primarily if the innovations are required by some regulation or guidelines [9][10]. | [9][10] |

| **The role of NGO's and lobby organizations** | |
|---|---|
| The influence of non-governmental and lobbying forces is not being felt [9][10]. | [9][10] |

| **Administrative procedures** | |
|---|---|
| e.g. approvement of new technologies for application in drinking water | |
| In general the application of new (e.g. membrane) technologies are not widespread due to the lack of specialists at the municipality [9][10].<br>The agreement about implementation of new technologies is reached in negotiations between end-users: municipality and a technology supplier. Most important factor in decision making is the technology price (with relatively short payback time) and a list of the references with "success stories". Availability of additional financial support (European funds) may encourage the end-users to choose in favor of new technologies [14]. | [9][10]<br>[14] |

| **The role of political parties** | |
|---|---|
| E.g. the Greens. These situations can change quickly, but are also more general trends visible? | |
| The political influence is not markedly coordinated due to the fact that the municipalities coordinate the water policy independently [13]. | [13] |

| **Changes in water quality standards** | |
|---|---|
| E.g. bathing water standards are prepared in different countries, which will affect the resource water quality. Also effluent quality standards are changing (?) for industry as well as community... | |
| The demands for drinking water quality are nearing the requirements in the EU (98/83/EC) or are meeting those. Until year 2015 (population less than 10000 and more than 2000) several parameters (bromides, THMs, Al, Fe, Mn and COD) are set below the maximum permissible levels of (98/83/EC). Only parameter which is regulated in addition to 98/83/EC is water hardness (< 7 mgeq/l). | |

| **Other Political Aspects** | |
|---|---|
| Not in particular. | |

## 6.1.5 Technical factors

| **Which breakthrough technologies are expected to be introduced in to practice in the time frame of 10-20 years?** | Source |
|---|---|
| Please provide report or reliable sources as a proof of reality of the technologies | |
| All water supplies, expect Riga, are using groundwater sources. Iron and manganese are the main ingredients exceeding water quality standards. For their removal the simple oxidation with filtration are considered as BAT (best available technologies). Thus introduction of new water treatment technologies is not likely. In some areas where high level of sulfates is found in groundwater, the membrane technologies might be introduced.<br>As water quality deterioration in the distribution networks is a significant problem in Latvia [4], technologies for control of water quality in the pipe might be introduced. | [4] |

| **Which technologies are emerging?** | |
|---|---|
| Some relations with ecological factors may exist - water quality deterioration and emerging pollutants | |
| The main economical growth specialists in Latvia do not forecast noticeable influence of new pollutants and ecological factors on drinking water sector considering the slow development of industry [13]. | [13] |

| **Point of use systems** | |
|---|---|
| Current expansion of point-of-use systems (?), trends in their efficiency, quality and control | |
| May develop and increase as players in the drinking water supply market due to good quality groundwater and artesian waters in many places and the safety and quality of these waters will be acceptable after light pretreatment. In areas with small population number long pipelines and centralized water treatment will not be economically feasible. | |

| **Water recycling systems** | |
|---|---|
| Are drinking water application of recycled water likely | |
| Water in reversible systems is mainly used in the field of energy and heat supply – in the sector electricity, gas steam, and hot water supply 100 090 thsd. $m^3$ or 70% of total used water in reversible systems have been used up in 2003 by reversible systems. Water amount in reversible systems since 1998 has increased from 55% to 62%.<br>Water recycling in drinking water sector is not being used yet. | [16] |

| **Water saving technologies** | |
|---|---|
| E.g. rainwater harvesting | |

| | |
|---|---|
| Because due to implementation of water saving policies, recession of industry and negative demographic trends the drinking water consumption in Latvia is low, often below 100 l/d capita , the wide application of water saving devices at the households is not likely. In public places the application of water saving devices might become more popular. According to survey carried out with companies who are selling plumbing goods information about water saving technologies in the stores is not available. Most popular water saving device are "water saving taps", but people do not show large interest in buying them.<br>In general information about water saving devices is not being popularized in the country. | [29][ |

| Other Technological Aspects | |
|---|---|
| New technologies sometimes are difficult to use for systems constructed in Soviet Union period (e.g. water meters), which results in their malfunction. | |

