VillageWaters

Interreg Baltic Sea Region

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A survey of available wastewater treatment technologies for sparsely populated areas

User's manual – Version 2.1

Virpi Vorne, Frans Silvenius (Eds.)

FINDING THE BEST FITTING SOLUTIONS FOR WASTEWATER MANAGEMENT IN VILLAGES

VillageWaters Project
Research about Wastewater
Treatment Systems

A survey of available wastewater treatment technologies for sparsely populated areas

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Table of Contents

Abstract

The Baltic Sea is one of the world's most polluted seas. Eutrophication of Baltic Sea has led to the serious environmental problems during the last century. One of the main contamination sources has been municipal wastewater, including wastewater from the small and scattered settlements. Sparsely populated areas are the third largest source of diffuse nutrient loads into the Baltic Sea. As concerns reducing water- and airborne inputs of nutrients, and hence eutrophication, this can only be done if the sources of nutrients reaching the Baltic Sea and magnitude of nutrient inputs are known. According to the Fifth HELCOM Pollution Load Compilation only several countries submit concerning values of the nutrient load coming from this source.

Combating eutrophication is seen to pose significant challenge. As EU legislation aims to improve the status of the water bodies in the EU, the implementation of directives has not been fully effective. For the Baltic Sea, the relevant convention is the Helsinki Convention (governed by the Helsinki Commission (Helcom)) and its Baltic Sea action plan. The Member States' plans for achieving Helcom nutrient reductions are based on their river basin management plans prepared on the basis of the EU Water Framework Directive. According to European Court of Auditors (Special Report No 3/2016), these plans lack ambition as they focus on 'basic measures' for implementing EU directives in relation to the specific activities causing nutrient pollution.

This report contains information about the EU and national legislation from Estonia, Finland, Latvia, Lithuania, Poland and Sweden concerning the waste water treatment in sparsely populated areas. The report also gives an overview of the small scale wastewater technologies in Estonia, Finland, Latvia, Lithuania, Poland and Sweden. The data explored are mostly covered with all relevant small-scale waste water treatment solutions currently available on the market. The data is used in the Information Tool, which will be published in VillageWaters web-page (https://villagewaters.eu/) by the end of year 2018.

The main objective of the WillageWaters project is to find the most cost-effective and environmentally friendly wastewater treatment solutions for sparsely populated area households. These solutions will bring the wastewater emissions into the Baltic Sea into compliance with the levels set forth in ongoing implementation of the EU water legislation. In this report the summary of different waste water treatment purification technologies for sparsely populated areas on the market in Estonia, Finland, Latvia, Lithuania, Poland and Sweden is presented. The collection of technology data of the small-scale treatment technologies is still going on. At this report (Version 2.1) the summarized results of collected data by the end of June 2018 is presented.

The following organisations have participated in the data collection and analysis:
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Institute of Technology and Life Sciences in Falenty, Poland
Natural Resources Institute Finland (Luke), Finland
Tallinn University of Technology (TTÜ), Estonia
University of Latvia (UL), Latvia

Keywords: wastewater treatment, purification technologies, holding tank, septic tank, package plant, soil filter, infiltration field, constructed wetland, legislation, Estonia, Finland, Latvia, Lithuania, Poland, Sweden.

Abbreviations

Agglomeration	An area where the population or economic activities are sufficiently concentrated for urban waste water to be collected and conducted to a waste water treatment plant or to a final discharge point
BAT	Best Available Technology
Black water	Waste water and excreta from water closets excluding waste water from baths, showers, hand basins and sinks
BOD	Biochemical Oxygen Demand is a commonly used measurement of the concentration of biodegradable organic impurities in wastewater. Mass concentration (mg/l) of dissolved oxygen consumed under specific conditions by the biological oxidation of organic and/or inorganic matter in water. BOD is generally measured over a five-day period
BOD7	The amount of oxygen consumed over a 7-day period
BSAP	Baltic Sea Action Plan
Buried sand filter	A wastewater sand filter constructed below the surface of the ground and covered with earth to prevent annoyance to nearby dwellings. These filters are often used for disposing of septic tank effluent.
By-product	A result from a production process that was not the primary aim of that process. Unlike waste, it must be able to be used afterwards. The directive allows the European Commission to set criteria to be met by substances so as to differentiate by-products from waste.
Cesspool	Underground watertight tank without outflow used for collecting domestic wastewater.
COD	Chemical oxygen demand is the amount of oxygen needed in chemical decomposition of wastewater. It describes the oxygen consumption caused by all organic matter, including slowly decomposing organic compounds.
Composting dry toilet	A toilet system without water flush used for disposal of and biological processing of human excrement into organic compost material.
Domestic waste water	Waste water from residential settlements and services which originates predominantly from the human metabolism and from household activities.
Eutrophication	Enrichment of water by nutrients causing, among other things, an accelerated growth of algae which disturb the balance of water organisms and the water quality.
EU	European Union
Groundwater	All water below ground surface.
Grey water	Non-industrial wastewater generated in domestic processes, excluding human excrements, such as washing dishes, laundry and bathing

HELCOM	The Baltic Marine Environment Protection Commission, known as the Helsinki Commission
Industrial waste water	Any waste water which is discharged from premises used for carrying on any trade or industry, other than domestic waste water and run-off rain water
Inland water	All standing or flowing water on the land's surface.
IPPC	Integrated Pollution Prevention and Control
Leaching field	A system of open pipes in covered trenches that permits effluent from a septic tank to enter surrounding soil.
MSFD	EU Marine Strategy Framework Directive
N	Nitrogen. Nitrogen comes to wastewater mainly from excrement and urine. When nitrogen leaves the settling well it is in ammonium form. Nitrogen is also a plant nutrient and it appears as a minimum nutrient in most of the European water systems. Organic or ammonium-formed nitrogen uses the oxygen supplies of the water system when oxidized to nitrate.
NH_4-N	Ammonium nitrogen is a measure for the amount of ammonia, a toxic pollutant often found in landfill leachate and in waste products, such as sewage, liquid manure and other liquid organic waste products. It can also be used as a measure of the health of water in natural bodies such as rivers or lakes, or in manmade water reservoirs. The term is used widely in waste treatment and water purification systems.
NO_3-N	Nitrate nitrogen
NPK	Nitrogen, phosphorus, potassium fertilizers
Ntot	Total nitrogen
O_2	Oxygen
Onsite Wastewater Treatment System	A system that relies on natural processes and/or mechanical components that are used to collect, treat, and disperse or discharge wastewater from a single dwelling or building. May include systems that range in complexity from a septic tank and drainfield to a variety of alternative technologies.
Organic Material	Carbon-based waste contained in plant or animal matter and originating from residential or industrial sources.
P	Phosphorus. Phosphorus appears as soluble phosphate in wastewater and it is a nutrient that increases the forming of organic matter in nature. This causes eutrophication. The formed matter uses the oxygen supplies of water.
PE	Population Equivalent. Means the load per day with a seven-day biochemical oxygen demand (BOD7) of 70 g of oxygen (O2); the population equivalent is calculated on the basis of the maximum average weekly load per day entering the treatment plant, excluding unusual situations.

Person-equivalent load for dispersed settlements	Means the average load of untreated wastewater generated by one resident measured in grams per day in organic matter, phosphorus and nitrogen
PO_4-P	Phosphate-phosphorous
Ptot	Total phosphorus
RBMP	River Basin Management Plan
SBR	Sequence Batch Reactor
Secondary treatment	A process generally involving biological treatment, so that the requirements in Annex I of the Directive are accomplished.
Sensitive areas	Natural waters which are found to be or may become eutrophic in the near future if protective action is not taken, or those which need more advance treatment to reach compliance with other EU directives (e.g., the Bathing Water Directive)
Sludge	Refers to settling or floating matter originating from wastewater in septic tanks, small-scale treatment facilities or other treatment processes that can be separated from wastewater as individual fractions.
Slurry	Sewage sludge. A thin, watery mud or any substance resembling it.
Surface water	All inland water except groundwater, transitional or coastal waters.
Suspended solid	Suspended solid in receiving water accumulates into sludge blankets and increases turbidity of water. Sludge blankets are substrate to organisms that consume oxygen. Turbidity debases the capability of light to permeate water layers, which leads to increased decomposing and decreased oxygen supply. Turbidity also disturbs the disinfection process in waste water treatment plants.
Transitional waters	Waters near river mouths, which are partly saline but contain substantial flows of freshwater.
Total Suspended Solids (TSS)	The amount of insoluble solids floating and in suspension in wastewater. Also referred to as total nonfilterable residue.
Urban waste water	Domestic waste water or the mixture of domestic waste water with industrial waste water or run-off rain water
Wastewater system	Refers to all domestic wastewater sewers and wastewater treatment systems located inside and outside buildings, which are needed for the conduction and treatment of the property's domestic wastewater
Wastewater treatment system	Refers to all equipment and structures needed for the purification or other treatment of domestic wastewater, which can comprise a septic tank, a soil infiltration system, a sand filter system, a cesspool, a package plant or other equipment, or a combination of such equipment and methods;
WFD	EU Water Framework Directive

1. Introduction

Wastewaters of the scattered dwelling are after agriculture the second largest non-point source of eutrifying nutrient emissions of scattered loading to Baltic Sea. The reduction of the eutrifying emissions from the scattered dwelling is an essential part of EU environmental policy for reaching good water quality in all member states of the EU. Also the EU legislation aims to achieving a good status of water bodies in the EU.

According to PLC-5 (HELCOM 2011, Fifth Baltic Sea Pollution Load Compilation) data the percentage of population not connected to urban wastewater collection and treatment systems in project countries are following: Estonia – 19 % (252 000 inhabitants), Finland – 19 % (900 000 inhabitants), Latvia – 29 % (645 000 inhabitants), Lithuania – 38 % (975 000 inhabitants), Poland – 38 % (14.7 million inhabitants) and Sweden – 13 % (1 million inhabitants). In the sparsely populated areas, the organic materials and total phosphorous in the wastewaters of a household pollute the environment 6—8 times more than the household wastewater of a resident whose house is connected to the water supply company's sewage network.

Scattered settlements are one of the nutrient load sources. According to the Fifth HELCOM Pollution Load Compilation only several countries submit concerning values of the nutrient load coming from this source. Herewith for some countries shares of the scattered settlements input to the overall diffuse nutrient load constitute 30 %, and for several catchments scattered settlements provide half of the nutrient load. So scattered settlements might have significant input into the anthropogenic nutrient load of Baltic Sea.

According to the Water Act, all **Estonia**n surface water bodies are defined as pollution sensitive. Unfortunately, the wastewater treatment capacity of small-scale wastewater treatment plants (WWTPs) for the two nutrients nitrogen and phosphorus is often limited causing adverse impact on the coastal sea, water-courses, lakes and groundwater quality. Large part of the small WWTPs are more than 20 years old and some have been in operation even 40 years without any major renovation and are, therefore, depreciated and outdated. During the construction period some decades ago, eutrophication was not recognised as an important issue. Nutrient removal in these WWTPs is a critical issue because they were designed mainly for efficient removal of organic matter.

In sparsely populated areas common wastewater treatment methods are biological systems (activated sludge plants, bioponds, biofilm reactors, biofilters) constructed in 1970-1990 years. Infiltration and subsurface filtration are in use also. However, there are still thousands summer cottages, which do not have proper wastewater treatment system. Since 2013 new wastewater Regulation nr 99 set limits only for organic compounds for small (< 300 ie) wastewater treatment plants. However taking into account that Estonian waterbodies are vulnerable to pollution, also nutrient removal is needed. The most common treatment/control solution for them is the septic tank as well soil filters that is in use to store and partially treat domestic wastewater.

In **Finland**, almost 1 million inhabitants of the population (5.4 million) live in sparsely populated areas. In addition, according to Statistic Finland there were over half a million summer cottages in Finland in 2015, which means that one million vacationers are located outwith the municipal sewer network especially during holidays and weekends. In terms of area, Finland is the eighth largest country in Europe and the most sparsely populated country in the European Union. Almost 20 % of the people live in rural areas where small scale wastewater treatment systems are needed. A new government decree concerning wastewater treatment in areas outside sewer networks came into effect on 3.4.2017. The ordinance demands better purification levels than what the old settling wells can achieve. Many households will have to meet these demands during the upcoming four years, either by building a new wastewater treatment system or renewing the old ones.

The Environmental Protection Act defines the general obligations to treat wastewater, sewage treatment requirements, as well as treatment exceptions to the requirements situations. In practice, the law gives the opportunity for many different treatment system solutions how the requirements of emission reductions can be achieved. There exist several technical solutions, such as a holding tank, a soil filter and a package plant which purchase prices and power operating cost ratios vary. The most common waste water treatment methods in sparsely populated areas are infiltration, subsurface filtration and small WWTP (batch and biological filtration). Therefore it is need to select the treatment system with expertise and with adequate output data of performance of treatment system components and operating costs in different situations.

The most urgent problem in **Latvia** is that the draft law tries to resolve is the following: the municipal council is not authorized to approve the binding regulations that would determine the requirements for rendering water management services and usage (including decentralized sewage service rendering, account and usage) in the administrative territory of the municipality, as well as the administrative liability for breach of these requirements.

To ensure the rendering of the service in compliance with the approved assumptions and development forecasts, outlined in the feasibility study for the water management development of the administrative territory of the municipality, it is necessary to delegate more authority to the municipality as it is formulated in the „Law on municipalities". For instance, to provide the possibility to approve the regulations with requirements for rendering and usage of water management services. At this moment, this unsettled issue may also endanger the completion of project, financed by EU. In brief, the networks are constructed but the residents not always do connect to them.

Wastewater treatment in small settlements still creates a number of problems in **Lithuania**. This is particularly evident in the course of land reform and changing infrastructure of rural settlements and towns. More than 600 wastewater treatment facilities existed in rural areas and small settlements (up to 4000 PE) of Lithuania. Wastewater treatment plants of 250 m^3/d capacity in small settlements (up to 1000 PE) made 80 % of all wastewater treatment plants. Biological wastewater treatment is the most popular one in small settlements and is applied in 95 % of wastewater treatment plants (mechanical treatment makes 5 %).

The Regulation on the Application of Wastewater Treatment Systems draws the requirements for designing, establishment and use of waste water treatment facilities. The person keeping the collected waste water shall deliver them to the carrier of waste water for further treatment based on a valid service agreement for the transportation of waste water. Removing the waste water in the spots which are not assumed for that by the administration of local municipalities is forbidden.

In **Poland**, almost 14.7 million inhabitants of the population (38.6 million) live in sparsely populated areas. Problems connected with nutrient pollution in Poland are closely connected with the relatively high level of population in the catchment area. If we add to this the inefficiently developed wastewater collection and treatment system of Poland, we have a serious environmental problem.

According to Central Statistical Office, in Poland 90 % of population not connected to municipal wastewater treatment plants use holding tanks as a solution for wastewater management. There are 2 257 000 holding tanks in Poland, located mainly in rural areas. Improperly maintained holding tanks are often underestimated source of contamination of soil, groundwater and surface water. Only 35.3 % population of villages is connected to municipal wastewater treatment plants. In rural areas, on-site wastewater treatment is getting more and more popular. In 2013 15 871 on-site wastewater treatment plants with a total capacity of 25 012 m^3/d have been installed. However, still septic tank with the drainfield is the most popular solution for on-site wastewater management in Poland.

Nearly one million households in **Sweden** have no access to municipal water treatment facilities, relying instead on small-scale wastewater systems, mostly infiltration and drainfield systems. Some

700,000 of these households have flush toilets, where approximately 130,000 have no more than simple sewage sludge separation that fails to meet legal requirements in the Environmental Code. The environmental load from phosphorus and nitrogen released from these small-scale systems is heavy on Swedish lakes, rivers, and coastal waters with limited water exchange. Faulty treatment systems can cause odour nuisance, contaminate groundwater and bathing sites, and make drinking water unusable.

Legally, Swedish municipalities are both examining and supervisory authority for wastewater volumes up to 2,000 person equivalents (PE). As of 1 July 2011, The Swedish Agency for Marine and Water Management (SwAM, Havs- och vattenmyndigheten) is the supervisory guidance authority for small-scale systems up to 200 PE. Swedish EPA General Recommendations for Small Scale Wastewater Treatment Systems (NFS 2006:7) provide guidance for municipal authorities regarding enforcement of environmental and health safety safeguard requirements for these small-scale systems.

In all project countries, corrective activities for faulty systems are needed. Property owners are obligated to ensure that their systems function properly and to address faults. The environmental load from phosphorus and nitrogen released from small-scale systems is heavy on the Baltic Sea. The understanding and motivation to build and renovate the on-site wastewater systems is needed. Small-scale wastewater systems are significant sources of phosphorus release and are a significant factor in causing eutrophication in our waters.

The main challenge of this VillageWaters -project ('Water emissions and their reduction in village communities – villages in Baltic Sea Region as pilots') is to find out the most sustainable technological wastewater treatment solutions to decrease wastewater emissions of sparsely populated areas locally but also into the Baltic Sea to the level set by the EU water legislation. The main objective is to support the needs of households to avoid unnecessary investments and operating costs when shifting to improved waste water treatment and thus encourage them to implement new treatment systems. The work is conducted in 13 activities under four work packages in this project by 13 partners from Estonia, Finland, Latvia, Lithuania and Poland. The project's schedule is 1st of March 2016 until 28th of February 2019, including 6 periods. The budget is about 3 million euros that is mainly funded by Interreg Baltic Sea Region (BSR).

This report titled as 'A survey of available wastewater treatment technologies for sparsely populated areas' was published on 31st of August 2017 (period 3 of the project) on project website. The report is part of the activity A2.1 'A survey for compiling a comprehensive technology' in VillageWaters project. The aim of the A2.1 activity was to conduct large survey to collect data of wastewater treatment technological solutions in all partner countries. In addition, general legislation in EU and partner countries will be written here. So the summary of collected data and available legislation is presented in this User Manual. More detailed technological information was added to the report and published as a 2. version of this report in the end of February 2018.

2. EU legislation and directives

2.1. The EU Water Framework Directive (2000/60/EC)

Protection of waters should secure good quality of waters within whole community

On 23 October 2000, the "Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy" or, in short, the EU Water Framework Directive (or even shorter the WFD) was adopted. The overall purpose of the WFD, Good-quality water in Europe (EU Water Directive), is to establish a framework for the protection of European inland surface water, transitional waters, coastal waters and groundwater.

The purpose of the Directive was to establish a framework for the protection of European waters in order for **Member States to reach "good status" objectives for water bodies throughout the EU**. These efforts are based on a six-year cycle, whereby the WFD environmental objectives were to be met by 2015, provided that no deadline extension or exception was invoked. Member States that avail themselves of an extension beyond 2015 are required to achieve all WFD environmental objectives by the end of the second and third management cycles, which extend from 2015 to 2021 and 2021 to 2027 respectively (European Commission, 2012a).

The environmental objective of the WFD is to achieve 'good status' for all ground waters and surface waters by 2015 at the latest. "Good status" is a concept that on the one hand ensures protection of all water bodies in a holistic way, and on the other hand integrates quality objectives for specific bodies of water derived from other legislation, e.g. the Drinking Water and the Bathing Water Directives. For surface water, it consists of a general requirement for ecological protection ("good ecological status"), and a general minimum chemical standard ("good chemical status"). Good ecological status is defined in terms of the quality of the biological community, the hydrological characteristics and the chemical characteristics. The controls are specified as allowing only a slight departure from the biological community that would be expected in conditions of minimal anthropogenic impact, thus accounting for ecological variability between different waters.

Good chemical status is defined in terms of compliance with all the quality standards established for chemical substances at European level. For groundwater, the WFD takes a precautionary approach, and defines 'good status' both in terms of chemical purity and of balance between abstractions and natural recharge. Direct discharges are generally prohibited. To control pollution from indirect discharges, there is a requirement to monitor groundwater bodies in order to detect changes in chemical composition and reverse pollution trends. In addition, the Directive also deals with groundwater quantity. There is only a certain amount of recharge back into groundwater each year; of this recharge, some is needed to support connected ecosystems (whether they be surface water bodies or terrestrial systems such as wetlands).

WHAT IS THE AIM OF THE DIRECTIVE?

It sets out rules to halt deterioration in the status of European Union (EU) water bodies and achieve 'good status' for Europe's rivers, lakes and groundwater by 2015.

Specifically, this includes:

- protecting all forms of water (surface*, ground*, inland* and transitional*);
- restoring the ecosystems in and around these bodies of water;

- reducing pollution in water bodies;
- guaranteeing sustainable water usage by individuals and businesses.

KEY POINTS

The legislation places clear responsibilities on national authorities. They have to:

- identify the individual river basins on their territory — that is, the surrounding land areas that drain into particular river systems;
- designate authorities to manage these basins in line with the EU rules;
- analyse the features of each river basin, including the impact of human activity and an economic assessment of water use;
- monitor the status of the water in each basin;
- register protected areas, such as those used for drinking water, which require special attention;
- produce and **implement 'river-basin management plans'** to prevent deterioration of surface water, protect and enhance groundwater and preserve protected areas;
- ensure the cost of water services is recovered so that the resources are used efficiently and polluters pay;
- provide public information and consultation on their river-basin management plans.

Source: http://ec.europa.eu/environment/water/water-framework/info/intro_en.htm

Legislation available in English:
http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32000L0060

2.2. The Urban Waste Water Treatment Directive (91/271/EEC)

Article 14: Sludge arising from waste water treatment shall be re-used whenever appropriate. Disposal routes shall minimize the adverse effects on the environment.

The Urban Wastewater Treatment Directive (91/271/EEC) is the main regulative document concerned with the treatment of wastewater in the whole EU area. The objective of the EU Urban Wastewater Directive (91/271/EEC) is to protect the environment from adverse impact from urban waste water discharges and from certain industrial processes. This includes the following requirements:

• All urban areas (where appropriate considering size and location) shall have a collection system for wastewater before 1998, 2000 or 2005.

• The water piped in a collection system shall be processed through no less than secondary treatment. This generally involves biological treatment or a similar process so the water complies with set quality standards.

• The treated water must meet specific minimum requirements in regard to water quality.

• When the wastewater is released to sensitive environments (sensitive to added nutrients) significantly stricter requirements are set for effective treatment.

The Directive applies to all wastewater collected in sewage systems, but quantitative requirements apply only to treatment plants serving more than 2,000 persons. Minimum demand for wastewater treatment for conurbations with more than 2000 inhabitants. **Require also smaller conurbations to have proper wastewater treatment**

This Directive sets **minimum sewage treatment standards** to be achieved in stages by the end of 2005, and provides for advanced waste water treatment for the removal of nitrogen and phosphorus from sensitive areas. **Sensitive areas are defined** as: areas particularly susceptible to eutrophication, surface waters intended for the abstraction of drinking water with high nitrate levels, and other waters that require a higher standard of treatment to satisfy the requirements of other Directives.

The article 14 prohibits the disposal of sludge to surface waters since 31/12/1998, and specifies that from 31/12/1998 onwards, the disposal of sludge from urban waste water treatment plants is subject to general rules, registration or authorisation. In addition, this Directive introduces detailed monitoring requirements and requires Member States to submit reports every two years on their sludge disposal activities.

WHAT IS THE AIM OF THE DIRECTIVE?

• It aims to protect the environment in the European Union (EU) from the adverse effects (such as eutrophication) of urban wastewater

• It sets out EU-wide rules for collection, treatment and wastewater discharge. The law also covers wastewater generated by industries such as the agro-food industries (like food-processing and brewing).

KEY POINTS

- EU countries must:
  - collect and treat wastewater in urban settlements with a population of at least 2,000 and apply secondary treatment on the collected wastewaters;
  - apply more advanced treatment in urban settlements with populations over 10,000 located in designated sensitive areas;
  - guarantee that treatment plants are properly maintained, so as to ensure sufficient performance, and can operate under all normal weather conditions;
  - take measures to limit the pollution of receiving waters from storm water overflows under extreme situations, such as unusually heavy rain;
  - monitor the performance of treatment plants and receiving waters;
  - **monitor sewage sludge disposal and re-use**.
- As well as outlining methods for the monitoring and evaluation of results, Annex I lists general requirements for:
  - collecting systems;
  - discharges from urban wastewater treatment plants, including emission limit values for these;
  - industrial wastewater discharged into urban collecting systems.

- Annex II describes the criteria for the **identification of sensitive and less sensitive areas**.
- The last available report from the European Commission on the implementation status and implementation programmes, published in 2016, notes that this directive has played an essential role in improving the quality of EU waters. However, there are still some implementation gaps, especially concerning the appropriate treatment level. The investments performed so far and planned by the EU countries are considerable, but are indispensable to bridge the above-mentioned gap and also to maintain compliance. Furthermore, the substantial contribution from the urban waste water sector to economic growth and the creation of jobs is significant.

Legislation available in English:
http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31991L0271

2.3. The Waste Framework Directive (2008/98/EC)

The polluter-pays principle is a guiding principle at European and international levels. The waste producer and the waste holder should manage the waste in a way that guarantees a high level of protection of the environment and human health.

Directive 2008/98/EC, DIRECTIVE 2008/98/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 19 November 2008 on waste and repealing certain Directives, sets the basic concepts and definitions related to waste management, such as definitions of waste, recycling, recovery. It explains when waste ceases to be waste and becomes a secondary raw material (so called end-of-waste criteria), and how to distinguish between waste and by-products. The Directive lays down some basic waste management principles: it requires that **waste be managed without endangering human health and harming the environment, and in particular without risk to water, air, soil, plants or animals**, without causing a nuisance through noise or odours, and without adversely affecting the countryside or places of special interest.

The Directive introduces the "polluter pays principle" and the "extended producer responsibility". The legislation does not cover certain types of waste such as radioactive elements, decommissioned explosives, faecal matter, waste waters and animal carcasses.

WHAT DOES THE DIRECTIVE DO?

It establishes a legal framework for treating waste in the EU. This is designed to protect the environment and human health by emphasising the importance of proper waste management, recovery and recycling techniques to reduce pressure on resources and improve their use.

KEY POINTS

- The legislation establishes a waste hierarchy: prevention, re-use, recycling, recovery for other purposes such as energy and disposal.
- It confirms the ‘polluter pays principle’ whereby the original waste producer must pay for the costs of waste management.
- It introduces the concept of ‘extended producer responsibility’. This may include an onus on manufacturers to accept and dispose of products returned after use.

- It makes a distinction between waste and by-products.
- Waste management must be carried out without any risk to water, air, soil, plants or animals, without causing a nuisance through noise or smells, or harming the countryside or places of special interest.
- Producers or holders of waste must treat it themselves or have it handled by an officially recognised operator. They require a permit and are inspected periodically.
- Competent national authorities must establish waste management plans and waste prevention programmes.
- Special conditions apply to hazardous waste, waste oils and bio-waste.
- It introduces recycling and recovery targets to be achieved by 2020 for household waste (50 %) and construction and demolition waste (70 %).
- The legislation does not cover certain types of waste such as radioactive elements, decommissioned explosives, faecal matter, **waste waters** and animal carcasses.

Legislation available in English:
http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32008L0098

2.4. The Nitrates Directive (91/676/EEC)

The directive on nitrates from agricultural sources is important in rural areas where sludge has to be separated from wastewater

The Nitrates Directive, COUNCIL DIRECTIVE of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources (91 / 676 /EEC), aims to protect water quality across Europe by preventing nitrates from agricultural sources polluting ground and surface waters and by promoting the use of good farming practices. The Nitrates Directive forms an integral part of the Water Framework Directive and is one of the key instruments in the protection of waters against agricultural pressures.

The Nitrates Directive aims at mitigating the negative effects of fertilisation on drinking water sources and ecosystems by limiting the input of inorganic fertilisers and manure on farmland. To this aim, Member States must identify waters affected by pollution caused or induced by nitrates from agricultural sources, as well as waters that could be affected by such pollution. Those waters and all known areas draining into those waters must be designated as '**vulnerable zones**'. For these zones Member States must then establish and implement action programmes to reduce pollution. Alternatively, action programmes may be implemented throughout the national territory; in this case the designation of vulnerable zones is not necessary. Action programmes under the Nitrates Directive include limits for the spreading of manure and chemical fertilisers. For areas outside the vulnerable zones reduction of pollution has to be promoted by (voluntary) codes of good agricultural practice. Member States are in this context obliged to **monitor the nitrate concentrations in groundwater and surface waters, as well as eutrophication in surface waters**.

WHAT DOES THE DIRECTIVE DO?

It aims to reduce water pollution from nitrates used for agricultural purposes and to prevent any further pollution. It is closely linked to other EU policies which address air and water quality, climate change and agriculture.

KEY POINTS

EU countries must:

- designate as vulnerable zones all those draining into waters which are or could be affected by high nitrate levels and eutrophication. The designation is reviewed and possibly revised at least every 4 years to take account of any changes that occur;
- establish mandatory action programmes for these areas, taking into account available scientific and technical data and overall environmental conditions;
- monitor the effectiveness of the action programmes;
- test the nitrate concentration in fresh ground and surface water at sampling stations, at least monthly and more frequently during flooding;
- carry out a comprehensive monitoring programme and submit every 4 years, a comprehensive report on the implementation of the Directive. The report includes information on nitrate-vulnerable zones, results of water monitoring, and a summary of the relevant aspects of codes of good agricultural practices and action programmes;
- draw up a code of good agricultural practice which farmers apply on a voluntary basis. It sets out various good practices, such as when fertiliser use is inappropriate;
- provide training and information for farmers, where appropriate.

The European Commission provides a report every 4 years on the basis of the national information it has received.

Legislation available in English:
http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31991L0676

2.5. The protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture (86/278/EEC)

Sets rules on how farmers can use sewage sludge as a fertiliser, to prevent it harming the environment and human health, by compromising the quality of the soil or surface and ground water.

The Sewage Sludge Directive 86/278/EEC seeks to encourage the use of sewage sludge in agriculture and to regulate its use in such a way as to prevent harmful effects on soil, vegetation, animals and man. To this end, it prohibits the use of untreated sludge on agricultural land unless it is injected or incorporated into the soil. Treated sludge is defined as having undergone "biological, chemical or heat treatment, long-term storage or any other appropriate process so as significantly to reduce its fermentability and the health hazards resulting from its use". To provide protection against potential health risks from residual pathogens, sludge must not be applied to soil in which fruit and vegetable crops are growing or grown, or less than ten months before fruit and vegetable crops are to be harvested. Grazing animals must not be allowed access to grassland or forage land less than three weeks after the application of sludge. The Directive also requires that sludge should be used in such a way that account is taken of the nutrient requirements of plants and that the quality of the soil and of the surface and groundwater is not impaired.

The Directive specifies rules for the sampling and analysis of sludges and soils. It sets out requirements for the keeping of detailed records of the quantities of sludge produced, the quantities used in agriculture, the composition and properties of the sludge, the type of treatment and the sites where the sludge is used. Limit values for concentrations of heavy metals in sewage sludge intended for agricultural use and in sludge-treated soils are in Annexes I A, I B and I C of the Directive.

WHAT DOES THE DIRECTIVE DO?

It sets rules on how farmers can use sewage sludge as a fertiliser, to prevent it harming the environment and human health, by compromising the quality of the soil or surface and ground water.

To this end, it sets limits on the concentrations allowed in soil of 7 heavy metals that may be toxic to plants and humans; cadmium, copper, nickel, lead, zinc, mercury and chromium. It bans the use of sewage sludge that leaves concentrations over these limits.

KEY POINTS

The specific limits are in the directive’s annexes:

- Annex IA - heavy metals in the soil,
- Annex IB - heavy metals in sludge,
- Annex IC - maximum annual quantities of heavy metals that may be added to the soil.

Normally, sludge has to be treated before being used in farming. However, in some EU countries farmers may be allowed to use untreated sludge if it is injected or worked into the soil.

In certain situations, sludge may not be used at all in farming:

- on grassland or forage crops that are going to be grazed by animals and for a minimum 3 weeks before crops are due to be harvested,
- on fruit and vegetable crops during the growing season. This rule doesn't include fruit trees,
- on soil used to grow fruit and vegetable crops that are usually in direct contact with the soil and eaten raw. This ban applies for 10 months before the harvest and during the harvest itself. Responsibility for ensuring farmers' use of sludge does not exceed the legal limits lies with national authorities, who have to sample and analyse sludge and the soil it is used on and keep a record of:
- how much is produced and used in farming,
- its composition and properties,
- how it has been treated,
- where it is used and who uses it.

The European Commission publishes a regular report on sludge use in EU farming, which brings together the information reported by individual countries on this subject.

Directive 86/278/ EEC was adopted over 20 years ago with a view to encourage the application of sewage sludge in agriculture and to regulate its use, so as to present harmful effects on soil, vegetation, animals and humans.

The European Commission is currently assessing whether the current Directive should be reviewed – and if so, the extent of this review. For example, Directive 86/278/EEC sets limit values for seven heavy metals. Since its adoption, several Member States have enacted and implemented stricter limit values for heavy metals and set requirements for other contaminants.

Legislation available in English:

http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:31986L0278

2.6. Construction Products Regulation (CPR), (EU) No 305/2011

This Regulation sets out the conditions for the marketing of construction products. It also defines criteria for assessing the performance of such products, and the conditions of use for CE marking.

The Construction Products Regulation (CPR) lays down harmonised rules for the marketing of construction products in the EU. The Regulation provides a common technical language to assess the performance of construction products. It ensures that reliable information is available to professionals, public authorities, and consumers, so they can compare the performance of products from different manufacturers in different countries.

Where a manufacturer decides to place a construction product on the market and that product is covered by a harmonised standard, it must complete a declaration of performance which contains, in particular, the following information:

•the product reference;
•the systems of assessment and verification of constancy of performance of the product;
•the intended use or uses for the product;

•declared performance.

Once the declaration of performance has been drawn up, the manufacturer must affix CE marking to the product.

Member States are to designate Product Contact Points for Construction pursuant to Regulation (EC) No 764/2008. These Contact Points have the task of providing information on the requirements for construction products and avoiding conflicts of interest.

Certain obligations are imposed upon economic operators:
• Obligations of manufacturers: they must provide the declaration of performance and technical documentation, and affix CE marking to the product. They must also ensure that their construction products bear a type number to facilitate identification. Furthermore, manufacturers must withdraw their products from the market if they consider that they are not in conformity with the declaration of performance, or change the declaration.

• Obligations of importers: they must check that technical documentation accompanies the product and that it bears CE marking. They must indicate their name, registered trade name or registered trade mark, and their contact address. They must ensure that the product is accompanied by instructions and safety information and that transport has not jeopardised performance.

• Obligations of distributors: they must ensure that the product bears CE marking and that it is accompanied by the documents described above. If they consider that the product is not compliant, they must not place it on the market. They must ensure that the product is stored in optimal conditions so as not to jeopardise performance.

Harmonised technical specifications include harmonised standards. These shall be drawn up by European standardisation bodies pursuant to Directive 98/34/EC. Harmonised standards serve the purpose of defining methods and assessment criteria for construction product performance. They refer to an intended use for the products covered by the standard and include the technical details necessary for the implementation of the system of assessment and verification of the constancy of performance. References to harmonised standards are published in the Official Journal of the European Union.

If a product is not covered by a harmonised standard, manufacturers may request European Technical Assessments in order to obtain European Assessment Documents issued by Technical Assessment Bodies (TABs).

Legislation available in English:
http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32011R0305

2.7. Establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive), 2008/56/EC

The aim is to protect more effectively the marine environment across Europe.

The Marine Directive aims to achieve Good Environmental Status (GES) of the EU's marine waters by 2020 and to protect the resource base upon which marine-related economic and social activities depend. It is the first EU legislative instrument related to the protection of marine biodiversity, as it contains the explicit regulatory objective that "biodiversity is maintained by 2020", as the cornerstone for achieving GES.

The Directive enshrines in a legislative framework the ecosystem approach to the management of human activities having an impact on the marine environment, integrating the concepts of environmental protection and sustainable use.

In order to achieve its goal, the Directive establishes European marine regions and sub-regions on the basis of geographical and environmental criteria. The Directive lists four European marine regions – the Baltic Sea, the North-east Atlantic Ocean, the Mediterranean Sea and the Black Sea – located within the geographical boundaries of the existing Regional Sea Conventions. Cooperation between the Member States of one marine region and with neighbouring countries which share the same marine waters, is already taking place through these Regional Sea Conventions.

In order to achieve GES by 2020, each Member State is required to develop a strategy for its marine waters (or Marine Strategy). In addition, because the Directive follows an adaptive management approach, the Marine Strategies must be kept up-to-date and reviewed every 6 years.

WHAT IS THE AIM OF THE DIRECTIVE?

• It establishes a common approach and objectives for the prevention, protection and conservation of the marine environment against damaging human activities.

• It requires European Union (EU) countries to develop strategies to achieve ‘good environmental status’* by 2020. The strategies, which span over 6-year cycles, need to include measures that protect the marine ecosystem and that ensure economic activities linked to the marine environment are sustainable.

• It emphasises the need for EU countries to cooperate with their neighbours in the marine regions (North-East Atlantic, Baltic, Mediterranean and Black Sea), namely when devising and implementing their marine strategies. The use of existing regional governance structures, such as Regional Sea Conventions, is therefore an important element to be considered by EU countries.

• It recognises the importance of spatial protection measures for the marine environment, thereby contributing to the creation of a global network of marine protected.

KEY POINTS

• EU countries, as part of their marine strategies, must assess the environmental status of their marine waters and the impact of human activities (including a socioeconomic analysis). They must

establish what is 'good environmental status' for their marine waters and set environmental targets. They must then develop monitoring programmes and prepare programmes of measures.

• EU countries' evaluations of their waters help improve the knowledge of Europe's marine waters. This is also supported by programmes such as Marine knowledge or Copernicus.

• Europe's seas are divided into four marine regions: the Baltic Sea, the North-East Atlantic, the Mediterranean and the Black Sea. Countries working in the same marine regions are required to coordinate their actions.

• Monitoring programmes are drawn up to measure and evaluate progress in reaching the objectives. If certain objectives are not met, EU countries must explain why and can, if necessary, apply certain exceptions.

• The directive contains a set of qualitative 'descriptors' for EU countries to consider when devising their strategies to achieve good environmental status of their waters. These include: • maintaining biodiversity;

• engaging in sustainable fishing;

• safeguarding the seabed; and

• keeping marine litter and contaminants in check.

The directive builds on existing EU legislation and covers specific elements of the marine environment not addressed in other policies, such as the Water Framework Directive, the Habitats and Birds Directives.

RECENT DEVELOPMENTS

• The EU's experience in developing a sustainable approach to ocean management through the Marine Strategy Framework Directive is seen as an important contribution to the European Commission's 2016 vision on Ocean Governance.

• In 2015, the Commission reported significant progress in establishing marine protected areas in the EU's seas, with benefits for the economy and the environment. Under the UN Convention on Biological Diversity, the EU has committed to ensure the conservation of 10% of its coastal and marine areas by 2020.

• In 2014, the Commission reviewed the first steps in the implementation of the directive. Since then, EU countries have established their monitoring programmes, the Commission's assessment of which is expected shortly. EU countries should have also submitted their programmes of measures to the Commission by March 2016.

• Innovation in the blue economy is identified as a means by which cost-effective marine protection measures contributing to the implementation of the Marine Strategy Framework Directive can be developed.

• The Marine Strategy Framework Directive serves as an environmental guideline for the Directive on Maritime Spatial Planning published in 2014.

• The latter is a part of the integrated maritime policy (IMP), which aims for the implementation of an optimal ocean management and maritime governance.

Legislation available in English:
http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32008L0056

3. National legislation and implementation of directives

3.1. Estonia

Estonia has three river basin districts (East-Estonia river basin, West-Estonia river basin, Koiva river basin), out of which two are international sharing water courses with Russia to the east and Latvia to the south. The River Basin Management Plans for East-Estonia, West-Estonia and Koiva river basins were adopted by the Government on 1 April 2010. River Basin Management plans for each river basin are established for six years and are then updated. The current valid Water Management plans have been drawn up for the period of 2009-2015.

To reach the environmental goals of protecting the areas stated in the Water Management plans and areas in need of protection, a program of measures will be developed where measures of water usage and protection shall be stated to be taken into account in establishing, reviewing and amending the general and detailed zoning plans and public water supply and sewerage system development plans of local authorities. The implementation of the program is organised by the Commission for Water Management. In general, according to the timetable presented by Ministry of the Environment, now they are working on implementation of Article 14.1 (Public information and consultation) - a timetable and work program for the production of the plan (2015-2021).

Estonia has the following national acts and regulations: Water Act; Public Water Supply and Sewage Act; the Regulation of the Government of Estonia no 99, 29 November 2012 “The requirements of wastewater treatment and discharging waste and storm water to the recipient, the limit values for waste and storm water pollution indicators and the control measures of the compliance check” (RT I, 04/12/2012, 1); Regulation of the Government of Estonia no 171, 16 May 2001 “Water protection measures of sewer works” (RT I 2001, 47, 261); Regulation of the Government of Estonia no 57, 19 March 2009 “The criteria for designate agglomeration areas” (RT I 2009, 19, 125); Regulation of the Minister of Environment no 78, 30 December 2002 “Requirements of using sewage sludge in agriculture, landscaping and re-cultivation” (RTL 2003, 5, 48) etc.