## 6.1.6 Ecological factors

| Emerging pollutants | Source |
|---|---|
| Governmental monitoring already exists? | |
| Directive 2000/60/EC is in force since 2006. This program is mainly oriented on the assessment of general water quality situation determining also Cd, Pb, Hg, Ni, oil products and Cu, Zn and As on case-by-case basis. This programme includes monitoring of underground water and surface water basins used for drinking water acquisition.<br>There is no special group in the Directive called emerging pollutants. Some of theses substances are analysed however due to limited resources not all of them and the number of samples is limited.<br>Endocrine system disruptors are not being analysed yet, however within the next 2 years the list of methods will be updated (there is a cooperation with SWIFT- WFD project). | [3]<br>[30] |

| Accumulation of pollutants in the environment | |
|---|---|
| Accumulation of organochlorine contamination in perch and heron (aquatic environment) of Latvia is in the same range as in Sweden lakes and is generally similar for other parts of the Baltic Sea region [8].<br>Up to 90% of lakes in Latvia are eutrophic due to the discharge of nutrients from domestic or agricultural sources [17]. | [8] |

| The effect of more stringent thresholds and pollution control | |
|---|---|
| As a result of political changes (after breakdown of Soviet union 1991 Latvia became independent) significant economical and legislative changes have occurred. Due to recession in industrial and agricultural production substantial reduction of fertilizer use has | [17] |

| | |
|---|---|
| occurred and number of livestock has decreased. This has resulted in reduction of pollution loads into environment. During the economical transition, an environmental protection system has been developed according to traditions in European countries. This has contributed to reduction of wastewater loads (see Fig.4 in Additional Report). However, in some, especially small size enterprises waste water handling (and waste load reporting) is not adequate and shall be improved further.<br>The control of water quality is carried out by Public State Agency (monitoring of drinking water quality) and by State Sanitary Inspectorate (control of execution of water quality requirements). | |

| **General quality / composition changes in water resources, e.g. due to climate changes** | |
|---|---|
| In general aquatic chemistry of water bodies in Latvia is influenced by soil composition, character of vegetation, precipitation, climate, land-use, and human impact. The combination of these factors differs for rivers from different regions. Hydrogen carbonate and calcium ions dominate among the water ingredients. Commonly, surface waters of Latvia are rich in organic matter. Changes in concentration of several ingredients have been observed in some rivers. For example increase of $Mg^{2+}$, $SO_4^{2-}$, and $HCO_3^-$ was observed in Daugava river. These changes are related to water discharge, natural geochemical processes (weathering of soil minerals etc.) and nutrient loading. Only Daugava river is used for drinking water production.<br>In general groundwater in Latvia is quite clean thus enabling its use for drinking water often without treatment [17]. Only iron and manganese and in some cases ammonium and sulfate should be removed. However in same cases unprotected groundwater is polluted. In rural areas the most common sources of drinking water are wells of which up to 20% are polluted [17]. | [17] |

| **Region-specific contaminants?** | |
|---|---|
| E.g. Arsenic, Cadmium, Radioactive elements | |
| Public Health Agency performs water monitoring according to the regulation No 235 of Latvian Cabinet of Ministers, April 29th, 2003 “Mandatory harmlessness and quality requirements for drinking water, and the procedures for monitoring and control thereof”. The data is collected in yearly reports. According to the Agency pollution by the heavy metals and radioactive elements is negligible. No data about other specific contaminants exists.<br>Results from hydrogeological research about heavy metals and radioactive elements are not combined and made publicly available. | |

| **Influence of water framework directive** | |
|---|---|

| | |
|---|---|
| The main goal of the Directive 2000/60/EC is to ensure that by the year 2015 the water quality in all European countries is good and that there is a system in place for consuming and protecting the water sources. Latvian Environmental, Geological and Meteorological Agency which is the responsible organization for working out procedures and plans of handling the river basins has determined the objects which are in the risk group not to meet the quality standards until year 2015. The characterization of water sources which is included in the report (2005) to the EC on the performance according to the Directive "The characterization of river basins. The evaluation of anthropogenic burden on underground and surface waters. Economical analysis" is considered when territorial planning of municipalities is made. The monitoring programme on the state of waters is in force since January 2006. The planning on handling river basins has been initiated. | [19]<br>[25] |

| **Other Ecological Aspects** | |
|---|---|
| Not in particular. | |

**Subfactor: Resources**

| **Trends in resource water** | Source |
|---|---|
| Due to Political factors | |
| E.g. NL: less groundwater use due to regulation on wetlands | |
| Due to abundant groundwater resources in whole country the political factors are not important in resource management in Latvia. | |
| Due to other factors | |
| E.g. climate change, river restoration projects | |
| The resources of surface and underground water are sufficient. Drinking water treatment from surface water will continue only in Riga from Riga hydroelectric plant. In costal areas the use of underground waters may be hindered by intrusion of sea water in the upper horizon of underground waters. For the growing needs of coastal inhabitants the underground water will have to be transported from a distance of 10-20 km, for example from the group of Aistere wells for Liepaja pipeline and the group of Ogsils wells for Ventspils pipeline. The resources will not be markedly influenced by climate changes or other ecological factors. In total the consumption of water resources has slightly decreased due to more rational use of it as well as due to the decrease in industrial intensity, nevertheless, it is forecasted that the consumption will rise due to an increasing welfare of the population and stabilization of the economic situation. | |