According to the Estonian Local Government Organisation Act, a local government should organise, in addition to other duties, water supply and sewerage, maintenance, waste management and territorial planning in a relevant rural municipality or town. According to the Public Water Supply and Sewerage Act, a local government should develop a Public Water Supply and Sewerage Development Plan, which is consistent with a Sub-River Basin Management Plan.

3.1.1. Water Act

Regulates the use and protection of water, relations between landowners and water users and the use of public water bodies and water bodies designated for public use.

An area in need of protection refers to an area of land or water where environmental requirements more stringent than usual and restrictions arising from these requirements apply. For the purposes of this Act, "areas in need of protection" mean: the sanitary protection zones of the water intakes that are used for abstraction of drinking water and the productivity of which per day as set out in the design is over 10 m^3, or which service more than 50 people; areas designated as recreational waters, including bathing waters and bathing areas; nutrient-sensitive areas, including nitrate sensitive areas; areas designated for the protection of habitats or species on the basis of the Nature Conservation Act where the maintenance or improvement of the status of water is an important protective factor and areas designated for the protection of economically significant aquatic species; pollution sensitive effluent recipients.

According to Water Act, all effluent recipients are pollution sensitive in Estonia.

For the special use of water, a user shall hold a permit. A permit for the special use of water is necessary if:

1) water is abstracted from a surface water body, including if ice is abstracted in a volume of more than 30 m^3 per day;
2) groundwater is abstracted in a volume of more than 5 m^3 per day;
3) mineral water is abstracted;
4) effluent or other pollutants are discharged into a recipient, including to groundwater.

The discharge of wastewater into groundwater and the discharge of wastewater and effluent onto frozen soil are prohibited.

Population equivalent (PE) means the unit of average potential water pollution load caused by one person per day. The value of the PE expressed through the biological oxygen demand (BOD7) is 60 grams of oxygen per day.

Requirements for and limits of wastewater treatment and discharging effluent and storm water into a recipient and the measures to be taken to verify that the requirements are met shall be established by a regulation of the Government of the Republic. The established requirements shall depend on the pollution load arising in the agglomeration and on the status class of the water body. If there is no agglomeration for the purposes of this Act, the requirements shall depend on the pollution load of the wastewater treatment plant and on the status class of the water body.

Wastewater shall be treated before discharging into a recipient up to the limits or treatment levels established by the regulation of the Government of the Republic no 99 on the spot, or transported or discharged into a wastewater treatment plant.

When discharging effluent into a recipient whose status class is poor or bad, the issuing authority of permits for the special use of water may impose requirements that are up to 30 percent more stringent than those established by the regulation of the Government of the Republic no 99 on effluent discharged to the recipient.

When discharging effluent into a recipient whose quality indicators deteriorate due to discharging effluent to the recipient and there is a threat that the status class of the water body will deteriorate, the issuing authority of permits for the special use of water may impose requirements that are up to

15 percent more stringent than those established by the regulation of the Government of the Republic no 99 on effluent.

Available in English: https://www.riigiteataja.ee/en/eli/520062017004/consolide

3.1.2. Estonian Public Water Supply and Sewerage Act

Water shall be extracted from a public water supply system and wastewater shall be conducted to a public sewerage system on the basis of a contract between a client and a water undertaking.

Estonian Public Water Supply and Sewerage Act regulates the organisation of water supply and the collection and treatment of wastewater, storm water, drainage water and other soil and surface water through the public water supply and sewerage system, as well defines the rights and obligations of the state, local governments, water users and clients.

"Public water supply and sewerage system" means a system of structures and equipment by which registered immovables are supplied with water and by which wastewater is led off and which is administered by a water undertaking or serving more than 50 persons. Public water supply and public sewerage system separately or both together are deemed to be public water supply and sewerage system.

Structures and equipment for leading off stormwater, drainage water and other soil water and surface water are deemed to be part of a public water supply and sewerage system unless the local government decides otherwise.

A public water supply and sewerage system may be in the ownership of a person in public law or a person in private law.

In an area covered by a public water supply and sewerage system, inhabitants have the right to receive water from the public water supply system and conduct wastewater to the public sewerage system.

Water shall be extracted from a public water supply system and wastewater shall be conducted to a public sewerage system on the basis of a contract between a client and a water undertaking (a legal person in private law who supplies the water supply facilities of a registered immovable of a client through the public water supply system with water or organises leading off from the sewerage facilities of a registered immovable of a client and treatment of wastewater, stormwater, drainage water and other soil and surface water).

A public water supply and sewerage system shall be constructed on the basis of a public water supply and sewerage development plan approved by the local government council. A local government shall organise the preparation of a public water supply and sewerage development plan.

The Act also regulates the price of water services. The Act stipulated that the price of the service should not be discriminatory with regard to different clients or groups of clients.

Available in English: https://www.riigiteataja.ee/en/eli/525042014001/consolide

3.1.3. Regulation on the criteria for designate agglomeration areas (no 57)

The determination of the agglomeration area is based on the groundwater vulnerability, taking into account the socioeconomic criterion and environmental considerations, including the surface water sensitivity.

Regulation of the Government of Estonia no 57, 19 March 2009 on the criteria for designate agglomeration areas.

The agglomeration area is determined for a settlement with a population of more than 50 people, with the minimum size of the designated wastewater collection area being 5 ha. The determination of the agglomeration area is based on the groundwater vulnerability, taking into account the socioeconomic criterion and environmental considerations, including the surface water sensitivity.

In protected or relatively protected groundwater areas, a wastewater collection area must be formed where more than 20 PE of organic pollution per hectare are generated, for moderately protected areas 15 PE and weakly protected or unprotected areas more than 10 PE.

On the basis of the written proposal of the Environmental Department, the agglomeration area for the purpose of protecting groundwater and surface water may form in the case of pollution loads lower than the pollution load provided in the regulation, if it is in terms of environmental protection and socio-economically justified.

In determining the agglomeration area, the social-economic criteria for paying public water supply and sewerage services shall be taken into account, according to which the expenses of one household member to the public water supply and sewerage service cannot exceed 4 % of the average net income of one household member in his county of residence.

3.1.4. Regulation on water protection measures of sewer works (no 171)

Water protection requirements for sewerage systems are planning, construction and operation requirements for sewerage buildings.

Regulation of the Government of Estonia on water protection measures of sewer works (regulation no 171).

The regulation provides water protection requirements for a wastewater collection, treatment or discharging to the recipient constructed sewerage pipeline, wastewater treatment plant, pumping station or other wastewater collection, treatment and wastewater treatment plant, building or facility (sewerage construction) that is built for collecting, treating or discharging wastewater to the recipient. Impact of pollution from a wastewater treatment plant that affects or is likely to cause damage to human health or the environment, including causing damage to property or aggravating or preventing the use of the environment for rest or other legitimate means, shall not extend beyond special protection zone. Protection zone should be between 25 and 500 meters depending on WWTP pollution load (50 – 299; 300 - 1999; 2 000 - 9 999; 10 000 -100 000 PE), used wastewater treatment and sludge treatment technology.

Available only in Estonian: https://www.riigiteataja.ee/akt/13305356?leiaKehtiv

3.1.5. Regulation on the wastewater treatment and requirements of waste- and storm water discharges (no 99)

The requirements for wastewater treatment, waste- and storm water discharges as well thresholds and verification of compliance with the requirements.

Based on the Water Act, a Regulation on the wastewater treatment and requirements of waste- and storm water discharges into receiving water, waste- and storm water pollutants thresholds and compliance verification measures (regulation nr 99) adopted by the Government in Estonia. Regulation introduces the requirements for wastewater treatment, waste- and storm water discharges as well thresholds and verification of compliance with the requirements. When discharging waste and storm water effluents should not worsen state of aquatic and terrestrial ecosystems. Regulation set treatment efficiency and wastewater concentration limits for outlets by BOD, COD, suspended solids, total nitrogen, total phosphorus, hydrocarbon, pH and etc. Since 2013, in case of small size of WWTPs < 300 PE, the focus is on removal of organic compound. Nutrient removal from household and small villages is not regulated (Table 1). It can probably be explained also by the fact that existing technologies for handling both black and grey waters are not cost-effective.

Table 1. Wastewater limit values (regulation 99) in Estonia.

Pa-rame-ter	Agglomeration pollution load									
	< 300 PE		300-1999 PE		2000-9999 PE		10 000-99 999 PE		100 000 PE and >	
	LV, mg/l	R, %	LV, mg/l	R, %	LV, mg/l	R, %	LV, mg/l	R, %	LV, mg/l	R, %
BOD7	40	is not adapted	25	80	15	80	15	80	15	80
COD	150	is not adapted	125	75	125	75	125	75	125	75
TP	is not adapted	is not adapted	2	70	1	80	0,5	90	0,5	90
TN	is not adapted	is not adapted	60	30	45	30	15	80	10	80
SS	35	70	35	70	25	80	15	90	15	90

Remark: LV- limit value; R – reduction

Effluent discharged to the karst lake should conform to the limit values established for agglomerations with the pollution load of more than 100 000 PE. Effluent does not contain more than 0.1 mg/l nitrites and more than 45 mg/l nitrates. Water permit could specify limit value for coliform bacteria.

Waste- and stormwater infiltration depth shall be during the whole year of at least 1.2 m above the groundwater highest level and remain higher than 1.2 m above the bedrock.

If the effluent into a distant body of water is not economically justified, and groundwater degradation risk does not exist, it is allowed discharge the effluent into the soil according to the following volumes:

1) up to 50 m^3 per day for protected, relatively protected and with moderately protected groundwater areas after biological wastewater treatment;
2) up to 5 m^3 per day for protected, relatively protected and with moderately protected groundwater areas using at least the mechanical wastewater treatment;
3) up to 5 m^3 per day for poorly protected groundwater areas after the mechanical wastewater treatment if treated only domestic wastewater, except for wastewater from water closets;
4) up to 10 m^3 per day for unprotected and poorly protected groundwater areas after biological wastewater treatment;
5) 10-50 m^3 per day for unprotected and poorly protected groundwater areas after tertiary treatment of wastewater, effluent shall meet the requirements set for the agglomerations with pollution load more than 100 000 PE and effluent does not contain more than 0.1 mg/l nitrites and more than 45 mg/l nitrates. Water permit could specify limit value for coliform bacteria.

Waste- and stormwater discharge into the soil is not allowed in the sanitary protection or the maintenance area of the water intake, and not less than 50 m from the outer boundary of the sanitary protection or maintenance, area and not less than 50 m from the water intake, which has no sanitary protection or maintenance area, or dug wells used for drinking water.

Hazardous substances should not be present in the waste- and stormwater discharged into the water body or soil or these substances content in the waste- and stormwater should not be over limit values presented in the regulation 99.

https://www.riigiteataja.ee/aktilisa/1161/2201/6006/VV_99m_lisa3.pdf#

Available only in Estonian: https://www.riigiteataja.ee/akt/116122016006?leiaKehtiv

3.1.6. Regulation on requirements of using sewage sludge in agriculture, landscaping and recultivation (no 78)

Regulates the use of sewage sludge in agriculture, landscaping and recultivation.

Regulation of the Minister of Environment no 78 on requirements of using sewage sludge in agriculture, landscaping and recultivation.

The regulation regulates the use of sewage sludge in agriculture, landscaping and recultivation in order to prevent its harmful effects on surface and groundwater, soil, plants, animal and public health. In agriculture, only a stabilized and hygienic sediment should be used.

Concentration of heavy metals, Cd, Cu, Ni, Pb, Zn, Hg and Cr, in sludge for use in agriculture landscaping and recultivation is limited.

Available only in Estonian: https://www.riigiteataja.ee/akt/119122015008?leiaKehtiv

3.1.7. Regulation on requirements of product manufacturing from sewage sludge (no 24)

Set the limit values and safety requirements for sewage sludge.

Regulation of Environment Minister no 24, 19.07.2017 on Requirements of product manufacturing from sewage sludge.

The regulation establishes requirements for the treatment of domestic sewage sludge, as well as safety indicators and quality limit values, in case of which domestic sewage sludge ceases to be waste.

Places used for sewage sludge applications are as follows:

1) agricultural land used for the production of agricultural products and for the production of short rotation coppice;
2) in landscaping for the establishment or repair of high or low vegetation in greenery and greenery zones;
3) during recultivation to tidy up or reuse area damaged by the extraction of mineral resources or in the preparation of reuse in some other way damaged area or to cover landfills

Limit values and safety requirements for product indicators for sewage sludge are in Appendix 2 of the regulation https://www.riigiteataja.ee/aktilisa/1280/7201/7004/KKM_19072017_m24_lisa2.pdf#

Available only in Estonian: https://www.riigiteataja.ee/akt/128072017004

3.1.8. Regulation on procedures for establishing surface water bodies (no 44)

Set the quality class boundaries, limit values, of hydrochemical variables, for Estonian rivers

Minister of the Environment Regulation no. 44 of 28 July 2009, Procedures for establishing surface water bodies, list of surface water bodies whose status class is to be determined, status classes for surface water bodies and procedures for determining quality indicator values corresponding to the status classes.

The Regulation establishes the procedure for the formation of surface waterbodies of watercourses, standing and coastal waterbodies, a list of the surface water bodies to be determined, the status classes of surface waterbodies, including the ecological and chemical status classes, the quality indicators corresponding to the status classes, and the procedure for determining the status classes.

The purpose of the Regulation is to ensure the protection of water bodies through the assessment of the status of water bodies and the determination of the status classes of surface water bodies in a way that enables the effective planning and implementation of water protection measures.

All the Estonian rivers are lowland rivers flowing at the height below 200 m. Five categories of catchment areas have been distinguished on the basis of the catchment areas of rivers between 10–100 km^2 (small), >100–1000 km^2 (medium-sized), >1000–10000 km^2 (large) and over 10000 km^2

(very large). Typology of rivers in Estonia is based on size and geological characteristics (soil conditions), and content of organic material - having low organic content (light water, A) or high organic content (dark waters, B), (low content – COD Mn <25mg/l, high content – COD Mn >25mg/l).

River types are following:

1) type I A – darkwater and humic (CODMn 90 percentile value over 25 mgO/l) rivers with catchment area 10–100 km^2;

2) type I B – light water and low organic content (CODMn 90 percentile value under 25 mgO/l) rivers with catchment area 10–100 km^2;

3) type II A – darkwater and humic (CODMn 90 percentile value over 25 mgO/l) rivers with catchment area 100–1000 km^2;

4) type II B – light water and low organic content (CODMn 90 percentile value under 25 mgO/l) rivers with catchment area 100 -1000 km^2;

5) type III A – darkwater and humic (CODMn 90 percentile value over 25 mgO/l rivers with catchment area 1000–10 000 km^2;

6) type III B – light water and low organic content (CODMn 90 percentile value under 25 mgO/l) rivers with catchment area 1000 – 10 000 km^2;

7) type IV – rivers with catchment area over 10 000 km^2.

The quality class boundaries, limit values, of hydrochemical variables, for Estonian rivers are listed in Table 2 and Table 3.

Table 2. The quality class boundaries, limit values, of hydrochemical variables - Estonian rivers, catchment types I, II, III.

Indicator	River	Unit	High	Good	Moderate	Poor	Bad
O_2 %	Type A Type B	Saturation %	>60 >70	60-50 70-60	<50-40 <60-50	<40-35 <50-40	<35 <40
BOD5	Type A Type B	mg O_2/l	<2.2 <1.8	2.2-3.5 1-8-3.0	>3.5-5.0 >3.0-4.0	>5.0-7.0 >4.0-5.0	>7.0 >5.0
Tot-N	all types	mg N/l	<1.5	1.5-3.0	>3.0-6.0	>6.0-8.0	>8.0
Tot-P	all types	mg P/l	<0.05	0.05-0.08	>0.08-0.1	>0.1-0.12	>0.12
NH4	all types	mg N/l	<0.1	0.1-0.3	0.3-0.45	0.45-0.6	>0.6
pH	all types		6-9	6-9	6-9	6-9	<6-9>

Table 3. The quality class boundaries, limit values, of hydrochemical variables - Narva River.

Indicator	River	Unit	High	Good	Moderate	Poor	Bad
O_2 %	IV-Narva River	Saturation %	>70	70-60	<60-50	<50-40	<40
BOD5		mgO2/l	<2.0	2.0-2.5	>2.5-4.0	>4.0-5.0	>5.0
Tot-N		mgN/l	<0.5	0.5-0.7	>0.7-1.0	>1.0-1.5	>1.5
Tot-P		mgP/l	<0.04	0.04-0.06	>0.06-0.08	>0.08-0.1	>0.1
NH4		mgN/l	<0.1	0.1-0.3	0.3-0.45	0.45-0.6	>0.6
pH			6-9	6-9	6-9	6-9	<6-9>

The overall result of the hydrochemical condition is calculated as follows:
- in case the pH value is out the limits 6-9, the overall result is 'bad'.
- If the pH value is within the limits, the other five variables are calculated: high – 5 points; good – 4 points, moderate – 3 points, poor – 2 points, bad – 1 point.

The overall result will be determined by the sum of the five variables: 23-25 – high; 18-22 – good; 13-17 – moderate; 8-12 – poor; <8 – bad.

Available only in Estonian: https://www.riigiteataja.ee/akt/125112010015?leiaKehtiv

3.1.9. Regulation on procedure for the establishment of groundwater bodies (no 75)

Set the quality indicators to determine the chemical status of a body of groundwater.

Minister of the Environment Regulation 29.12.2009 no 75 on Procedure for the establishment of groundwater bodies and the list of those groundwater bodies which status class has to be determined, groundwater bodies status classes, quality indicator values corresponding the statues classes and conditions of quantitative indicators, the list of pollutants threating groundwater and their threshold values and quality limit values in groundwater, the methodology for determining the level of the background and procedure of determining statues classes of groundwater bodies.

The purpose of the regulation is to ensure the protection of groundwater through the assessment of the status of groundwater and the determination of the status classes of groundwater bodies in a way that enables the effective planning and implementation of water protection measures.

Based on main groundwater levels, 39 bodies of ground water have been distinguished; several qualitative indicators evaluate their status. In determining the status class of a body of groundwater, the influence of human activity and the hydrogeological conditions of the groundwater body, including the protection of groundwater and the status of groundwater-dependent ecosystems, shall be taken into account.

The quality indicators used to determine the chemical status of a body of groundwater are groundwater quality limit values, groundwater pollution levels, conductivity, pH, dissolved oxygen content, chemical oxygen demand, ammonia, chlorides, sulfates and dangerous substances including arsenic, cadmium, lead, mercury, trichloroethylene, tetrachloroethylene and synthetic substances.

The chemical status class of a body of groundwater is good if, for a given groundwater body, 80 % or more of the quality indicators specified in the groundwater monitoring program's observation points correspond to the limit values.

The concentration of sulphates and chlorides, and the electrical conductivity measured by the concentration of the dissolved substance does not show upward trend that would refer to the pollution due to human activity, or the saltwater inflow. PH shall be the range of 6-9.

The dissolved oxygen concentration does not show a decrease trend, or oxygen demand is ≤5 mg/l O_2, or in case quality indicator value is exceeded, is proven that dissolved oxygen concentration in groundwater is natural origin.

The ammonium concentration does not exceed naturally aerobic groundwater 0.5 mg/l or naturally anaerobic groundwater 1.5 mg/l or in case quality indicator value is exceeded, is proven that ammonium in groundwater is natural origin.

There are no hazardous substances, including arsenic, cadmium, lead, mercury, trichloroethylene, tetrachloroethylene, synthetic substances or their concentrations do not exceed the hazardous substances limit values in the groundwater or their presence is identified of natural origin.

The concentration of the pollutants does not hinder to achieve environmental objectives of surface water associated with the groundwater body nor cause significant damage on the ecological and chemical status of surface water or directly on the body of groundwater dependent terrestrial ecosystems.

In determining the chemical status of a body of groundwater, the limit values for nitrates is 50 mgN/l and pesticides, active substances - 0,1 µg/l, total 0,5 µg/l, shall be taken into account.

Available only in Estonian: https://www.riigiteataja.ee/akt/112072016002?leiaKehtiv

3.1.10. Waste Act

The processes or methods used in waste handling shall not endanger health, property or the environment.

Act provides the organisation of waste management, requirements for preventing waste generation and the health and environmental hazards arising from waste, including measures for improving the efficiency of the use of natural resources and reducing the adverse impacts of such use, and liability for violation of the established requirements.

Wastewater and waste subject to treatment or emitted into the environment together with waste water shall not fall within the scope of application of Waste Act, except waste generated in waste water treatment.

The processes or methods used in waste handling shall not endanger health, property or the environment. The waste handling shall implement all the necessary measures to avoid or reduce as much as possible the environmental nuisances caused by waste and the harmful impact of the waste on the environment, including landscapes and sites of special interest, and the human health.