| **How does Agricultural use of water influence resources?** | |
|---|---|
| E.g. overexploitation of resources or expansion of bio-technologies? | |

| | |
|---|---|
| Less than 20% of water are used for agriculture [18][20] (see Fig. 3 in Additional Report). In period from 1990 to 1996 agricultural production dropped twice and is now slowly recovering [4]. However extensive development of agriculture is not forecasted, thus a significant increase of water use is not expected in the future. | [18][20]<br>[4] |

| **Industry in general: increase / decrease** | |
|---|---|
| E.g. heavy industry moving out of W-Europe | |
| The transfer of West European heavy industry to Latvia is not expected hence the drinking water situation in Latvia will not be influenced by this. | |

| **Wastewater treatment in general: influence on surface water quality** | |
|---|---|
| | |
| Wastewaters will not decrease the quality of surface waters since with the financial support of EC modernization of sewage treatment equipment in inhabited places currently is and will be carried out in the future. | [17] |

## 6.1.7 Demographical factors

| **Distribution of population (Rural areas / cities)** | Source |
|---|---|
| Trends in rural-urban migration of population: rich people are moving out of the cities, young people - in? | |
| In year 2001 about 70% of population lived in cities from which 1/3 lived in Riga [4]. This situation is not likely to be changing in future [22]. | [4]<br>[22] |

| **Absolute growth of population** | |
|---|---|
| Population of the country will decrease [21] (see Fig. 5 in Additional Report). | [21] |

| **Age distribution / life expectancy** | |
|---|---|
| E.g. older persons are more sensitive to water contaminants | |
| It is expected that the number of young people decreases and the number of old people increases (see Fig.6. in Additional Report)<br>Now the life expectancy in Latvia is one of the lowest in Europe. It is expected to increase in the future (see Fig.7. in Additional Report) | [21] |

| **Education level** | |
|---|---|
| Number of students studying in highest education is more than 65% of all people (data for 2000), however there is a need to increase quality of education (especially technical) and to invest more into infrastructure (laboratories etc) [4]. | |

| **Health-related issues** | |
|---|---|
| Increase in immunocompromised persons | |

| | |
|---|---|
| Number of AIDS patients will stay constant but their cumulative number constantly will increase [22] (Fig. 9 in Additional Report) | [23] |
| AIDS patients in certain regions strongly increasing (e.g. Africa?) | |
| See above. | |
| Chronic diseases and water quality | |
| No data available. | |

| **Other Demographical Aspects** | |
|---|---|
| No. | |

## 6.1.8 Organizational factors

| **Privatization (different models)** | Source |
|---|---|
| There are 1381 water supply systems, At present all water supply enterprises in the country are municipal.<br>In the future the tendencies are foreseen to privatize the handling of the systems [9][10] . The immobile parts (outer pipes, buildings, constructions and equipment) will remain as the property of municipalities. | [9][10] |

| **Centralization / Regionalization** | |
|---|---|
| Many of enterprises are small in size however there is no tendency of water supply enterprises merging [9][10]. | [9][10] |

| **Other Organizational Aspects** | |
|---|---|
| Not in particular. | |

## 6.1.9 Risk- related factors

| **Risk of terror attacks** | Source |
|---|---|
| (MEKOROT is also involved in this item within WA-4) | |
| Equipment of sanitary protection zones with modern surveillance and alarm devices are being improved. | |

| **Risk of technical failure: one-step versus multi-barrier systems** | |
|---|---|
| Optimization of (Risk/Cost) factor | |
| Most of water supply systems are using naturally protected groundwater resources. It is therefore, multi-barrier principle is used only in surface water treatment plant (in Riga).<br><br>According to experts the major risks are:<br>1. Contamination of water supply systems after pipe repairing,<br>2. Floods, droughts<br>3. Intrusion in protective zone of water abstraction wells<br>4. Pollution of water sources by industry or accidents | [9]<br>[10]<br>[28] |

| **Optimisation of Risk versus Water Quality** | |
|---|---|
| For example, chlorine is added to the distribution net to anticipate to possible microbiological terrorist attacks, which deteriorates water quality. | |
| In some water supply systems, even if the water is abstracted from groundwater aquifer, the chlorine is added for safety reasons, mainly to protect drinking water from accidental pollution in distribution networks. | |