The minister responsible for the area shall have the right establish handling requirements for waste containing polychlorinated biphenyls or polychlorinated terphenyls, waste containing asbestos, waste generated in the production of titanium oxide, biodegradable waste, waste electrical and electronic equipment, end-of-life vehicles, waste batteries and accumulators, construction and demolition waste; waste tyres, packaging waste, wastes from human or animal health care, municipal waste, metal waste, waste from thermal processing (including pyrolysis) of oil shale, extractive waste, **sewage sludge**, waste used for filling the workings or recoverable waste otherwise placed in the environment and waste oil.

Available in English: https://www.riigiteataja.ee/en/eli/521082017002/consolide

3.1.11. Environmental Monitoring Act

Environmental monitoring and the objectives thereof.

Act establishes the organisation of national, local government and voluntary environmental monitoring, the completion of national environmental monitoring programme and its sub-programmes, the establishment, use, protection and liquidation of national environmental monitoring stations and areas, the procedure for the storage, use and dissemination of data obtained during the course of environmental monitoring, and the organisation of state supervision and the responsibility for failure to meet the requirements provided in the Environmental Monitoring Act.

The environmental monitoring of the holder of environmental permit or integrated environmental permit, required by the permit, is subject to the requirements established by the Act regulating the respective permit and the requirements established on the basis of that Act.

Environmental monitoring is the continuous surveillance of the status of the environment and the factors affecting thereof, involving environmental observations, collection, processing and storage of observational data, analysis of observational results and predicting of changes.

Environmental monitoring is divided into national environmental monitoring and into local government environmental monitoring.

National environmental monitoring data constitute the basis for the compilation of action, development and management plans and the drafting of legislations, and the assessment of the impact thereof.

Local government conducts environmental monitoring for the performance of its statutory functions or for the organisation of its work.

Voluntary environmental monitoring is conducted by a legal person governed by public law or a legal person governed by private law or a natural person at their own request and expense and for their own purpose.

Available in English: https://www.riigiteataja.ee/en/eli/527102015001/consolide

3.1.12. Environmental Charges Act

Pollution charge rates upon emitting one ton of pollutant into a water body, groundwater or soil.

Environmental Charges Act provides the grounds for determining the natural resource charges, the rates of the pollution charge, the procedure for calculation and payment thereof, and the grounds and specific purposes for using state budget revenue obtained from environmental use.

Environmental charges are established and imposed based on the need for environmental protection, the economic and social situation of the state and, in the events specified in this Act, also based on the value created by natural resources subject to the charge. For the purposes of Environmental Charges Act, ‘environmental charge’ means the price of the right of use of the environment.

Environmental use means extraction of a mineral resource, water abstraction, fishing, hunting, emission of pollutants into ambient air, water bodies, groundwater or soil, waste disposal by way of depositing in landfills or other activities that result in the emission of waste into the environment.

The environmental charges are divided into the natural resource charges and the pollution charge.

Natural resource charges and pollution charge are paid at the rates established on the basis of the Environmental Charges s Act.

The sensitivity to pollution of the emission site, the hazardousness of the pollutant and the use of the best possible technology are taken into account upon establishment of the charge rates.

The purpose of imposing environmental charges is to prevent or reduce the possible harm related to the use of natural resources, emission of pollutants into the environment and disposal of waste, encourage more effective use of the natural resources and earn income for the state from granting use of natural resources.

The proceeds from environmental charges are divided between the state budget and the budgets of the local authorities determined based on the location of the environmental use or on another basis.

A person who, on the basis of an environmental permit or another basis provided by law, has been granted the right to remove natural resources from their natural state, emits pollutants into the environment or disposes waste or who has performed those acts without the corresponding right, pays environmental charges.

Environmental permit means mineral resource extraction permit and permit for consumption or transfer of a mineral or overburden and a mineral resource removed from its natural state on land servicing an extracting permit area or a rock or deposit that has not been registered as a mineral resource, integrated environmental permit, special **water use permit**, fishing permit of a fishing vessel, fisherman's fishing permit, special purpose fishing permit, document in proof of payment for the right to fish for recreation, or a fishing card, document certifying payment of the hunting charge or an electronic confirmation thereof, air pollution permit, permit for carbon dioxide emission allowance trading and waste permit for disposal or incineration of waste.

The obligation to pay environmental charges does not extend to persons who use the environment to an extent which does not require an environmental permit.

If a person uses natural resources, emits pollutants into the environment or disposes waste in quantities exceeding the quantity allowed by the environmental permit, ignores the obligation to hold a permit or carries out such activities at a prohibited location, the person will pay environmental charges at a higher rate.

An environmental charge is not collected if the use of natural resources, emission of pollutants into the environment or disposal of waste without an environmental permit or in a quantity exceeding the allowed quantities: 1) is carried out to prevent damage on an even larger scale than the damage caused by such activity; 2) is carried out to prevent an accident which may cause loss of human life; 3) is caused by a natural disaster or carried out to eliminate the results of a natural disaster.

The pollution charge is imposed if the following is emitted into water bodies, groundwater or soil:

1) organic matter;
2) phosphorous compounds;
3) nitrogen compounds;
4) suspended particles;
5) sulphates;
6) monophenols;
7) oil, oil products, mineral oil or liquid products obtained from the thermal treatment of solid fuel

or other organic matter;
8) waste water which has a hydrogen ion exponent (pH) greater than 9.0 or less than 6.0;
9) other substances hazardous to the aquatic environment for the purposes of the Water Act, which have not been specified in this subsection.

The pollution charge (Table 4) is not imposed if the substances and compounds are used as fertilizers in compliance with the Water Act and the requirements established on the basis thereof.

Table 4. Pollution charge rates upon emitting one ton of pollutant into a water body, groundwater or soil are the following:

Parameter	Rate since 01.01.2015, euros
organic matter	1435
TP	12 014
TN	2826
SS	552.89
SO_4	7.09
monophenols	24 326
oil, oil products, mineral oil or liquid products obtained from the thermal treatment of solid fuel or other organic matter	4582
other hazardous waste for the purposes of the Water Act	21 056
pH	0.19 euros per each tenth of the pH unit by which the pH of the wastewater is higher than 9.0 or lower than 6.0 per cubic metre

The pollution charge rates are increased by a factor of:
1) 2.5 if the pollutants are emitted into soil with unprotected groundwater;
2) 1.5 if the receiving water body is located within the boundaries of a city, town or beach, or nearer than 200 metres to a beach specified by a resolution of a local authority, or if the receiving water body is a sea or transboundary water body or a water body under protection as the habitat or spawning site of salmonids or cyprinids;
3) 1.2 if waste water is directed into the sea through a deep-sea outlet.

If all the indicators that characterise the wastewater emitted by a payer of the pollution charge are lower than or equal to the wastewater limit values set by a special water use permit the pollution charge rates will be reduced regarding the emission by a factor of 2.

Available in English: https://www.riigiteataja.ee/en/eli/505072017002/consolide

3.2. Finland

In Finland for treating domestic wastewater outside sewer networks according to the EU Water Framework Directive, the Council of state issued the Environmental Protection Act (527/2014) and supplementary for that the regulation for household waste water treatment outside areas of sewage networks (157/2017). The amendment to the Environmental Protection Act (Act amending the Environmental Protection Act, 19/2017) concerning the treatment of wastewater from areas with dispersed settlement entered into force on 3 April 2017. The new Government Decree on Treating Domestic Wastewater in Areas Outside Sewer Networks entered into force at the same time. The amendments to the Act and the Decree substituted for earlier regulation from 2011, based on which the Ministry of the Environment published the first Environmental Guide concerning wastewater from areas with dispersed settlement.

The EU Water Framework Directive (WFD) (2000/60/EC) sets the framework and objectives for water protection in Finland. The Act on the Organisation of River Basin Management forms part of Finland's implementation of this Directive. The two main laws in Finland for the protection of groundwater are the Water Act and the Environmental Protection Act (527/2014).

The Åland Islands or Åland is an archipelago at the entrance to the Gulf of Bothnia in the Baltic Sea belonging to Finland. Åland has its own provincial laws in a number of important areas based on its autonomous position. The Act on the Autonomy of Aland 1144/1991 describes the division of powers between the Åland Islands and the Finnish Parliament. The division of competences between the Aland Parliament and the Municipalities is defined in Ålandic law. The environmental licensing for industrial plants is outlined in the Provincial law on environmental protection (ÅFS 2008:124, ändrad ÅFS 2015:14) and decree (ÅFS 2008:130, ändrad ÅFS 2015:15). Since the beginning of 2005, the Åland Islands have adopted the requirements for household waste water treatment in the provincial decree (ÅFS 38/2004), which mainly correspond to Finnish regulation for household waste water treatment outside areas of sewage networks for sensitive areas.

3.2.1. Environmental Protection Act (527/2014), inc. (19/2017)

All onsite owners must fulfill the requirement of removing from influent in minimum 80 % of organic matter, at least 70 % of the total phosphorus, and least 30 % of total nitrogen.

The Finnish Environmental Protection Act (527/2014) has the purpose of preventing environmental pollution. The act applies to all activities that cause or may cause environmental pollution. Environmental Protection Act regulates whether or not activity requires an environmental permit.

The principles and general duties of the Environmental Protection Act are:

•the prevention or reduction of harmful impacts (principle of preventing and minimizing harmful impact),

•the best available technique shall be used (principle of BAT),

•the use of best practices to prevent pollution (principle of environmentally best use),

•parties engaged in activities that pose a risk of pollution have a duty to prevent or minimize harmful impacts

Municipal councils may issue general regulations on the basis of local circumstances, pertaining to the entire municipality or part thereof (municipal environmental protection regulations). The

regulations may apply to areas where conducting wastewater into the ground, a water body or a ditch, spring, artificial pond or streamlet is prohibited due to a special pollution risk.

155 § The general obligation to treat wastewater

If a property is not connected to a sewer network and the activity is not subject to a permit pursuant to this Act, wastewater shall be conducted and treated so as not to pose a risk of environmental pollution. Domestic wastewater must be treated before it is conducted into the ground, water body or ditch, artificial pond or streamlet referred to in Chapter 1, section 3(1)(6) of the Water Act (streamlet means a channel smaller than a brook whose catchment area is less than ten square kilometres where water does not flow continuously and the passage of fish is not possible to any significant extent). Wastewater other than that issuing from a water closet may be conducted into the ground without treatment, if the amount of wastewater is negligible and no threat of environmental pollution is posed.

154 b § The general obligation to treat wastewater

Domestic wastewater must be treated in such a way that the environmental loading is reduced by at least 80 per cent for organic matter, by at least 70 per cent for total phosphorus, and by at least 30 per cent for total nitrogen in comparison to loading caused by untreated wastewater, as determined by applying the person-equivalent load for dispersed settlements.

156 § Wastewater treatment system

According to the regulation technological neutrality applies to choosing method of treatment. Owner must choose a method which will meet the requirements. For the treatment of domestic wastewater, a property shall be equipped with a wastewater treatment system that must be suitable for its intended purpose, considering the load of untreated wastewater resulting from using the property, properties of other parts of the wastewater system, the risk of environmental pollution and environmental conditions such as the location of the property in a coastal area, or an important or other groundwater area suitable for water supply.

The wastewater treatment system shall be planned, constructed and maintained so that, in normal use, it can be reasonably assumed to achieve a sufficient standard of treatment as regards organic matter, phosphorus and nitrogen, according 154 b §.

More detailed provisions on the standard of treatment required, and the load of domestic wastewater on the environment, as well as on the planning, use and servicing of a wastewater system, and on sludge removal, are given by Government decree.

156 c § The stricter obligation to treat wastewater

Stricter treatment requirements will be applied if there are provisions on them elsewhere under law, in accordance with or under which more stringent requirements are laid down. Further provisions may be given by Government decree on the normative standard of treatment that should be attained through the treatment of domestic wastewater, if the municipal environmental protection regulations specify requirements that are more stringent.

156 d § Derogation from the requirements for treatment of domestic wastewater

An exception may be granted with respect to requirements for the treatment of domestic wastewater provided above under section 156 a if the environmental load can be considered negligible considering the use of the property, in comparison with the load from untreated domestic wastewater, and the measures required for upgrading the treatments system, when assessed in aggregate, are deemed unreasonable for the property holder due to high costs or excessive technical requirements. When assessing the unreasonableness of measures for the property holder, the following shall be taken into account:

1) the property being located in an area intended for coverage by a sewer network;

2) the property holder and those living permanently on the property being of an advanced age, as well as other, corresponding special factors related to the current circumstances of the occupants;

3) the property holder being affected by long-term unemployment or illness, or some other comparable social hindrance to the performance of the provisions under the Act.

Upon submission of an application for the exception referred to in this section 3, authority to grant the exception is vested in the competent local authority. An exception may be granted to an applicant for a maximum period of five years at a time.

The amendment to the Environmental Protection Act (**Act amending the Environmental Protection Act, 19/2017**) concerning the treatment of wastewater from areas with dispersed settlement entered into force on 3 April 2017. According to the regulation technological neutrality applies to choosing method of treatment. Owner must choose a method which will meet the requirements. As for the general treatment specifications it is required that all onsite owners must fulfill the requirement of removing from influent in **minimum 80 % of organic matter, at least 70 % of the total phosphorus, and least 30 % of total nitrogen**. The municipality has the right for setting higher requirements for sensitive areas. All onsite owners are obliged of being aware and for making a clarification of its waste water system so that an estimation of the load of the system for the environment can be made. Owner is also obliged to monitor the functioning of its system, and if needed, to show that the system meets the demands set in the regulation. Before starting a wastewater renovation an operation permit has to be applied from the municipality. A wastewater plan is an obligatory appendix to the application. **The municipality is responsible for safety handling of the sludge born at onsite treatment systems**.

Properties located less than 100 m from water systems or in the groundwater area have to fulfill requirements by the end of October 2019. Other properties can renovate their wastewater systems when they are doing some other major renovations, e.g. when building water toilet or renovating domestic wastewater system.

Acts available only in Finnish:

http://www.finlex.fi/fi/laki/alkup/2014/20140527

http://www.finlex.fi/fi/laki/alkup/2017/20170019

3.2.2. Government Decree on Treating Domestic Wastewater in Areas Outside Sewer Networks (157/2017)

Standards for planning, construction, use and maintenance of the waste water system. Sets normative standard for the treatment of waste water in areas sensitive to pollution. Composition of the person-equivalent load for dispersed settlements.

The government decree on treating domestic wastewater in areas outside sewer networks came into effect on 3.4.2017. The Decree applies to the conduction and treatment of domestic wastewater in areas outside sewer networks referred to in section 16 of the Environmental Protection Act (527/2014).

2 § Person-equivalent load for dispersed settlements: Under the person-equivalent load for dispersed settlements, the amount of organic matter in untreated domestic wastewater per resident is 50 g per day, expressed as biological oxygen demand over seven days (BOD7); the amount of total phosphorus is 2.2 g and the amount of total nitrogen14 g per day (Table 5).

4 § Normative standard of treatment in **areas sensitive to pollution**: In an area subject to municipal environmental protection requirements, concerning maximum wastewater loads conducted into the environment and issued under section 156c of the Environmental Protection Act (527/2014), the standard of treatment of domestic wastewater should be such that **environmental loading is reduced by at least 90 percent for organic matter, by at least 85 percent for total phosphorus, and by at least 40 percent for total nitrogen** in comparison to the loading caused by untreated wastewater, as determined by applying the person-equivalent load for dispersed settlements.

Table 5. Composition of the person-equivalent load for dispersed settlements: the origin of loading and the amounts for various types of loading as grams/person/day (g/p/d) and their percentages (%).

Origin of loading	Organic matter (BOD7)		Total phosphorus		Total nitrogen	
	g/p d	%	g/p d	%	g/p d	%
Faeces	15	30	0.6	30	1.5	10
Urine	5	10	1.2	50	11.5	80
Other	30	60	0.4	20	1.0	10
Person equivalent load	50	100	2.2	100	14	100

Content of the report of the wastewater system shall include information on the location of wastewater generation sites, wastewater system components and discharge site and an estimate of the quantity and quality of wastewater formation and the reasoning of that.

The wastewater system must be constructed in accordance with the plan, must take into account the other possible use of the property and the life cycle of the buildings. The plan shall include the information on the quantity and quality of the waste water generated and information on the waste water system and its dimensions. A site plan indicating the location of the wastewater system and wastewater discharge outlets must be appended to the report. Other information necessary for the use, maintenance and monitoring of the wastewater system, must also be appended to the report. The plan must be based on adequate surveys of the terrain and soil at the building site, as well as on studies of surface and ground water conditions and on surveys of household-water wells.

Degree available only in Finnish: http://www.finlex.fi/fi/laki/alkup/2017/20170157

3.2.3. Environmental Protection Decree (713/2014)

An environmental permit shall be required in the treatment plants intended for handling a volume of wastewater at least equal to that produced by a population of 100 people, or for the conducting of domestic wastewater produced by at least 100 people to a destination other than a public sewer.

According the Environmental Protection Decree an environmental permit shall be required in waste and water management if the treatment plants intended for handling a volume of wastewater at least equal to that produced by a population of 100 people, or for the conducting of domestic wastewater produced by at least 100 people to a destination other than a public sewer.

The environmental permit is a permit issued by an environmental authority that is needed for activities that involve a risk of environmental pollution. Municipal environmental authorities grant environmental permits to activities that are significant at the local level. One important condition for permits is that emissions are limited to the levels obtainable by using **Best Available Techniques (BAT)**.

The Environmental Protection Act (527/2014) and the Environmental Protection Degree (713/2014) determines which activities are controlled by municipal authorities. The environmental permit is required when new activity or a substantial change in the operation is to be done. Action must not be taken before it is granted. The environmental permit includes all the operating licenses, for example, emission limits, their monitoring and reporting. The authority will then make the application public as appropriate, giving the relevant authorities and anyone affected by the plans time to comment and make proposals concerning the requirements for the permit. The activity is monitored throughout its life cycle. The municipal environmental protection authority also acts as the supervising authority referred to in the Environmental Protection Act (527/2014), Water Act (587/2011) and Waste Act (646/2011) and makes decisions on application issues under the Water Act.

The State Regional Administrative Agency (AVI) makes decisions on licences and permits pursuant to the Environmental Protection Act and the Water Act. The statutes specify the activities for which permits are required and whether the matter is handled by the AVI Agency or by municipal environmental permit authorities. Environmental permits are for example required for many industrial plants and waste and water management operations.

Decree only available in Finnish: http://www.finlex.fi/fi/laki/alkup/2014/20140713

3.2.4. Government Decree on Urban Waste Water Treatment (888/2006)

This degree sets minimum requirements for the waste water treatment from domestic waste water or the mixture of domestic waste water with industrial waste water or run-off rain water, and for monitoring of urban waste waters and evaluation of results.

In Finland, The EU Directive on urban wastewater treatment (91/271/EEC) has been implemented by means of the Decree (888/2006) requiring biological wastewater treatment and intensified recovery of phosphorus in areas with more than 100 people. When the wastewater treatment system encompasses an area with over 10,000 people, the process must include intensified nitrogen recovery should this lead to improved state of waters. Government Decree on Urban Waste Water Treatment sets minimum standards both for wastewater treatment, and for the design, construction, use and maintenance of treatment facilities.

The provisions of this Decree apply to the treatment and conducting of urban waste waters that require an environmental permit as specified in Environmental Protection Act. Waste water treatment requirements are:

(1) Waste waters shall be subject to secondary (biological) or an equivalent treatment and the treatment must comply with the requirements listed in Table 6. Phosphorus must be removed from waste waters and the phosphorus removal process must comply with the requirements listed in Table 7.

(2) The need for nitrogen removal from waste waters must be determined in the environmental permit application and decided in the environmental permit. Nitrogen must be removed whenever the reduction of nitrogen load can improve the status of waters. Denitrification requirements must meet the terms set forth in Table 7. The required nitrogen removal must be implemented within seven years of any permission granted becoming legally valid.

(3) Requirements stricter than those specified in Table 6 and Table 7 are applicable should the Environmental Protection Act or any provisions issued under it so provide. Secondary (biological) treatment means treatment of waste water by a process involving biological treatment with a secondary settlement or another equivalent process in which the requirements established in the Tables are respected. The requirements set forth for concentrations and the minimum percentage of reduction can be optional.

Table 6. Minimum requirements for secondary (biological) waste water treatment.