| **Risk of water availability / drought / climate change** | |
|---|---|
| Also changes in water salinity | |
| Latvia is abounded in water resources; therefore the risk of water shortage is not significant. Higher risk is from floods. If the mentioned phenomena are correctly assessed and the trends will be kept also in future the groundwater level in the lowest coastal zone of Riga Bay could rise by approximately 50-70 cm. Risk of floods in the lower reaches of the big rivers (Lielupe, Daugava, Gauja) will become higher.<br><br>Due to climate changes the frequency and severity of floods increase in Latvia. The situation is very similar as in Europe. Latvia experiences 3 types of floods: in spring during melting period, during high precipitation period and as a result of wind from sea.<br>Floods increase runoff intensity from agriculture which may<br>- increase chemical pollution of water source (Daugava river),<br>- increase resuspension of sediments which increase turbidity and possibly heavy metal concentration in water sources and<br>- as a result of flooding of toilets and sewerage increase risk of bacterial pollution in groundwater sources. | |

| **Other Risk-related Aspects** | |
|---|---|
| Water consumption is decreasing, this posses risk of water quality changes during distribution. | |

# 6.2. Additional report

**1. General information about water supply in Latvia [15]**

Percentage of inhabitants served: 84
Specific household consumption in litre per person and day: 64 – 200
Total production of drinking water: 290 219 900 litres per day
Origin of drinking water %: surface water 33, groundwater 67, spring water 0

**2. Water Services [4]**

Water services (water supply, wastewater collection and treatment) are not provided in appropriate quality and in accordance with environmental requirements in most of the settlements in Latvia. In order to ensure qualitative services for as many inhabitants as possible and in order to considerably reduce the environmental pollution, the financing for the development of the water services according to the strategic investment priorities has been allocated to agglomerations with a population equivalent above 2 000. The main financing sources in the pre-accession period have been Phare and ISPA. For the period 2004-2006 the continuation of the development of appropriate water services in these urban agglomerations has been defined as one of the highest priorities in the Reference Framework Document for the Cohesion Fund. At the same time, there are around 750 settlements, where the number of inhabitants is (much) lower than 2 000 and where around one third of Latvia's population lives. The majority of these settlements are located on the Baltic Sea coast, along the banks of rivers and lakes that are potential tourist places. Small population numbers, employment problems and the absence of the entrepreneurship have a considerable impact on municipal budgets and are limiting their ability to improve the water services. Despite rich surface water resources, approximately 13 300 $m^3$/capita (average in EU-15 is 7250 m3/capita. Only Ireland, Finland and Sweden exceed Latvia in this regard), and the possibility to provide drinking water to the entire territory of Latvia from ground water resources (currently only in Riga surface water is still used as source of drinking water) the protection of water resources and their rational use are not properly ensured. The overall quality of ground water is good in Latvia with the exception of elevated concentrations of iron, manganese and sometimes there are problems with the hardness of water and too high sulphate concentrations. To comply with the drinking water quality standards abstracted groundwater is treated before it is distributed to the final consumers. At the moment appropriate drinking water treatment is being provided to around 35% of the population. Although the quality will be good after treatment the drinking water quality provided to the final consumers is often worsened due to the poor condition of the water supply networks. According to the monitoring data for the year 2001, the overall quality of drinking water supplied to the consumers was not corresponding to the requirements for both the chemical quality (49.5% of the samples) and the biological quality (5.3% of samples). Here it should be noted that the quality of drinking water at final consumer is only controlled at the request (and expenses) of the house owner. Around one third of the water is being lost in the water supply networks, which is comparable to other EU-15 and Accession Countries. Estimated network losses vary widely over Europe: e.g. on average 15% in Italy, 30% on average in France, 33% in the Czech Republic. However poor metering and monitoring in some countries makes accurate estimations difficult. According to data provided by the Latvian Environmental Agency, the total amount of produced wastewater was 306.83 million $m^3$ in 1998 and 220.91 million m3 in 2001. Being a country where most water is used by the public water supply sector, the biggest wastewater producers are consequently the municipal water utilities. In 2001 they produced 47.6% of the total wastewater amount compared to 29.8% from the industrial sector (including energy and heat production) and 19.1% from the agricultural, fishing sector. Although the total amount of the treated wastewater against the total collected wastewater amount has increased, the big part of the produced municipal wastewater, particularly in small settlements, is still not being appropriately collected and treated. In most of the around 1,100 wastewater treatment plants in Latvia, of which an inventory was made, the technologies applied are not complying with the environmental requirements and are creating surface water pollution. The poor condition of the sewage networks creates leakages and the collected sewerage may pollute groundwater (especially of shallow wells), and thus creating a danger of microbiological contamination. Close attention is focused on improvement of drinking water and sewerage services, on metering (real consumption of resources instead of norms) and cost recovery, the latter is in line with the requirements of the Water Framework Directive, thus implementing the Polluter Pays Principle. The result for the final water consumers is that they will pay tariffs that include both depreciation and operational costs related to the provision of drinking water and sewerage services. As for waste water management the operational costs include Natural Resources Tax: on both the abstraction of water (surface or groundwater) and the pollution of the fresh water into which the treated sewerage is discharged. Water and sewerage tariffs reflect more and more the full costs of providing these services. This implies that the services currently developing, improving and co-financed by the EU, will generate sufficient revenues to continue the services in a financially sustainable manner.