Parameters	Concentration	Minimum percentage of reduction [1)]	Reference method of measurement [2)]
Biochemical oxygen demand (BOD7 at 20°C without nitrification [3)])	30 mg/l O_2	70 %	Homogenised, unfiltered, undecanted sample. Determination of dissolved oxygen before and after 7-day incubation at 20°C ± 1° C, in complete darkness. Addition of a nitrification inhibitor.
Chemical oxygen demand (COD)	125 mg/l O_2	75 %	Homogenised, unfiltered, undecanted sample. Oxidizing agent: potassium dichromate.
Total suspended solids	35 mg/l	90 %	Filtering of a representative sample filtered through a 0.45 µm filter membrane. Drying at 105°C and weighing.

1) Minimum percentage of reduction calculated in relation to the load of the influent entering the treatment plant.
2) The reference method of measurement can be replaced by another if a relationship between the results of the substitute method and the one mentioned herein can be established.
3) The measurement of BOD7 can be replaced by the measurement of total organic carbon (TOC) or total oxygen demand (TOD), if a relationship can be established between BOD7 and the substitute parameter.
Analyses concerning discharges from lagooning will be carried out on filtered samples; however, the concentration of total suspended solids in unfiltered water samples shall not exceed 150 mg/l.

Table 7. Minimum requirements for nutrient removal in waste water treatment. The requirements set for concentrations and the minimum percentage of reduction can be optional.

Parameters	Concentration	Minimum percentage of reduction [1)]	Reference method of measurement [2)]
Total phosphorus	3 mg/l (less than 2,000 p.e.) 2 mg/l (2,000-100,000 p.e.) 1 mg/l (more than 100,000 p.e.)	80 %	Molecular absorption spectrophotometry
Total nitrogen [3)]	15 mg/l (10,000-100,000 p.e.)4) 10 mg/l (more than 100,000 p.e.) [4)]	70 %	Molecular absorption spectrophotometry

1) Minimum percentage of reduction calculated in relation to the load of the influent entering the treatment plant.
2) The reference method of measurement can be replaced by another if a relationship between the results of the alternative method and the one mentioned herein can be specified.
3) Total nitrogen means the sum of total Kjeldahl nitrogen (organic N+NH_4) nitratenitrogen (NO_3) and nitrite-nitrogen (NO_2).
4) These values for concentration are annual means as referred to in paragraph B 3, subparagraph c of this Annex. However, compliance with the requirements set for nitrogen may be controlled using daily averages, if it can be proven in accordance with this Annex that the same level of protection is obtained. In such cases, the total nitrogen concentration of each 24-hour sample may not exceed 20 mg/l when the temperature from the effluent in the plant's biological process is 12 °C at a minimum. The conditions concerning temperature can be replaced by a limitation on the time of operation, in order to take account of regional climatic conditions.

Available in English: http://www.finlex.fi/en/laki/kaannokset/2006/en20060888.pdf

3.2.5. Water Services Act (119/2001)

The objective of this act is to ensure water services which provide a sufficient amount of impeccable household water and appropriate sewerage.

Water Services Act (119/2001) is to ensure water services which provide a sufficient amount of impeccable household water with respect to health and otherwise as well as appropriate sewerage in terms of the protection of health and the environment.

Rights and obligations of municipalities, water supply and sewerage plants and their customers are described in the Act. Also charges and agreements in water supply and sewerage are addressed. Regulations on joining water and sewer systems of water utilities are included. In the Water Services Act water services are seen more as basic services that need to be made available for everyone, than just municipal engineering. **The act aims at guaranteeing the availability of water supply services in**

both urban and rural areas. The municipal water services are being incorporated, and in this connection it is important to secure the consumer interests, reasonable payments, equality and compatibility of payments with the real costs of water services.

Available in English: http://www.finlex.fi/fi/laki/kaannokset/2001/en20010119.pdf

3.2.6. Water Act (587/2011)

Conducting and treatment of waste water can be limited, for example in water protection areas, such as area around a groundwater or area surrounding a surface water.

The aim of Water Act is promote, organise and control water resource and use of waters, so that is socially, economically and ecologically sustainable and to prevent damages caused by water and use of water resources and to improve water resources and environment of water.

The purpose of this Act is to:

1) promote, organise and coordinate the use of water resources and the aquatic environment, so as to render it socially, economically and ecologically sustainable;

2) prevent and reduce the adverse effects of water and the use of the aquatic environment; and

3) improve the state of water resources and the aquatic environment.

Section 11 – Protected area around a water abstraction site

(1) The permit authority may, in a decision on the abstraction of water or separately, designate an area around a groundwater abstraction site as a protected area. A protected area may be designated if it is necessary to restrict the use of the area in order to secure the quality of water or yield of a groundwater body. The protected area may not be designated as larger than necessary. A claim or application for the purpose of designating a protected area may be filed by the party responsible for the project, the supervisory authority or an interested party.

(2) Under the conditions laid down in subsection 1, an area surrounding a surface water abstraction site may also be designated as a protected area.

(3) A decision on designating a protected area shall be complied with in spite of any appeal procedures.

Available in English: http://www.finlex.fi/en/laki/kaannokset/2011/en20110587.pdf

3.2.7. Waste Act (646/2011)

A municipality must organise waste management for waste generated in permanent dwellings, holiday homes, residential homes and other forms of dwellings, including sludge in cess pools and septic tanks.

The purpose of this Act is to prevent the hazard and harm to human health and the environment posed by waste and waste management, to reduce the amount and harmfulness of waste, to promote the sustainable use of natural resources, to ensure functioning waste management, and to prevent littering.

Section 6, Other definitions, (1) For the purposes of this Act:

2) municipal waste means waste generated in permanent dwellings, holiday homes, residential homes and other forms of dwelling, including sludge in cess pools and septic tanks, as well as waste comparable in its nature to household waste generated by administrative, service, business and industrial activities;

Chapter 5 – Waste management organised by municipalities, Section 32, Obligation of a municipality to organise waste management

(1) A municipality must organise waste management for the following non-hazardous waste:

1) waste generated in permanent dwellings, holiday homes, residential homes and other forms of dwellings, including sludge in cess pools and septic tanks;

According to Section 91, Municipal waste management provisions:

(1) A municipality may issue general provisions due to local circumstances, applicable to the municipality or part thereof, necessary to implementing this Act:

1) concerning the reduction, sorting, storage, collection, transport, recovery and disposal of municipal waste generated by an activity referred to in section 32, and the technical requirements concerning these;

2) in order to comply with the requirements provided in section 13(1) and (2), on practical arrangements at properties or waste reception points for the collection, reception and transport of waste other than those referred to in paragraph 1, and the technical requirements concerning these;

3) concerning measures to prevent littering;

4) concerning the obligation to submit information to the municipal waste management authority or municipal environmental protection authority on waste referred to in paragraph 1, or waste transports referred to in section 39.

(2) The provisions issued pursuant to subsection 1(1) above may concern composting of municipal waste other than that generated by an activity referred to in section 32, or other, corresponding small-scale treatment of waste on the site where it is produced, but not, however, waste treatment subject to an environmental permit.

(3) An authority specified in the municipal waste management provisions may, in an individual case, grant an exception to complying with a waste management provision on the grounds mentioned therein.

Available in English: http://www.finlex.fi/en/laki/kaannokset/2011/en20110646.pdf

3.2.8. Nitrates decree (1250/2014)

Sewage sludge is a valuable fertilizer and should be recycled in the agriculture when, of course, it is considered as safe/clean. Nitrates decree controls use, storage and processing of manure and other fertilizers.

The government decree on limiting certain emissions from agriculture and horticulture, also known as nitrates decree (1250/2014) controls use, storage and processing of manure and other fertilizers. The decree's aim is to prevent and to reduce emissions from those source as well as domestic animal production. The decree was enacted under the environmental protection act (527/2014) and it also implements the directive of the Council of the European Communities concerning the protection of water against pollution caused by nitrates from agricultural sources, also known as nitrates directive (91/676/EEC).

Section 10: Use of fertilisers

(1) **Fertiliser shall be applied on fields in such a way that nutrient runoff into water bodies and any risk of subsoil compaction are prevented**. The average crop yield, cultivation zone, crop rotation and soil type shall be taken into account in fertilisation.

(2) The application of manure and organic fertilisers in fields is prohibited from the beginning of November to the end of March. However, deviation from this prohibition is possible until the end of November in situations where exceptional weather conditions have prevented the use of manure as fertiliser during the growing season. An exceptional weather condition is a situation where the wetness of the field, resulting from prolonged heavy rains and low evaporation, has prevented the autumn fertilisation in October at the latest. (1261/2015)

(3) Fertilisers shall not be applied on snow-covered, frozen or water-saturated ground.

(7) **Fertilisation less than five metres from a water body is prohibited**. The surface application of manure and organic fertiliser products is prohibited in the next five-metre zone from the water body unless the field is tilled within 24 hours of the application. However, these prohibitions on fertilisation and surface application do not prevent domestic animals from grazing in the areas in question. (1262/2015)

(8) The application of **slurry, urine and liquid organic fertiliser products** by any other means than injection is always prohibited in sections of field parcels where **the gradient is not less than 15 per cent**. Other manure and organic fertiliser products to be applied in sloped sections of field parcels shall be incorporated into the soil within 12 hours of application. (435/2015)

Section 11: In the application of farm animal manure and organic fertiliser products containing manure, the amount of **total nitrogen contained in these may not exceed 170 kg/ha per year**. (435/2015)

Available in English: http://www.finlex.fi/en/laki/kaannokset/2014/en20141250.pdf

3.2.9. Government Decree on Water Resources Management (1040/2006)

Factors used in the classification of ecological status include biological, hydrological–morphological and physiochemical factors

This Decree lays down provisions on the accounts to be included in a water resources management plan, on the assessment and monitoring of the status of waters, and on the preparation of a water resources management plan.

Limit values for maximum permissible emissions and prohibitions on emissions of substances dangerous to the aquatic environment can be found, for example, in the Decree. The Water Resources Management Decree (Appendix 7 A) **lists groundwater pollutants** that, under the Water Framework Directive, may have a negative impact on groundwater chemical status. In cases where the groundwater chemical status deteriorates, consideration must be taken of the quality norms of the Water Resources Management Decree. However, introduction of a substance listed in the decree may be enough to trigger the groundwater pollution threshold, without exceeding the maximum permissible emission value.

Section 3 - Determining the characteristics of surface waters and groundwaters

(1) Within its territory, **each regional environment centre determines the location and boundaries of surface waters and groundwater bodies**, on which surface water ecosystems and land ecosystems are directly dependent.

(2) When determining the characteristics, conducting **further analyses and assessing and monitoring the status of waters**, similar surface waters and groundwater bodies can be examined as groups.

Section 6 - Activity influencing surface waters and groundwater bodies

Within its territory, a regional environment centre compiles information on human activity with significant effects on the status of surface waters and groundwater bodies, including information on:

1) **Point source and diffuse source pressures** from habitation, industry, agriculture, forestry and other business activity;

2) The quantity of water extracted for the needs of habitation, industry, agriculture, forestry and for other purposes, and the formation of artificially recharged groundwater;

3) Construction influencing the status of surface water and the regulation of waters; and

4) Other activities influencing the status of waters.

The basic water resources management measures are included into several national laws.

Available in English: http://www.finlex.fi/en/laki/kaannokset/2006/en20061040.pdf

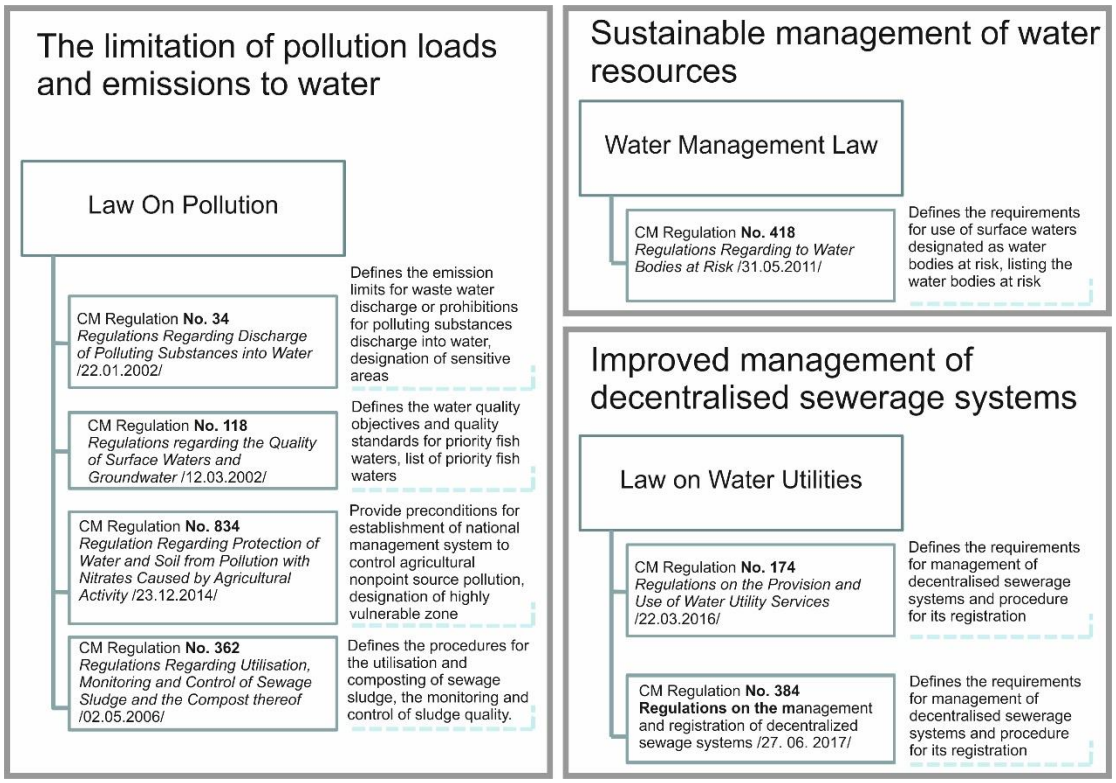
3.3. Latvia

Water management in Latvia is composed of central and local management level. The central government – Ministry of Environment and Reginal Development – is responsible for the formulation and implementation of national water policy, including development of legal framework for protection and governance of water resources and supervision of its use. The local government is in charge of management of water use and sewage treatment. According to the *Law on municipalities* (Clause Nr.1 of the paragraph Nr.15), one of the autonomous functions of the municipality is to organize the utility services for the residents, including water supply and sewerage collection, disposal and treatment of waste water.

Latvian Water Policy has undergone a long restructuring process to comply with requirements set by EU water Sector directives, resulting in development of existing legal framework and comprehensive water resources management system. The main water-related laws or the so-called "umbrella" laws are (1) Law on Pollution, (2) Water Management Law and (3) Law on Water Utilities Services (Figure 1).

The limitation of pollution loads and emissions to water are regulated by *Law on Pollution* to developing system for setting requirements for permissible emissions and water quality standards. The system for sustainable management of water resources are introduced by the *Water Management Law* and its subordinated Ministers Cabinet Regulations. The newest and most important legal act with respect to reduction of pollution loads originated from decentralised waste water treatment systems is *Law on Water Utilities Services*. This Law has been elaborated in order to set preconditions for improved management of decentralised sewerage collection systems and to establish system for registration and control of decentralised sewerage collecting systems.

Figure 1. Legal framework setting requirements for sewerage treatment



3.3.1. Law On Pollution

The main objective of the law is to prevent or reduce harm (damage) caused by pollution to human health, property or the environment, including prevention of pollution of water or, if it is impossible, reduce emission into water to certain degree.

The *Law on Pollution* (adopted 15.03.2001) determines requirements for operators (polluters), procedures for prevention of pollution and control of polluting activities, including both limitation of pollution loads originated from point sources, which in case of waters are discharge of sewerage collected in the centralised waste water collecting system, and diffuse pollution loads originated from widespread agricultural and forestry activities.

This legal act provide preconditions to balances economic development with environmental preservation and defines necessity for setting of water quality requirements and values of permissible emissions to water (Paragraph 12.2), elaboration of Action Plans and Programs to reduce pollution loads, as well as designates *Areas of Critical Environmental Concern* (sensitive areas and nitrate vulnerable zones) and water quality objectives for particular water sources (list of priority fish waters).

Translation of Regulation in English available: https://m.likumi.lv/doc.php?id=6075. Look: Darbības ar dokumentu → Tiesību akta pase → Tulkojums.

3.3.1.1. Regulations Regarding Discharge of Polluting Substances into Water (No. 34)

Regulation defines the emission limits for waste water discharge or prohibitions for polluting substances discharge into water, designation of sensitive areas and procedure for monitoring and reporting to governmental authorities on produced pollution loads.

The European Union policy for the management of urban waste water and requirements set by *Council Directive 91/271/ EEC concerning urban waste water treatment* in Latvian legislation was transposed as Ministers Cabinet Regulation No. 34 *Regulations Regarding Discharge of Polluting Substances into Water* adopted on 22.01.2002 (further in the text – *Regulation No.34*). In accordance with given regulation (Paragraph 30) the whole territory of Latvia is determined as a sensitive area and therefore more strict requirements for urban waste water treatment have to be set for all territory of country.

The requirements of the Directive adopted by *Regulation No.34* are aimed to agglomerations where CE is > 2000 and is targeted to reduction of total pollution loads originated in biggest agglomerations. This regulation specifies the permissible sewerage water emission and dangerous substances standards, and also establishes procedures how an operator (producer of sewerage) shall control the emissions to surface water, perform monitoring and report to responsible governmental authority.

According to *Regulation No.34* establishment of centralised collecting systems is binding for all agglomerations where the PE > 2 000 and a local government is responsible for its installation (Paragraph 32). The establishment of centralised collecting systems for agglomerations where the PE < 2 000 is based on decision of local government (Paragraph 33) and is not mandatory.

In general, the *Regulation No.34* requires that municipal sewage treatment plants upgrade to a secondary treatment level or a third treatment level (for very big agglomerations), a step beyond decanting, subjecting the wastewater to a biological treatment process that further removes solids and organic wastes.

The requirements defined by *Regulation No.34* (refer Table 8) are the minimal ones and can be set more strict to reach water quality objectives of particular water body. According to existing institutional structure the regional divisions of State Environmental Service – Regional Environmental Boards (REB) – have the main responsibility for setting requirements to prevent both point and nonpoint source pollution of surface and groundwater in the region. The requirements for emissions of polluting substances are part of:

- Permit of B Category, if capacity of WWT plant is > 20 m3/day and the treated waste water is discharged into the environment; or
- Technical Requirements for construction of centralised or decentralised sewerage systems, if capacity of WWT plant is > 5 m^3/day or < 5 m^3/day in cases when WWT plant is located in protected area.

The more strict requirements can be set in cases when treated waste water is discharged to surface water identified as water body at risk or recipient water is designated as Salmonid or Cyprinid Water. The difficulty for REB with respect to setting of more strict requirements in practice is that existing legislation prescribes procedure "what have to be set" not "how to be set". Therefore in case of small WWT facilities the reduction of total P and total N caused eutrophication of Baltic Sea is not required in practice.

Table 8. Minimum requirements for secondary (biological) waste water treatment in Latvia.

Parameter and reduction requirements		**Size of agglomeration**			
		< 200 PE	**200–1999 PE**	**2000–9999 PE**	**> 10 000 PE**
Biochemical oxygen demand – BOD_5	Concentration or treatment technology	appropriate treatment	appropriate treatment	25 mg/l	25 mg/l
	Percentage of reduction of pollution	no limits	50–70%	70–90%	70–90%
Chemical oxygen demand – COD	Concentration or treatment technology	appropriate treatment	appropriate treatment	125 mg/l	125 mg/l
	Percentage of reduction of pollution	no limits	50–75%	75%	75%
Total suspended solids – TSS	Concentration or treatment technology	less than 35 mg/l			
	Percentage of reduction of pollution	90%			
Total nitrogen	Concentration or treatment technology	appropriate treatment	appropriate treatment	15 mg/l	10 mg/l
	Percentage of reduction of	no limits	10–15%	70–80%	70–80%

Parameter and reduction requirements		Size of agglomeration			
		< 200 PE	**200–1999 PE**	**2000–9999 PE**	**> 10 000 PE**
	pollution				
Total phosphorus	Concentration or treatment technology	appropriate treatment	appropriate treatment	2 mg/l	1 mg/l
	Percentage of reduction of pollution	no limits	10–15%	80%	80%

Table 9. Parameters Characterising Typical* Domestic Waste Water in Latvia.

Parameter	Concentration (mg/l)
Biochemical oxygen demand (BOD5)	150–350
Chemical oxygen demand(COD)	210-740
Total suspended solids	120–450
Total phosphorus	6-23
Total nitrogen	20-80

Notes: * Typical domestic waste waters do not contain the dangerous substances defined in Annex 1 and 2 of Regulation.

Translation of Regulation in English available: https://likumi.lv/doc.php?id=58276. Look: Darbības ar dokumentu → Tiesību akta pase → Tulkojums.

3.3.1.2. Regulations regarding the Quality of Surface Waters and Groundwater (No. 118)

Regulation defines the water quality objectives and quality standards for fish waters, permissible concentrations of priority and dangerous substances for surface and coastal waters.

In order to ensure good quality of surface water and to save fish resources the list of priority fish waters are defined by Cabinet of Ministers Regulation No. 118 *Regulations regarding the Quality of Surface Waters and Groundwater* (12.03.2002). The most important surface water resources are included in the list priority fish waters including 123 rivers (or river stretches) and 45 lakes.

Translation of Regulation in English available: https://likumi.lv/doc.php?id=60829. Look: darbības ar dokumentu → Tiesību akta pase → Tulkojums.

3.3.1.3. Regulation Regarding Protection of Water and Soil from Pollution with Nitrates Caused by Agricultural Activity (No. 834)

Regulation provide preconditions for establishment of national management system to control agricultural nonpoint source pollution.

The *Law on Pollution* provides preconditions for establishment of national management system to control agricultural nonpoint source pollution. Cabinet of Ministers Regulation No. 834 *Regulation Regarding Protection of Water and Soil from Pollution with Nitrates Caused by Agricultural Activity* (adopted 23.12.2014) is subordinated to mentioned before law and defines the requirements for the protection of water and soil from pollution with nitrates caused by agricultural activity, designation of highly vulnerable zone, as well as the procedures for the management of those zones. The vulnerable zone includes lowland areas and sandy soils covering area of 26 local municipalities including 3 municipalities located in the Baltic Sea Coast. The more strict requirements for treatment of waste water also are applied for those areas.

Translation of Regulation in English available: https://likumi.lv/doc.php?id=271376. Look: darbības ar dokumentu → Tiesību akta pase → Tulkojums.

3.3.1.4. Regulations Regarding Utilisation, Monitoring and Control of Sewage Sludge and the Compost thereof (No. 362)

Regulation defines the requirements for utilisation and use of sewage sludge, and order for monitoring and control

Cabinet of Ministers Regulation No. 362 *Regulations Regarding Utilisation, Monitoring and Control of Sewage Sludge and the Compost thereof* (adopted 02.05.2006) prescribe the procedures for the utilisation and composting of sewage sludge, the monitoring and control of sludge quality.

Translation of Regulation in English available: https://likumi.lv/doc.php?id=134653. Look: darbības ar dokumentu → Tiesību akta pase → Tulkojums.

3.3.2. Water Management Law

The main objective of the law is to establish system for governance of water resources to promotes sustainable use of water resources and ensure protection of water environment.

Water Management Law (adopted 12.09.2002) came into force on October 26, 2002, and is the main regulation in water management and protection. The aim of the Law is to establish both surface waters and groundwater protection system that promotes sustainable and rational use of water resources, improves protection of water environment, ensures water protection and facilitates achievement of goals set in international agreements. The Law has been elaborated in order to transpose in national legislation requirements set by the Water Framework Directive of the European Parliament and the Council and establishes system to achieve at least good ecological condition for all surface waters and groundwater until certain deadline or to identify water bodies at risk of failing such environmental objectives. In order to achieve objectives of ecological condition and to target management measures needed Latvia is divided into 4 river basin districts and 256 water bodies (the smallest management unit) are identified. With respect to selection of the most appropriate waste water treatment solution the water bodies at risk of failing to meet good ecological condition identified by procedure specified in the Water Management Law is very important.

3.3.2.1. Regulation Regarding to Water Bodies at Risk (No. 418)

Regulation defines the requirements for use of surface waters designated as water bodies at risk to reduce the pollution loads by limiting emissions to water and leading the improvement of ecological condition.

Cabinet of Ministers Regulation No. 418 *Regulations Regarding to Water Bodies at Risk* (adopted 31.05.2011) prescribes surface water bodies which are at risk of failing to meet good ecological condition specified in the Water Management Law and the period of time provided for. In the Annexes of Regulation are listed water bodies (and its concerning information – river basin district, agglomerations in the catchment area of a water body) for which the more strict requirements for waste water discharge have to be set to prevent pollution or to reduce pollution loads. In total 89 river water bodies, 79 lake water bodies, 1 transitional and 4 coastal water bodies are designated in Latvia.

Translation of Regulation in English available:

https://likumi.lv/doc.php?id=231084#piel4&pd=1. Look: darbības ar dokumentu → Tiesību akta pase → Tulkojums.

3.3.3. Law on Water Utilities Services

The main objective of the law is to facilitate availability of good quality water services to ensure sustainable use of water resources and to balance environmental protection and socio-economic interests.

Law on Water Utilities Services (adopted 18.06.2015) came into force on January 1, 2016 has been elaborated in order to set preconditions for improved management of decentralised sewerage collection systems and to establish system for registration and control of decentralised sewerage collecting systems. This Law determines the competence of public authorities in provision of availability of the water services, general requirements and procedures for the provision and use of the water services, as well as rights and obligations of a service provider and service user.

Translation of Regulation in English available: https://likumi.lv/ta/id/275062-udenssaimniecibas-pakalpojumu-likums. Look: darbības ar dokumentu → Tiesību akta pase → Tulkojums.

3.3.3.1. Regulations on the Provision and Use of Water Utility Services (No. 174)

Regulation defines the requirements for management of decentralised sewerage systems and procedure for its registration.

Cabinet of Ministers Regulation No. 174 *Regulations on the Provision and Use of Water Utility Services* (adopted 22.03.2016) prescribes the procedures for the provision, use and termination of public water services, the procedure for connecting of household or small enterprise to a centralized water supply or sewerage system, the procedure for the accounting of water services provided and its payment order.

Translation of Regulation in English available: https://likumi.lv/ta/id/281230-noteikumi-par-sabiedrisko-udenssaimniecibas-pakalpojumu-sniegsanu-un-lietosanu. Look: darbības ar dokumentu → Tiesību akta pase → Tulkojums.

3.3.3.2. Regulations on the management and registration of decentralized sewage systems (384)

Regulation defines the requirements for management of decentralised sewerage systems and procedure for its registration.

Cabinet of Ministers Regulation No. 384 *Regulations on the management and registration of decentralized sewage systems* (adopted 27. 06. 2017) is applied to decentralized sewage systems located in the agglomerations where for sewage collection septic tanks is used or WWT facilities are used for treatment of waste water in amounts < 5 m^3/day and treated water is discharged into the environment. In order to improve management of sewerage water and to reduce contamination risk of soil and groundwater local municipalities before 1 January 2019 have to developed register of decentralised sewerage systems. The registration of all sewerage collection and treatment systems located in the area of particular municipality have to be complete not later as 31 December 2021.

Translation of Regulation in English available: https://m.likumi.lv/doc.php?id=291947. Look: darbības ar dokumentu → Tiesību akta pase → Tulkojums.

3.3.4. Summary and conclusions

With respect to prevention of pollution, reduction and control of polluting activities, Latvian legislation in very beginning was focused on major polluters whose point of discharge could either be identified or stipulated, and thence controlled. But as experience and knowledge were gained, increasing attention is paid to "nonpoint source pollution," including the pollution of groundwater by individual septic systems and improved management of decentralised sewerage collection and treatment systems.

Since 2004 the reduction of urban waste water loads was focused mainly on biggest agglomerations. According to *Action program for reduction pollution of surface water from urban waste water and hazardous substances for time period 2004–2020* (accepted by Cabinet of Ministers with Order No. 181, 12.03.2004) the expected results and targeted value is 95% population connection to centralized collecting system and appropriate sewerage treatment in agglomerations with PE > 2000. 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 PE > 2000. At present WWT plants with a capacity > 20 m^3/day are strictly controlled and treated water discharged to environment correspond to requirements set. Nevertheless there are around 750 settlements, where the number of inhabitants is < 2000 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. Therefore reduction of pollution loads from these settlements become as new priority for Latvia.

It is defined by *Environmental Policy Guidelines for 2014–2020* (accepted by Cabinet of Ministers with Order No 130; 26.03.2014) that main priorities with respect to reduction of pollution loads from decentralised sewerage collection systems to focus on are:

- development of water legislation for improved water service (water supply and sewerage) in small agglomerations, including treatment requirements;
- increased availability of centralized water services in small agglomerations.

3.4. Lithuania

Lithuania has four river basin districts, all of which are international. Nemunas RBD shares water courses with Byelorussia, Kaliningrad (Russia) and Poland. The other three - Dauguva, Venta and Lielupe - RBDs share water courses with Latvia. The River basin district management plans and programmes for implementing relevant measures were produced and approved by the Government of the Republic of Lithuania for each river basin district. The management plans have implemented in the period from 2010 through 2015 and will be updated every six years, that is, in 2015, 2021, etc.

River basin (under the Water Framework Directive), known as the area from which surface water rivers and lakes draining into the sea of the river estuary. Lithuanian territory identifies seven rivers (Nemunas, Lielupė, Daugava, Venta, Bartuva, Šventoji, Prieglius). The small, directly into the Baltic Sea and the lagoon flowing stream basins are combined into one, the Lithuanian coastal river basin.

Lithuania has own national lows, acts and regulations in the field of water and wastewater treatment. The eight regional environmental protection departments are responsible for realization of the laws, resolutions of the Government, Minister for Environment and other legal acts.

Regulation on the application of wastewater treatment systems, approved by Order No. D1-412 On the Approval of the Regulation on the Application of Wastewater Treatment Systems of the Minister of Environment dated 11 September 2006 (Official Gazette, No. 99-3852, 2006); Technical Regulation for Construction STR 2.07.01:2003 “Water supply and wastewater removal plant. Building engineering systems. Field engineering”, approved by Order No. 390 of the Minister of Environment dated 21 July 2003 (Official Gazette, No. 83-3804, 2003); Recommendations for the installation, operation and control of wastewater storage tanks and the procedure for the operation of wastewater storage tanks and septic tanks, adopted by Order No. 400 of the Minister of Environment dated 20 September 2000 (Official Gazette, No. 82-2499, 2000); Environmental rules of the installation of domestic wastewater treatment systems under natural conditions (LAND-21-01), approved by Order No. 252 of the Minister of Environment dated 9 May 2001 (Official Gazette, No. 41-1438, 2001).

The development strategy of drinking water supply and waste water treatment for the period 2008-2015, approved by the Government decision from 27-08-2008 is the main currently valid legal act. The strategy assumes availability of drinking water supply and waste water treatment services for at least 95% of Lithuanian population.

The major issue currently in Lithuania could be considered the waste water treatment in small settlements with the population under 2000 inhabitants as they had no opportunity to receive EU support to install waste water treatment systems. Assuming this, the focus will be on the waste water treatment and improving the quality of drinking water in such settlement during the 2014-2020 EU financial perspective.

The services of waste water treatment were available for 65.06 % of population according to the data from 2010 (including the inhabitants delivering the waste water to sewage systems, operating individual waste water treatment facilities, having concluded agreements on wastewater storage tanks and using septic tanks). The waste water for 13.62 % of population is not collected nor treated in any way – this should be assumed as a share of population not receiving the services waste water treatment (facts originate from some report, i.e. they are not statistics)

In order to achieve the aims water management projects and to fulfill the obligations to EU, around 95 % of Lithuanian population should be connected (use them) to the water supply and waste water collection networks. According to the data from Ministry of Environment of Republic of Lithuania, the drinking water should be supplied in a centralized way for 81 % of population by 2016, and 74 % of population should be connected to the centralized waste water collection systems.

3.4.1. Law on environmental protection

The Law on environmental protection of the Republic of Lithuania was published on 21/01/1992 in the Official Gazette, 1992, No. 5-75.

This Law shall regulate public relations in the field of environmental protection, establish the principal rights and duties of legal entities and natural persons in preserving the biodiversity, ecological systems and landscape characteristic of the Republic of Lithuania, ensuring a healthy and clean environment, rational utilization of natural resources in the Republic of Lithuania, its territorial waters, continental shelf and economic zone, determine responsibility and economic sanctions for violation of legal acts regulating environmental protection and natural resources committed by legal entities, in order to achieve effective prevention of these violations, as well as determine provisions regarding legal proceedings of cases on imposition of economic sanctions.

Available only in Lithuanian:

https://www.e-tar.lt/portal/lt/legalAct/TAR.E2780B68DE62/TAIS_449517

3.4.2. Law on environmental monitoring

Law on environmental monitoring of the Republic of Lithuania, 20 November 1997, No. VIII-529 Official Gazette, 10/12/1997, No. 112-2824.

New edition since 20/05/2006: No. X-595, 04/05/2006, Official Gazette 2006, No. 57-2025 (20/05/2006).

The Law on Environmental Monitoring shall specify the content, structure, implementation of environmental monitoring, the rights and duties as well as responsibility of the entities participating in the process of environmental monitoring.

The fundamental tasks of environmental monitoring shall be:

1) to observe continually and systematically the state of natural environment and its elements in the territory of the Republic of Lithuania;

2) to systematize, evaluate and forecast the spontaneous changes and the changes caused by an anthropogenic impact occurring in the natural environment, tendencies of changes in the natural environment and their possible consequences;

3) to accumulate, analyse and provide to the authorities and the public any information concerning the state of natural environment required to ensure sustainable development, to adopt decisions regarding territorial planning and social development, for scientific and other needs;

4) to analyse and assess the effectiveness of the environmental protection measures under implementation; and

5) to ensure international exchange of environmental monitoring information.

Available only in Lithuanian:

https://www.e-tar.lt/portal/lt/legalAct/TAR.1A98CE535B1C/PHBNEuNChH

3.4.3. Law on water

The law on water of the Republic of Lithuania, No. VIII-474 was published on 21 October 1997 in the Official Gazette, 1997, No. 104-2615.

New edition of the law: No. IX-1388, 25/03/2003, Official Gazette, 2003, No. 36-1544 (16/04/2003).

This Law regulates the relations arising from usage, management and protection of waters in natural environment.

Purpose of the Law:
1) not to allow declining of the condition of water ecosystems and ecosystems that depend directly on the water, to protect and/or improve it;

2) to improve quality of water through application of the measures meant to reduce consistently leakage of hazardous substances and to cancel leakage of underlying substances to water;

3) to use water in rational and well-balanced mode;

4) to reduce harmful impact of water.

Legal acts of the European Union under implementation - Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (OL *2004, special edition*, chapter 15, volume 5, p. 275)

Available only in Lithuanian:

https://www.e-tar.lt/portal/lt/legalAct/TAR.B3CC2C0B9BD2

3.4.4. Law on drinking water

Law on drinking water of the Republic of Lithuania, 10 July 2001 No. IX-433.

Official Gazette, 25/07/2001, No. 64-2327.

This Law shall establish the conditions of ensuring the safety and quality of the drinking water supplied to market and used in food enterprises and individually in households in implementation of the right of the residents of the Republic of Lithuania to consume healthy and clean drinking water and obtain information on its safety and quality.

Available only in Lithuanian:

https://www.e-tar.lt/portal/lt/legalAct/TAR.9893688FA176

3.4.5. Order regarding approval of hygienic standard "requirements of safety and quality of drinking water"

Order of the Minister of Health of the Republic of Lithuania regarding approval of the Lithuanian hygienic standard hn 24:2003 "requirements of safety and quality of drinking water", 23 July 2003 No. V-455.

This hygienic standard shall establish the quality and safety requirements of drinking water and hot water used in household. Values are listed in Table 10 to Table 12.

Table 10. Microbial indexes of drinking water.

Name of the index	Size of Sampling, ml	Limitary number of microorganism
1. *Escherichia coli*	100	0
2. Enterococci	100	0

Table 11. Toxic (chemical) indexes of drinking water.

Name of the index	Measurement unit	Threshold limit value not exceeding	Requirements for analyte's determination method		
			Correctness, percentage	Cohesion, percentage	Detection limit, percentage
Nitrates	mg/l	50	10	10	10
Nitrites	mg/l	0.50	10	10	10

Table 12. Indicatory indexes and values of parameters of drinking water.

Name of the index	Measurement unit	Threshold limit value not exceeding	Requirements for analyte's determination method		
			Correctness, percentage	Cohesion, percentage	Detection limit, percentage
Ammonius	mg/l	0.50	10	10	10
Electrical conductivity	µS cm^{-1} 20 ^{0}C temp.	2500	10	10	10
pH	pH unit	6.5 – 9.5	–	–	–
Index of permanganate	mg/l O_2	5.0	25	25	25

Available only in Lithuanian:

https://www.e-tar.lt/portal/lt/legalAct/TAR.2099D15473C7/RyFevWFOyw

3.4.6. Law on supply of drinking water and wastewater treatment

Law on supply of drinking water and wastewater treatment of the Republic of Lithuania 13 July 2006 No. X-764.

Official Gazette, 27/07/2006, No. 82-3260.

The purpose of this Law is to establish general requirements for provision of services of supply of drinking water and wastewater treatment, organization and planning of supply of drinking water and wastewater treatment in such a way as to avoid negative impact on human health and environment, to ensure continuous provision of services of supply of drinking water and wastewater treatment, to ensure development of facilities of supply of drinking water and wastewater treatment in compliance with public needs, and to create conditions for natural persons and legal entities to receive drinking water and services of wastewater treatment in compliance with safety and quality requirements.

Available only in Lithuanian:

https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/TAIS.280587

3.4.7. Order regarding approval of description of establishment procedure of protected areas of surface waters and protected coastal belts

Order of the Minister of Environment of the Republic of Lithuania regarding approval of description of establishment procedure of protected areas of surface waters and protected coastal belts, 07 November 2001 No. 540 Official Gazette, 14/11/2001, No. 95-3372.

The description of establishment procedure of protected areas of surface waters and protected coastal belts shall regulate the determination principles of protected areas of surface waters (save for the Baltic Sea and the Curonian Lagoon) and protected coastal belts.

Available only in Lithuanian:

https://www.e-tar.lt/portal/lt/legalAct/TAR.6D0F2D3FC9D0/ZqMjbINhyg

3.4.8. Law on protection of the marine environment

Law on protection of the marine environment of the Republic of Lithuania, 13 November 1997 No. VIII-512 Official Gazette, 28/11/1997, No. 108-2731.

New edition since 28/12/2010: No. XI-1205, 07/12/2010, Official Gazette 2010, No. 153-7780 (28/12/2010)

This Law shall establish the key principles and measures for protection of the marine environment, the rights and duties of the persons engaged in the marine activities affecting or likely to affect, directly or indirectly, the marine environment, the competence of state and municipal authorities and the main functions thereof in the field of management of protection of the marine environment (Table 13).

Table 13. List of characteristics, hazards and impacts specific to marine environment.

	Specific characteristics
Physical and chemical characteristics	– topography and bathymetry of seabed; – annual and seasonal temperature regime and ice cover; – speed of currents, upwelling, impact of waves, mixing characteristics, turbidity, and duration of activeness; – distribution of salt content with regard to space and time; – distribution of nutrients and oxygen with regard to space and time; – information needed to determine acidification of seawater.
Other characteristics	– description of situation related to chemical substances, including chemical substances of great concern, pollution of sediments, pollution centres, health problems, pollution of flora and fauna (first of all, intended for human food); – description of other characteristics typical or specific to the Baltic region.
	Hazards and impacts
Pollution with hazardous substances	– entrance of synthetic compounds (e.g., underlying substances related to marine environment, pesticides, substances removing organic scurf, pharmaceutical products, which result from pollution from spread sources of pollution, pollution from ships, atmospheric pollution and biologically active substances); – entrance of non-synthetic substances and compounds (e.g., heavy metals and hydrocarbons resulting from pollution from ships, search and extraction of oil, gas and minerals, and atmospheric pollution with water of tributary rivers); – entrance of radionuclides.
Continuous and/or deliberate discharge of pollutants	Entrance of other substances (liquids, solids or gases) permitted by the legal acts of the European Union and/or international conventions into seawater due to their continuous and/or deliberate discharge to marine environment.
Enrichment with nutrients and organic substances	– entrance of fertilizers and other substances containing nitrogen and phosphorus (e.g., from spot and spread sources of pollution, including agriculture, water culture, atmospheric pollution); – entrance of organic substances (e.g., domestic wastewater, mariculture, impact of tributary rivers).

Available only in Lithuanian:

https://www.e-tar.lt/portal/lt/legalAct/TAR.56935A08DD06/ENxvnGODBk

3.4.9. Order regarding approval of regulation on wastewater treatment

Order of the Minister of Environment of the Republic of Lithuania regarding approval of regulation on wastewater treatment , 17 May 2006 No. D1-236 Official Gazette, 25/05/2006, No. 59-2103.

The Regulation on Wastewater Treatment establishes main environmental requirements for collection, cleaning and discharge of wastewater in order to protect environment from pollution.