## 6.2.1 Figures

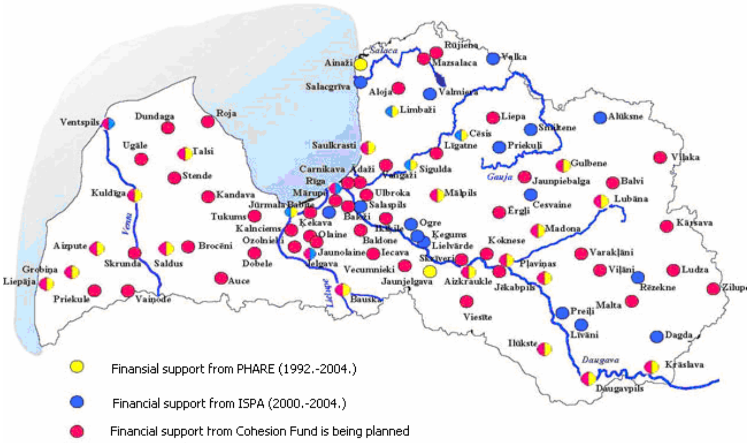


**Fig.1. Renovation of water supply systems in Latvia. Map shows cities which have or will have received funding for their water supply system rehabilitation.**

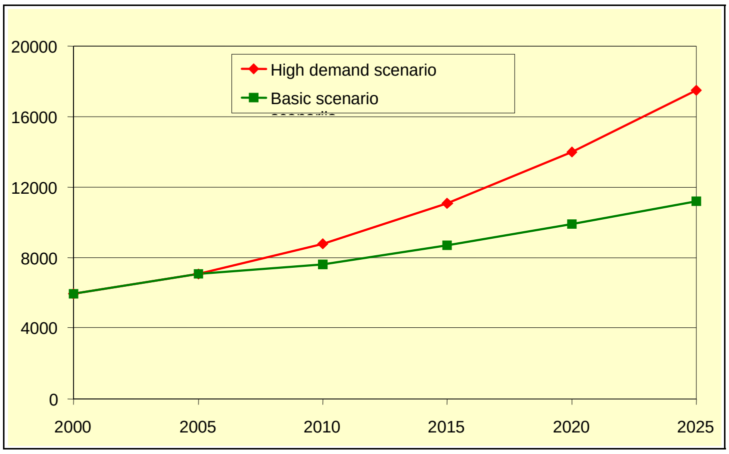


**Fig. 2. Forecast of electric energy demand GWh in Latvia.** This forecast was made by the Ministry of Economics using "basis scenario" which takes into account GNP forecast and "high demand scenario" which assumes the development of energy consuming industries.


**Fig. 3. Water consumption from 1998 to 2003.** Trends can bee seen in all sectors that by 2001 consumption of water decreased but after 2001 increased. That is related to the decrease of economic activity and the following stabilization of the industry and the agriculture.

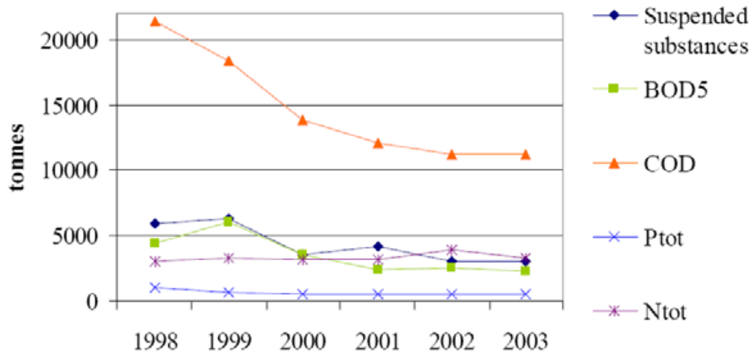


**Fig. 4. Pollutant load to waste water in Latvia from 1998-2003.** In smaller enterprises the sewage analyses mostly are done once a month or even once a quarter. That certainly might influence the quality of results and the correspondence with the real situation.