When wastewater is discharged (planned to be discharged) to the pool of running water (river, channel), the BOD concentration in the average daily sample of wastewater or in the instantaneous sample of wastewater, in case of which the permissible impact to receptacle will not be exceeded, shall be calculated according to the following formula:

$$C_{wastewater} = \frac{1.1 \cdot C_{river\,(HPC)} \cdot Q_{wastewater} + 360 \cdot C_{river(HPC} \cdot Q_{river}}{Q_{river}} [1]$$

Where:

C wastewater – the highest BDS_7 concentration in the average daily sample of wastewater or in the instantaneous sample of wastewater, in case of which the permissible impact to receptacle will not be exceeded, mg/l;

C river (HPC) – the highest permissible concentration with regard to BDS7 in the receptacle (requirements for good condition of the receptacle), mg/l;

Q wastewater – the highest calculated hourly yield of discharged wastewater (in dry season), m^3/h;

Q river – average water yield in discharge place of minimal lower water in summer-autumn of 80 % probability for 30 consecutive driest days, m^3/s. The average water yield in discharge place of minimal lower water in summer-autumn of 80 % probability for 30 consecutive driest days may be determined by persons, who are entitled to design hydrotechnical structures and/or carry out hydrological measurements/calculations.

The annual load of N and P, in case of which the permissible impact on the pool of running water will not be exceeded, is calculated according to the following formula:

$$T_n = \frac{1.1 \cdot C_{river\,(HPC)} \cdot Q_{wastewater} + 0{,}1 \cdot C_{river(HPC)} \cdot Q_{river}}{1000} [2]$$

Where:

Q river – average leak of receptacle of multiple years in the place of wastewater discharge, thousand m^3/year. The average leak of receptacle of multiple years may be determined by persons, who are entitled to carry out hydrological measurements/calculations;

T_n – annual load of N and P, in case of which the permissible impact on the receiving water pool will not be exceeded, t/year;

C river (HPC) – N or P HPC in receptacle (requirements for good condition of the receptacle), mg/l;

Q wastewater D– volume of wastewater discharged (planned to be discharged) in a year, thousand m^3/year;

When the wastewater is discharged (planned to be discharged) to the pool of slack water (lake, pond, the Curonian lagoon, artificial closed water pool), the annual load of BDS, N and P, in case of which the permissible impact on the receiving water pool will not be exceeded, shall be calculated according to the following formulas:

When the volume of the water pool is known:

$$T_n = \frac{V_{pool} \cdot C_{pool}}{100000} [3]$$

When only the area of the water pool is known:

$$T_n = \frac{V_{pool} \cdot C_{pool}}{2000} [4]$$

Where:

T_n – annual load of BOD, N or P, in case of which the permissible impact on the receiving water pool will not be exceeded, t/year;

V_{pool} – the pool's volume, thousand m^3 (if the volume of the water pool exceeds 5000 thousand m^3, 5000 thousand m^3 are applied for calculation);

C_{pool} – the highest permissible concentration of BDS, N or P respectively in the water pool (requirements for good condition of the receptacle), (mg/l);

F_{pool} – the pool's area, ha (if the area of the water pool exceeds 100 ha, 100 ha are applied for calculation).

Table 14. General requirements to wastewater discharged to natural environment.

Parameters	Unit	Limit value[3]
Maximum temperature	°C	Not more than 30[1]
pH[2]	-	6.5–8.5
Mineralization	g/l	Not more than 2
Wastewater cannot be toxic [4]		

Table 15. Pollution norms of wastewater discharged to natural environment.

Parameter	Agglomeration (pollution source) size / amount of effluent	Unit	MPC of average daily sample	Instant MPC	Average annual pollution (MPC) of effluent	Minimal treatment efficiency
Biochemical Oxygen Demand $BOD_5/BODS_7$	< 5 m^3/d	mgO_2/L	-	50/58	30/35	–
	5 m^3/d – 2000 PE	mgO_2/L	-	40/46	25/29	–
	2000 PE – 10000 PE	mgO_2/L	25/29	-	determined individually	70-90
Total phosphorus	5 m^3/d – 10000 GE	mgP/L	-	-	2	80
Total nitrogen	5 m^3/d –10000 PE	mgN/L	-	-	20	70-80

Available only in Lithuanian:

https://www.e-tar.lt/portal/lt/legalAct/TAR.4D0DFCDD673A/GYdugGvOlU

3.4.10. Order regarding approval of regulation on surface wastewater treatment

Order of the Minister of Environment of the Republic of Lithuania regarding approval of regulation on surface wastewater treatment, 02 April 2007 No. D1-193 Official Gazette, 14/04/2007, No. 42-1594.

The Regulation on Surface Wastewater Treatment establishes main environmental requirements for collection, cleaning and discharge of surface wastewater in order to protect environment from pollution.

The surface wastewater has to be treated separately from domestic, municipal and industrial wastewater. It is prohibited to discharge surface wastewater to the treatment systems of domestic, municipal and industrial wastewater, unless the wastewater treatment system in prejudice to this requirement had been installed (or the building permit had been issued) before the present Regulation entered into force. All the requirements established in the legal acts with regard to treatment of wastewater that gets into the mixed wastewater system shall be applicable to the mixed wastewater treatment systems.

It is prohibited to discharge (in order to dispose) hazardous substances and any waste to the surface wastewater treatment system. Such disposal does not cover entrance of hazardous substances onto the territories or directly to surface wastewater treatment systems together with dust and precipitation or due to economic activities carried out in the territory in compliance with the requirements (e.g. operational discharges from technically orderly vehicles, other mechanisms, dirt from tires, etc.).

The pollution of surface wastewater discharged to environment cannot exceed:

1. annual average concentration of floating substances – 30 mg/l, highest instantaneous concentration – 50 mg/l;

2. BOD_5 annual average concentration – 25 mg O_2/l, highest instantaneous concentration – 50 mg O_2/l. This parameter has to be established and controlled only with regard to wastewater collected from possibly polluted territories, which may be polluted by organic pollutants (e.g. objects of recycling of agricultural production, food industry, management of organic waste, etc.);

3. annual average concentration of petroleum products – 5 mg/l, highest instantaneous concentration – 7 mg/l;

4. the concentration of other hazardous substances cannot exceed the highest permissible concentration of underlying hazardous substances listed in the Annex I to the Regulation of Wastewater Treatment approved by the Order No. D1-236 of the Minister of Environment of the Republic of Lithuania of the 17th of May 2006 “Regarding Approval of Regulation of Wastewater Treatment”, hazardous and other controlled substances listed in the Annex II thereof that can be discharged to natural environment, unless other requirements are established for discharged surface wastewater in the Regulation or other legal acts.

Available only in Lithuanian:

https://www.e-tar.lt/portal/lt/legalAct/TAR.F79C1136595E/lucFqjBbjm

3.4.11. Order regarding approval of description of accounting procedure of water consumption and wastewater treatment

Order of the Minister of Environment of the Republic of Lithuania regarding approval of description of accounting procedure of water consumption and wastewater treatment, 28 December 2012 No. D1-1120 Official Gazette, 08/01/2013, No. 3-88.

The Description of Accounting Procedure of Water Consumption and Wastewater Treatment shall establish requirements for accounting of water consumption and wastewater treatment for undertakings and submission procedure of annual reports on such accounting.

Calculation methodology of the pollutant's amount, average concentration and cleaning effectiveness in wastewater

The annual amount of the pollutant in the domestic, municipal or industrial wastewater before cleaning is calculated as follows:

$$M_{NV} = \sum_{i,j=1}^{n} \frac{C1_i \times Q_j}{1000 \times 1000} \quad [1]$$

where:

M_{NV} – annual amount of the pollutant in the wastewater before cleaning (t/year);

$C1_i$ – the pollutant's concentration in the i^{th} sample of wastewater taken before cleaning (mg/l):

Q_j – amount of wastewater measured during the period j (m^3);

The annual average concentration in the domestic, municipal or industrial wastewater before cleaning is calculated as follows:

$$C1_M = \frac{M_{NV} \times 1000 \times 1000}{Q_M} \quad [2]$$

where:

$C1_M$ – annual average concentration of the pollutant in the wastewater before cleaning (mg/l);

Q_M – annual amount of wastewater (m^3), that is calculated as follows:

$$Q_M = \sum_{j=1}^{n} Q_j \quad [3]$$

The annual amount of the pollutant discharged to natural environment or wastewater collection system together with domestic, municipal or industrial wastewater is calculated as follows:

$$M_V = \sum_{i,j=1}^{n} \frac{C2_i \times Q_j}{1000 \times 1000} \quad [4]$$

where:

M_V – annual amount of the pollutant in the discharged wastewater (t/year);

$C2_i$ – the pollutant's concentration in the i^{th} sample taken from discharged wastewater (mg/l):

Q_j – amount of wastewater measured during the period j (m^3);

The annual average concentration of the pollutant in the natural environment or in the domestic, municipal or industrial wastewater discharged to wastewater collection system is calculated as follows:

$$C2_M = \frac{M_V \times 1000 \times 1000}{Q_M} \quad [5]$$

where: $C2_M$ – annual average concentration of pollutant in the discharged wastewater (mg/l).

The cleaning effectiveness of the pollutant from wastewater (in percentage) is calculated as follows:

$$AE = \frac{M_{NV} - M_V}{M_{NV}} \times 100 \quad [6]$$

where: AE – cleaning effectiveness (in percentage);

M_{NV} – annual amount of the pollutant in the wastewater before cleaning (t/year);

M_V – annual amount of the pollutant in the wastewater after cleaning (t/year).

Available only in Lithuanian:

https://www.e-tar.lt/portal/lt/legalAct/TAR.83620262D6A8/yTCYtzrOBv

3.4.12. Order regarding approval of the normative document land 20-2005 “requirements for application of wastewater sludge for fertilization and recultivation”

Order of the Minister of Environment of the Republic of Lithuania regarding approval of the normative document land 20-2005 “requirements for application of wastewater sludge for fertilization and recultivation”, 29 June 2001 No. 349 Official Gazette, 13/07/2001, No. 61-2196

The purpose of the requirements for application of wastewater sludge for fertilization and recultivation LAND 20-2005 is to regulate the application of wastewater sludge in agriculture, forest nurseries, growing of energy crops (fast-to-grow plants, the direct usage of which is to make biofuels), growing of plantations of stock trees and bushes, plantation forest plants or seedlings, planted in the previous landed property, and in recultivation of damaged territories (for example, quarries, used-up peatbogs, closed dumps, road beds, etc.) in such a way as to avoid negative impact on groundwater, soil, plants, animals and humans.

The provider of sludge has to carry out accounting of quality of wastewater sludge (accumulative wastewater sludge including). The form of accounting journal of wastewater sludge is enclosed hereto. The following data shall be registered in the journal:

1. sludge treatment method;
2. qualitative indexes of sludge:
2.1. amount of dry substances (%);
2.2. amount of organic substances (%);
2.3. concentration of nitrogen (N), phosphorus (P) (mg/kg of dry substances);
2.4. Pb, Cd, Cr, Cu, Ni, Zn, Hg concentrations (mg/kg of dry substances);
2.5. results of microbiological-parasitological tests;
2.6. sludge’s pH;

Upon transfer of sludge to the user, the sludge provider has to issue a certificate containing the following information: amount of sludge, sludge treatment technologies, class (Table 16) and category (Table 17) of sludge, amount of dry substances, amount of organic substances, pH, concentrations of total nitrogen, phosphorus and heavy metals (Table 18 to Table 20).

Table 16. Distribution of sludge into classes according to the microbiological-parasitological parameters.

Class of sludge	Faecal intestinal stick (Escherichia coli), col. count/g	Anaerobic clostridia (Clostridium perfringens), col. count/g	Eggs and larvae of helminths, un./kg	Pathogenic enterobacteria, col. count/g
A	≤ 1000	≤ 100 000	0	0
B	1001–100 000	100 001–10 000 000	1–100	0
C	> 100 000	>10 000 000	> 100	>1

Table 17. Distribution of sludge into categories according to the concentration of heavy metals.

Rank of sludge	Concentration of heavy metals, mg/kg						
	Pb	Cd	Cr	Cu	Ni	Zn	Hg
I	<140	<1,5	<140	<75	<50	<300	<1.0
II	140–750	1.5–20	140–400	75–1000	50–300	300–2500	1.0–8.0
III	>750	>20	>400	>1000	>300	>2500	>8.0

Table 18. Background concentrations of heavy metals in soil.

Soil granulometric composition	Concentration of heavy metals, mg/kg						
	Pb	Cd	Cr	Cu	Ni	Zn	Hg
Sand, sandy loam	15	0.15	30	8.1	12	26	0.075
Clay, loam	15	0.2	44	11	18	36	0.1

Table 19. Highest permissible concentration (HPC) of heavy metals in soil.

Soil granulometric composition	Concentration of heavy metals, mg/kg						
	Pb	Cd	Cr	Cu	Ni	Zn	Hg
Sand, sandy loam	50	1.0	50	50	50	160	0.6
Clay, loam	80	1.5	80	80	60	260	1.0

Table 20. Highest permissible annual amounts of heavy metals that may enter soil at the time of fertilization with sludge.

Soil granulometric composition	Quantity of heavy metals , kg/ha in year						
	Pb	Cd	Cr	Cu	Ni	Zn	Hg
Sand, sandy loam	10	0.1	7	8	2	20	0.05
Clay, loam	15	0.15	10	12	3	30	0.1

Available only in Lithuanian:

https://www.e-tar.lt/portal/lt/legalAct/TAR.3536A8337E8A/IlGyWVLwmn

3.4.13. Order regarding approval of regulation on application of wastewater treatment plants

Order of the Minister of Environment of the Republic of Lithuania regarding approval of regulation on application of wastewater treatment plants, 11 September 2006. No. D1-412 Official Gazette, 19/09/2006, No. 99-3852.

The purpose of this Regulation is to regulate application of treatment plants of domestic wastewater and industrial and municipal wastewater of analogical composition, the output of which is below 2000 GE, separators of light liquids (e.g., oil and petrol), the output of which is below 500 l/s, and of separators of fats, the output of which is below 25 l/s (designing, supply, construction, launching, usage, control).

Summary of technological parameters of industrial wastewater treatment plants

Table 21. Name of treatment plants or their type.

Identification (according to the output)	Output			Pollutants due to elimination (indexes)	Load with pollutants		Cleaning indexes		Removal of formed waste (mud, sludge, sand, etc.), replacement of filters (in each element)				Performance parameters (capacity, energy input, needs of reagents, work input, etc.)
	m^3/d	m^3/h	l/s		kg/d	mg/l	mg/l	%	Name of the waste (filter)	Frequency of removal (replacement), d	kg SM/removal	m^3/removal	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
xx-xxxx	xx	xx	xx	xxxx	xx	xxx	xx	xx					Xxxxx xxxxx xxxxx xxxxx xxxxx xx xxxx xxxx xx xxxx xxxxx xx xxxx xxxxx xxxxx
				xxxx	xx	xxx	xx	xx					
				xxxx	xx	xx	xx	xx	xxxx	xx	xx	xx	
									xxxx	xx	xx	xx	

Table 22. Summary table of main technological parameters.

No.	Plant's name	Technological parameter			Calculating formula
		name	meas. un.	value	
1	2	3	4	5	6
1.	Septic tanks – sumps (sludge is removed once-twice a year)	Capacity of septic tank	m^3	$V_S \geq N*0.3$	
2.	Sprinkling (drip biofilter)	Inlet load with organic pollutants (when the inlet surface area is approx. 100 m^2/m^3)	$\frac{kgBDS_5}{m^3*d}$	≤ 0.2	$A_b = \frac{L_a \cdot Q}{1000 \cdot V_b}$
		Inlet load with organic pollutants (when the inlet surface area is approx. 200 m^2/m^3)	$\frac{kgBDS_5}{m^3*d}$	≤ 0.4	$A_b = \frac{L_a \cdot Q}{1000 \cdot V_b}$
		Hydraulic surface load	$m^3/m^2/h$	≤ 0.8	$q_b = \frac{Q_{hvid}}{F}$
3.	Aeration biofilter	Inlet load with organic pollutants	$\frac{kgBOD_5}{m^3*d}$	≤ 0.6	$A_b = \frac{L_a \cdot Q}{1000 \cdot V_b}$
		Inlet hydraulic surface load	$m^3/m^2/h$	≤ 3.0	$q_b = \frac{Q_{hvid}}{F}$
		Hydraulic surface (operational section) load of vertical secondary sump (after biofilter)	$m^3/m^2/h$	≤ 1.0	$q_b = \frac{Q_{h\max}}{F}$
4.	Aerotank	Load of active sludge with organic pollutants (total load of sludge in anaerobic, anoxic and aeration areas): highest permissible – when excess sludge is removed at least once a week; average (between removals of excess sludge) – when excess sludge is removed more rarely than once a week (in this case the highest load (after removal of excess sludge) cannot exceed 0.15)	$\frac{kgBOD_5}{kg*d}$	A ≤ 0.05 (GE ≤ 50); A ≤ 0.1 (50 < GE ≤ 500); A ≤ 0.15 (500 < GE ≤ 2000)	$A = \frac{L_a \cdot Q}{a \cdot V \cdot 1000}$ Aerotanks with bio inlet: $A = \frac{L_a \cdot Q}{(a*V + a_b*V_b)*1000}$ a_b=4–6 g/l
		Precipitation duration in secondary sump	h	≥ 2.5	$t_n = \frac{V_n}{Q_{h\max}}$

		Hydraulic surface (operational section) load of vertical secondary sump	$m^3/m^2/h$	≤ 0,6	$q_n = \frac{Q_{h\max}}{F_n}$
5.	Sand separators (applied for sand separators, the output of which (NS): 0.6-1500 l/s)	Hydraulic presence duration	min.	≥ 5	
		Capacity of sand separator	litres	300*NS	Minimal capacity – 600 litres
		Minimal height left for accumulation of sediments (on the bottom)	m	≥ 0.35	
6.	Oil separators (applied for oil separators, the nominal output of which (NS) 1.5-500 l/s)	Minimal height left for accumulation of petroleum products (on the surface)	m	≥ 0.15	
7.		Minimal height left for accumulation of sediments (on the bottom)	m	≥ 0.35	
8.		Water surface (operational section) area	m^2	0.2 x NS *	
9.		Minimal capacity of separator	m^3	0.5 x NS *	
10.		Hydraulic duration of wastewater presence	min.	≥ 5; with coalescent module equivalent to 18 and 19: ≥ 3	
11.		Accumulation volume of petroleum products	litres	10 x NS (in presence of protective float valve); 15 x NS (in absence of protective valve);	
12.		Minimal power of sorption substances	g/g	6 g oil 1 g sorbent	
13.		Filtration speed through sorption substance *Fibroil*	$l/m^2/s$	≤ 8	
14.		Filtration speed through sorption substance *OilSorb*	$l/m^2/s$	≤ 20	
15.		Filtration speed through sorption substance USVR-VIP	$l/m^2/s$	≤ 1.4	
16.		Filtration speed through sorption substance *Woolspill*	$l/m^2/s$	≤ 11	

17.		Presence duration in sorption substance	sec.	≥ 15	$\frac{V_U}{Q_L}$*1000
18.		Hydraulic load of coa-lescent module	l/m/^{2}s	≤ 7	Q/F
19.		Presence duration in coalescent module	sec.	≥ 30	$\frac{V_U}{Q_L}$*1000

Remark. * When coalescent modules are not used.
Conditional marking:
a – concentration of active sludge, g/l;
a_b – bio-membrane's concentration in bio-inlet, g/l;
L_a –pollution of treated wastewater according to BDS_5, mg/l;
Q – estimated daily yield of treated wastewater, m^3/d;
Q_{hvid} – average hourly yield, m^3/h;
Q_{hmax} – maximal hourly yield, m^3/h;
F – surface area of filter's module, m^2;
V_b – inlet volume, m^3;
concentration of active sludge, g/l;
V – aerotank's capacity, m^3;
V_n – capacity of precipitation part of secondary sump, m^3;
F_n – surface area (operational section) of secondary sump, m^2;
V_z – total capacity of anaerobic, anoxic and aeration areas, m^3;
N – number of residents or size of wastewater source according to equivalent of residents (GE), un.;
t_n – wastewater precipitation duration in secondary sump, h;
V_s – capacity of septic tank, m^3;
NS – output, l/s;
Q_L – rain wastewater yield, l/s;
q – filtration speed, m^3/m^2/h;
A – load of active sludge with organic pollutants (when dry substances are used for measurement), kgBDS_5 /kg*d;
A_b – load with organic pollutants, kgBDS_5 /m^3*d;
Q_t – wastewater yield, m^3/h;
V_u – filling volume or volume of coalescent module, m^3.