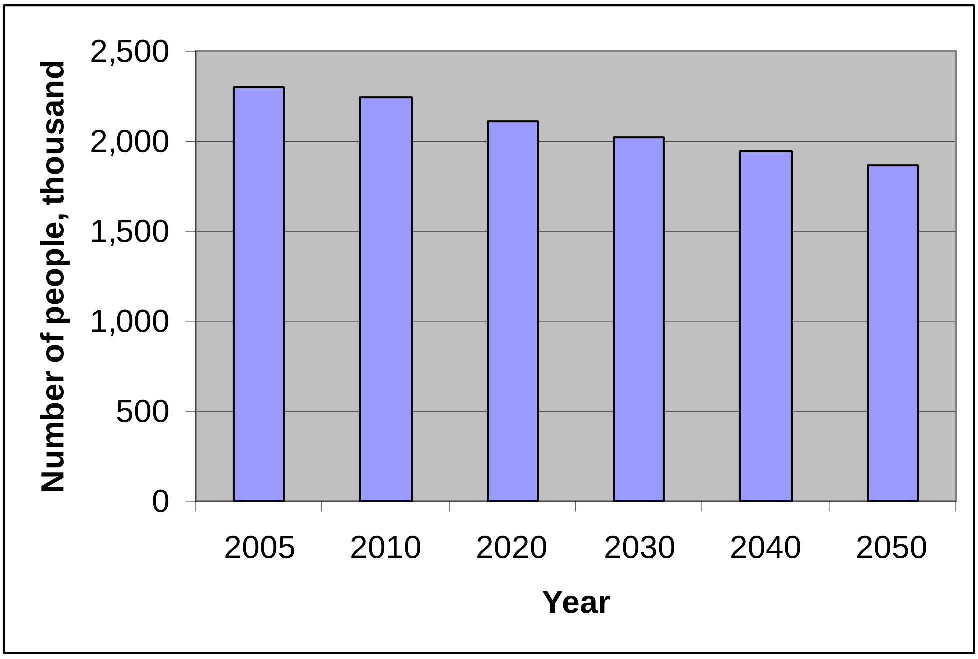


**Fig. 5. Forecast about population changes in Latvia from 2005-2050** [21].

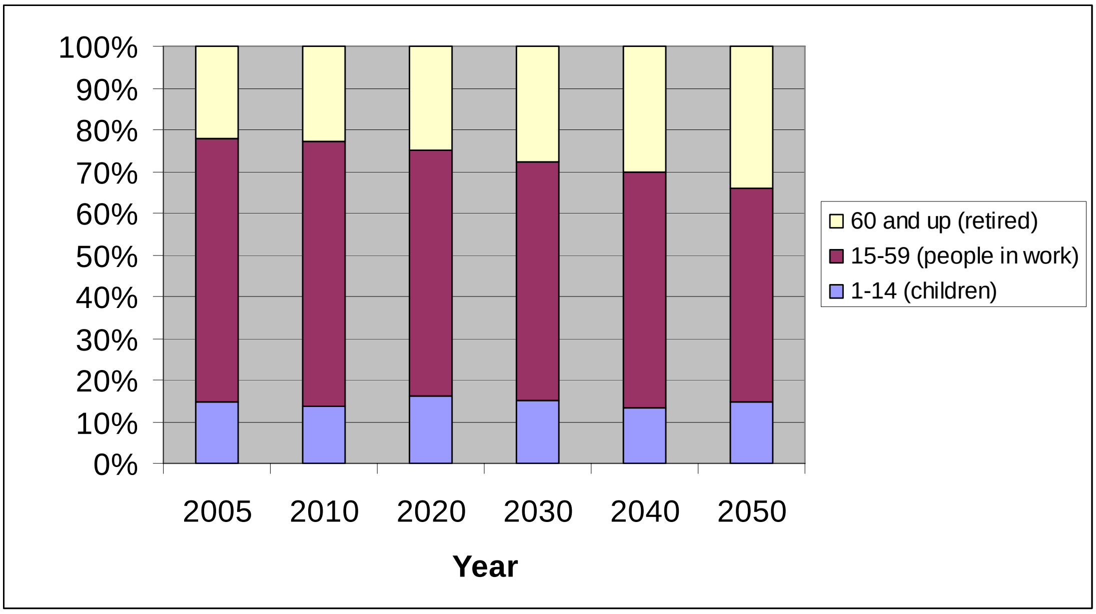


**Fig. 6. Forecast about population changes in Latvia from 2005-2050** [21]
Remarks: The percentage was obtained by calculation using the information on absolute population number in each age group and in total which was available on the home page of „Eurostat".

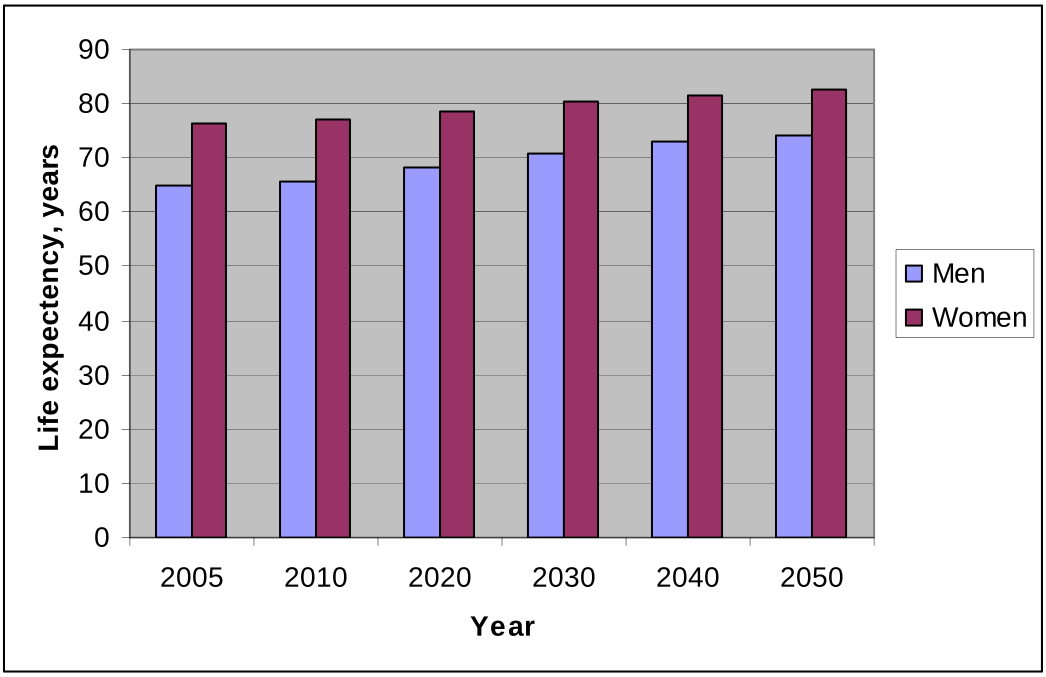


**Fig. 7. Forecast lifespans in Latvia from 2005-2050** [21].

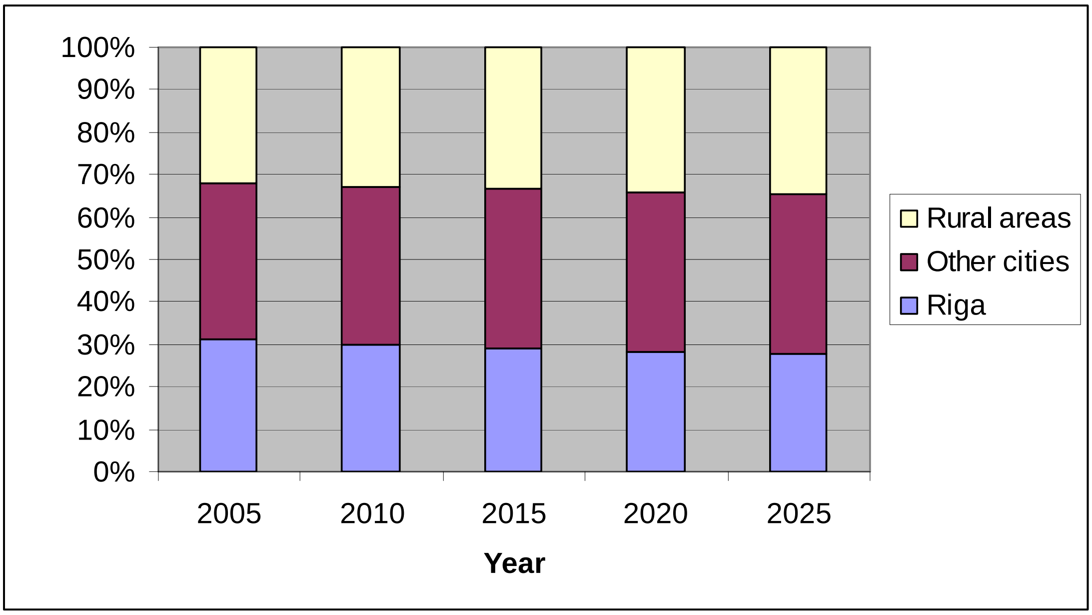


**Fig. 8. Forecast of population distribution from 2005-2050** [21]. Remarks: the forecast is made considering only the Active case which is based on an assumption that all the influencing factors would cause changes which promote only the recovery of the demographic situation regarding the movement of the population.

A

B

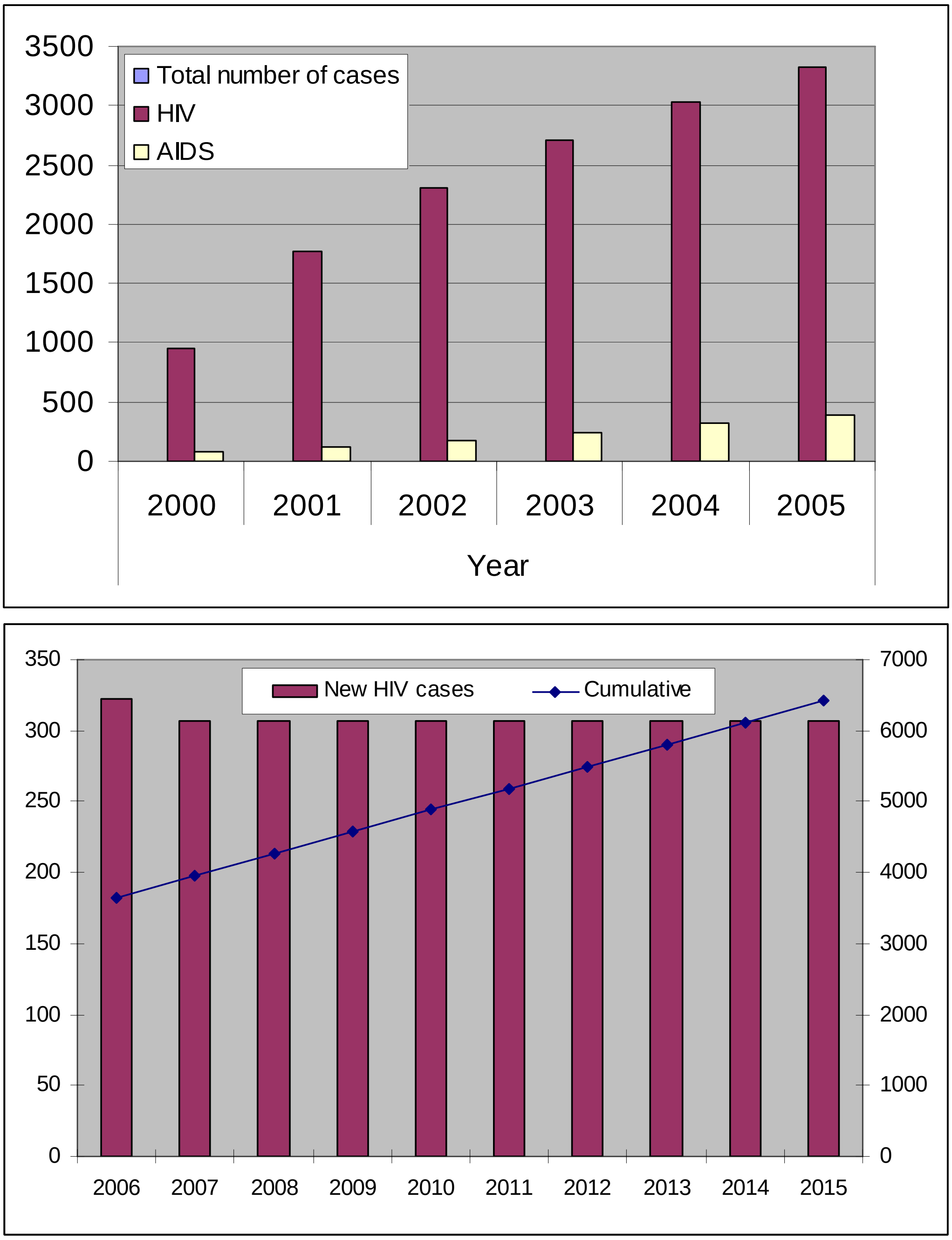


**Fig. 9. Current (A) and forecasted (B) number of AIDS or HIV patient population distribution from 2005-2015 [23]**

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