Available only in Lithuanian:

https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/TAIS.282911/nxFBupcUCX

3.4.14. Order regarding approval of description of requirements on protection of surface waters, where freshwater fish may live and breed

Order of the Minister of Environment of the Republic of Lithuania regarding approval of description of requirements on protection of surface waters, where freshwater fish may live and breed, 21. December 2005, No. D1-633 Official Gazette, 14/01/2006, No. 5-159.

The purpose of the Description of Requirements on Protection of Surface Waters, where Freshwater Fish may Live and Breed, is to establish threshold limit values of water quality, assessment procedure of water quality, and sampling procedure in water pools, where salmons live, may live or in other water pools.

Threshold limit values of water quality, sampling methods and frequency of surface waters, where freshwater fish may live and breed.

Available only in Lithuanian:

https://www.e-tar.lt/portal/lt/legalAct/TAR.AE00F974917D/CgqvLLVwpK

3.4.15. Order Regarding approval of determination methodology of state of surface waters

Order of the Minister of Environment of the Republic of Lithuania amending order no. D1-210 of the Minister of Environment of the Republic of Lithuania of 12 April 2007 “Regarding approval of determination methodology of state of surface waters”, 04 August 2016, no. D1-533.

The Determination Methodology of State of Surface Waters (hereinafter – Methodology) is sued to determine assessment criteria of ecological state of rivers, lakes, borderline, littoral water pools and ecologic potential of artificial or strongly changed water pools in accordance with the types of water pools, the assessment criteria of chemical state of surface waters, and classification rules of the state of surface waters.

The ecologic state of rivers is assessed according to physical-chemical, hydromorphological and biological quality elements.

The ecologic state of rivers is assessed according to the indexes of physical-chemical quality elements: indexes that describe general data (nutrients, organic substances, saturation with oxygen) – nitrate nitrogen (NO_3-N), ammonium nitrogen (NH_4-N), total nitrogen (Nb), phosphate phosphorus (PO_4-P), total phosphorus (Pb), biochemical consumption of oxygen in 7 days (BOD7) and amount of melted oxygen in water (O2), and indexes that describe specific pollutants (heavy metals): aluminium (Al), arsenic (As), chromium (Cr), copper (Cu), vanadium (V), zinc (Zn) and stannum (Sn). The water pool is attributed to one of five classes of ecologic state in accordance with average annual values of indexes of general data of physical-chemical quality elements. The water pool is attributed to one of two classes of ecologic state in accordance with average annual values of indexes of specific pollutants of physical-chemical quality elements (Table 23).

Assessment criteria of ecologic state of rivers

Table 23. Criteria for ecological status of rivers according to the values of indicators of physico-chemical quality elements.

No.	Quality element		Indicator	Type of river	Criteria for ecological status of rivers according to the values of indicators of physico-chemical quality elements				
					Very good	Good	Average	Bad	Very bad
1.	General data	Nutrients	NO_3-N, mg/l N	1–5	<1.30	1.30–2.30	2.31–4.50	4.51–10.00	>10.00
2.			NH_4-N, mg/l N	1–5	<0.10	0.10–0.20	0.21–0.60	0.61–1.50	>1.50
3.			N_b, mg/l	1–5	<2.00	2.00–3.00	3.01–6.00	6.01–12.00	>12.00
4.			PO_4-P, mg/l P	1–5	<0.050	0.050–0.090	0.091–0.180	0.181–0.400	>0.400
5.			P_b, mg/l	1–5	<0.100	0.100–0.140	0.141–0.230	0.231–0.470	>0.470
6.		Organic matters	BDS_7, mg/l O_2	1–5	<2.30	2.30–3.30	3.31–5.00	5.01–7.00	>7.00
7.		Oxygen saturation	O_2, mg/l	1, 3, 4, 5	>8.50	8.50–7.50	7.49–6.00	5.99–3.00	<3.00
8.			O_2, mg/l	2	>7.50	7.50–6.50	6.49–5.00	4.99–2.00	<2.00

Assessment criteria of ecologic state of lakes

The ecologic state of lakes is assessed according to physical-chemical, hydromorphological and biological quality elements.

The ecologic state of lakes is assessed according to the indexes of physical-chemical quality elements: indexes that describe general data (nutrients, organic substances and water's clarity) – total nitrogen (N_b) and total phosphorus (P_b), biochemical consumption of oxygen in 7 days (BOD_7), Secchi depth (S), and indexes that describe specific pollutants (heavy metals): aluminium (Al), arsenic (As), chromium (Cr), copper (Cu), vanadium (V), zinc (Zn) and stannum (Sn). The water pool is attributed to one of five classes of ecologic state in accordance with average annual values of indexes of general data of physical-chemical quality elements of samples from the surface water layer. The water pool is attributed to one of two classes of ecologic state in accordance with average annual values of indexes of specific pollutants of physical-chemical quality elements (Table 24).

Table 24. Criteria for ecological status of lakes according to the values of indicators of physico-chemical quality elements.

No.	Quality element		Indicator	Type of lake	Criteria for ecological status of lakes according to the values of indicators of physico-chemical quality elements				
					Very good	Good	Average	Bad	Very bad
1.	General data	Nutrients	N_b, mg/l	1-3	<1.00	1.00-2.00	2.01-3.00	3.01-6.00	>6.00
2.			P_b, mg/l	1	<0.040	0.040–0.060	0.061–0.090	0.091–0.140	>0.140
3.			P_b, mg/l	2-3	<0.030	0.030–0.050	0.051–0.070	0.071–0.100	>0.100
4.		Organic matters	BDS_7, mg/l O_2	1	<2.3	2.3-4.2	4.3-6.0	6.1-8.0	>8.0
5.			BDS_7, mg/l O_2	2-3	<1.8	1.8-3.2	3.3-5.0	5.1-7.0	>7.0
14.			Sn, µg/l	1-5		≤5.0	>5.0		

Assessment criteria of ecologic state of borderline water pools

The ecologic state of borderline waters is assessed according to physical-chemical and biological quality elements (Table 25).

Table 25. Criteria for ecological status of borderline waters according to the values of indicators of physi-co-chemical quality elements.

No.	Quality element		Indicator	Type of borderline waters	Criteria for ecological status of borderline waters according to the values of indicators of physico-chemical quality elements				
					Very good	Good	Average	Bad	Very bad
1.	General data	Nutrients	N_b, mg/l	1, 3*	<0.94	0.94–1.08	1.09–1.23	1.24–1.41	>1.41
2.			N_b, mg/l	2	<0.95	0.95–1.07	1.08–1.17	1.18–1.26	>1.26
3.			N_b, mg/l	3**	<0.43	0.43–0.67	0.68–0.81	0.82–1.00	>1.00
4.			N_b, mg/l	3***	<0.13	0.13–0.25	0.26–0.40	0.41–0.60	>0.60
5.			P_b, mg/l	1, 3*	<0.060	0.060–0.080	0.081–0.136	0.137–0.312	>0.312
6.			P_b, mg/l	2	<0.061	0.061–0.079	0.080–0.130	0.131–0.278	>0.278
7.			P_b, mg/l	3**	<0.037	0.037–0.053	0.054–0.084	0.085–0.175	>0.175
8.			P_b, mg/l	3***	<0.015	0.015–0.026	0.027–0.033	0.034–0.039	>0.039

Assessment criteria of ecologic state of littoral water pools

The ecologic state of littoral water pools is assessed according to physical-chemical and biological quality elements (Table 26).

Table 26. Criteria for ecological status of Littoral water pools according to the values of indicators of physico-chemical quality elements.

No.	Quality element		Indicator	Type of Littoral water pools	Criteria for ecological status of Littoral water pools according to the values of indicators of physico-chemical quality elements				
					Very good	Good	Average	Bad	Very bad
1.	General data	Nutrients	N_b, mg/l	1, 2	<0.13	0.13–0.25	0.26–0.40	0.41–0.60	>0.60
2.			P_b, mg/l	1, 2	<0.15	0.015–0.026	0.027–0.033	0.034–0.039	>0.039

Available only in Lithuanian:

https://www.e-tar.lt/portal/lt/legalAct/81bef6e05df711e693cf945f20391699

3.5. Poland

In the Polish legal system, there is no single legal act which would cover the matter that is mentioned in the Helsinki Convention. There are numerous legal acts amongst which the Environment Protection Law Act from 2001, Water Law Act from 2001, Provision of environmental information, environment conservation, public participation in environment conservation, evaluation of environmental impact act from 2008, the Law on Marine Areas of Poland and Marine Administration of 1991 and The Law on Planning and Spatial Management of 2003 are the most important for the protection of the Baltic Sea environment.

Regulation on conditions for the introduction of sewage into water or soil and on the list of substances particularly harmful to water environment entered into force on 31 December 2014. This Regulation of the Minister of Environment, which is composed of 30 articles and 12 Annexes, lays down that the substances particularly harmful to water environment, causing pollution that should be eliminated, and the substances that are particularly harmful to water environment, causing pollution which should be limited.

All individual small wastewater treatment plants need to prepare their design documentation on the basis of the provisions of the Building Act, obtain a building and water permit for water devices (construction of the outlet of treated wastewater to the sewage receiver) issued by the Staroste.

3.5.1. Regulation on conditions for the introduction of sewage into water or soil and on the list of substances particularly harmful to water environment

According to this act small domestic waste water treatment stations in agglomeration must fulfill the same conditions as great stations.

Warsaw, December 16, 2014

Pos. 1800, ORDINANCE MINISTRY OF THE ENVIRONMENT of 18 November 2014

On the conditions to be met for the introduction of sewage into waters or to land,

And on substances particularly harmful to the aquatic environment2)

Official Journal - 15 - Pos. 1800

Based on Article. 45 sec. 1 point 1, 3 and 4 of the Act of July 18, 2001 - Water Law (Journal of Laws of 2012, item 145, as amended with later changes 3)) the following is ordered:

§ 1. The regulation defines:

4) maximum permissible pollutant values for sewage from domestic and municipal sewage treatment plants and for wastewater from sewage treatment plants **in the agglomeration.**

§ 2. Whenever the regulation mentions:

1) the value of the pollutant index in the average daily sample - this is the value measured in the sample

Resulting from the mixing of samples taken manually or automatically during the 24 hours at intervals of at most

Two hours, proportional to flow, excluding pH and temperature indicator;

2) the value of the pollutant index in the average monthly sample - this is calculated as the mean value

Arithmetic of all measured values in average daily samples taken in a given month;

3) the value of the pollutant index in the average annual sample - this is calculated as the mean value

Arithmetic of all measured values in the mean daily samples taken in a given year.

§ 3. Substances particularly harmful to the aquatic environment causing water pollution which should be

Eliminated (List I), and substances that are particularly harmful to the aquatic environment, causing pollution

Waters that should be restricted (List II) are set out in Annex 1 to the Regulation.

§ 4. 1. Household or municipal wastewater entering the waters should not exceed the highest limit values Indicators of pollution or should meet the minimum percentage of pollution reduction set out in the Annex No. 2 to the regulation.

2. Household wastewater entering the wastewater treatment plant in the agglomerations should not exceed the highest levels. The permissible values of pollution indicators or should meet the minimum percentage of pollution reduction, specified in Annex 3 to the Regulation.

3. Municipal sewage other than domestic sewage, entering the waters of a municipal sewage treatment plant or a treatment plant, sewage in the agglomeration should not exceed:

1) the maximum permissible values of pollutants or should meet the minimum percentage of pollution reduction specified in Annex 2 or Annex 3 to the Regulation respectively;

2) the highest permissible values of pollution indicators for industrial effluents, specified in Annex 4 to the Regulation, excluding lp. 3, 5, 6, 11 and 12 in Table II of Annex 4 to the Regulation,

with the proviso that:

A) if the effluents of municipal waste water come from industrial waste water from plants belonging to sectors industrial waste from which biodegradable industrial effluents are disposed of as defined in the Annex No. 5 of the regulation, hereinafter referred to as "biologically degradable industrial wastewater", shall not exceed the maximum limit values for pollutants specified for these wastewater in Table II of Annex 4 to the Regulation,

(B) if urban waste water is included in industrial effluent, these effluents should not exceed the maximum permissible values for the other pollutants specified in Table I of Annex 4 to the Regulation and should not exceed the maximum values for the other pollutants specified In Table II of Annex 4 to t4. Where municipal waste water contains substances that are particularly harmful to the aquatic environment, 3-16

In Table I of Annex 4 to the Regulation, they can be labelled as total AOX (absorbable chloro-organic compounds).

5. Fulfillment of the conditions referred to in sec. 1-3, is judged on the basis of quantity and quality measurements of waste water.

6. The effluent of the wastewater treatment plant, expressed in terms of population equivalent, hereinafter referred to as "RLM", on which they depend waste water treatment requirements are calculated on the basis of the maximum average weekly load impurities expressed by an index of five-day biochemical oxygen demand, hereinafter referred to as "BOD5", which flows into the treatment plant during the year, excluding atypical conditions, in particular resulting from heavy

rainfall. The burden of a newly built, expanded or rebuilt wastewater treatment plant is based on project assumptions.

7. A simplified way of calculating the load on existing wastewater treatment plants is allowed:

1) in agglomerations with RLM up to 9,999 - based on the results of the wastewater tests carried out in the last one year, in accordance with § 5 2, if these tests have shown that the waste water meets the required conditions;

2) up to 14,995 - on the basis of the results of the wastewater tests carried out in the last year, in accordance with § 5 2, if these tests have shown that the waste water meets the required conditions.

8. Sewage coming from their own household or farm located outside the agglomeration, introduced to waters, should not exceed the maximum limit values for pollutants specified in Annex 2 to the Regulation that are less than 2000 below the RLM.

9. Wastewater coming from its own household or farm located in an agglomeration, introduced to waters, should not exceed the maximum limit values for pollutants specified in Annex 3 of the Regulation, which are specific to agglomerations in the area of the household.

§ 5. 1. Sampling of domestic, municipal and domestic sewage from sewage treatment plants in agglomerations and sewage in addition to on-site municipal and municipal water or sewage treatment plants, or from sewage treatment plants in the agglomerations, within the limits of the maximum permissible indicators of pollution, defined respectively in Annex 2 or Annex 3 to the Regulation, and measurements of their quantity and quality should be made:

1) at regular intervals throughout the year;

2) constantly in the same place where sewage flows into the sewage treatment plant or the municipal sewage system either to sewage treatment plants in the agglomerations either put into water or to the ground and, if necessary, another place representative of the quantity and quality of these wastewater.

2. The number of daily average samples of domestic, municipal and domestic sewage from the sewage treatment plant in the agglomerations and municipal sewage other than by-products, entering and entering into the waters or land from domestic or municipal sewage treatment plants or sewage treatment plants in the agglomeration can’t be less than:

1) for the RLM below 2000 - 4 samples per year, and if it is shown that the waste water meets the required conditions

- 2 samples in the next year; In case one sample from two taken does not meet the required conditions, in the next year, 4 samples are taken again;

2) for RLM from 2000 to 9999 - 12 samples per year and if it is shown that the waste water meets the required conditions

- 4 samples in the next year; In case one sample from four taken does not meet the required conditions, the next year, 12 samples are taken again;

3) for RLM from 10000 to 49999 - 12 samples per year;

4) for 50,000 RLM and greater - 24 samples per year.

3. If in the water permit for the introduction of domestic or municipal sewage into the water or to the ground are the maximum permissible values of pollutant indices are the sampling of effluent concerns the effluents entering the treated municipal or municipal sewage and entering the water or the land from domestic or municipal sewage treatment plants.

4. Sampling of urban waste water other than domestic wastewater entering the water from the wastewater treatment plant communal or sewage treatment plant in the agglomerations, in the scope of pollution indicators specified in Annex No. 4 to the Regulation, excluding lp. In Table II of Annex 4 to the Regulation, and the measurements of the quantity and quality of these wastewater should be made at regular intervals, at a frequency not less than once every two months, constantly in the same place.

§ 6. 1. Household, municipal and household sewage from sewage treatment plants in agglomerations and non-domestic municipal sewage meet the required conditions if:

1) the number of daily average daily wastewater samples that did not meet the highest requirements the permissible values of pollution indicators or the minimum percentage of pollution reduction BOD5, chemical oxygen demand, hereinafter referred to as "COD", and general slurries, are not higher than the average of the daily average samples specified in Annex 7 to the Regulation;

2) samples that do not meet the conditions referred to in point 1 do not show deviations from the maximum permitted value of pollutants or minimum percentage reduction of pollutants greater than: 100 % for BOD5 and COD and 150 % for general suspensions;

3) General and total nitrogen values in the average annual sample do not exceed the highest permissible values of pollutants or meet the minimum percentage of pollution reduction specified in Annex 2 or Annex 3 to the Regulation respectively.

§ 13. 1. Domestic sewage, municipal sewage, sewage from a water treatment plant, biologically degradable industrial sewage, sewage, referred to in § 12 1, drainage water from mining plants and waste water treated in reverse osmosis can be introduced to the ground if:

5. Wastes coming from their own household or agricultural land located outside the agglomeration may be introduced into the soil, within the limits of the land being the landowner, if the following conditions are met:

1) their quantity does not exceed 5,0 m^3 per day;

2) BOD5 of wastewater entering the individual wastewater treatment system is reduced by at least 20 % and the total slurry content by at least 50 %;

3) place of sewage into the ground is separated by a layer of soil with a thickness of at least 1.5 m from the highest usable groundwater aquifer.

6. Sewage from its own household or farm located in an agglomeration may be introduced to the ground, within the limits of the land being the property of the seller, if the following conditions are met:

1) their quantity does not exceed 5,0 m^3 per day;

2) do not exceed the maximum values of pollution indicators specific to agglomerations, in the area of the farm located in Annex 3 to the Regulation;

3) the place of their introduction into the ground is separated by a layer of soil with a thickness of at least 1.5 m from the highest usable aquifer of groundwater.

7. Sewage from their own household or agricultural land located outside the agglomeration may be introduced into the water facility within the limits of the land being the landowner if the following conditions are met:

1) their quantity does not exceed 5,0 m^3 per day;

2) Do not exceed the maximum permissible value of pollution indicators for treatment plants with RLM since 2000

Up to 9999 specified in Annex 2 to the Regulation;

3) the highest utility water level of groundwater is at least 1.5 m below the bottom of this device.

7. Sewage from their own household or agricultural land located outside the agglomeration may be introduced into the water facility within the limits of the land being the landowner if the following conditions are met:

1) their quantity does not exceed 5,0 m^3 per day;

2) Do not exceed the maximum permissible value of pollution indicators for treatment plants with RLM since 2000

Up to 9999 specified in Annex 2 to the Regulation;

3) the highest utility water level of groundwater is at least 1.5 m below the bottom of this device.

8. Sewage from its own household or farm located in an agglomeration may be introduced into a water facility within the limits of the land being the landowner if the following conditions are met:

1) their quantity does not exceed 5,0 m^3 per day;

2) do not exceed the maximum values of pollution indicators specific to agglomerations,

In the area of the farm located in Annex 3 to the Regulation;

3) the highest utility water level of groundwater is at least 1.5 m below the bottom of this device.

§ 14. Waste water may be used for agricultural use if:

1) BOD5 of waste water is reduced by at least 20 % and the content of slurries by at least 50 %;

2) meet the sanitary conditions set out in Annex No. 8 to the Regulation;

3) do not pose a threat to the quality of groundwater and surface water and, in particular, will not pollute those waters with substances that are particularly harmful to the aquatic environment;

4) do not exceed the maximum values of pollution indicators specified in:

A) lp. 1 and 2 in Table I of Annex 4 to the Regulation,

B) lp. 2 and 21-58 in Table II of Annex 4 to the Regulation.

§ 15. The permissible content of heavy metals in soils, in the 0-30 cm layer, in areas where agricultural use of waste water may be used is set out in Annex 9 to the Regulation.

§ 16. 1. Compliance with the conditions referred to in § 14 and § 15 shall be assessed on the basis of tests of waste water and soil.

2. Microbiological and parasitological investigations and tests of the condition and composition of waste water intended for agricultural use shall be carried out at least once every two months.

3. Investigation of heavy metal content in soils in areas where agricultural waste can be used is carried out every 5 years.

§ 17. 1. The agricultural use of waste water may be used outside the shallow areas of crevices that are not insulated from the surface of the impermeable layer.

2. The location of land where agricultural waste can be used, and the facilities and installations used for the storage and preparation of waste water for agricultural use should comply with the conditions set out in Annex 10 to the Regulation.

Table 27. Highest limit values of pollution indicators or minimum reducing rate of pollution for wastes introduced to water or earth.

No.	Indicator name[3)]	Unit	Maximum values of indicators Impurities or minimal reduction percentage pollution of sewage entering the waters or to land: For RLM waste water treatment plant[2)]				
			Less than 2000	From 2000 to 9999	From 10000 to 14999	15000 to 99999	100000 and above
1	1 5-day biochemical oxygen demand (BOD_5 at 20^0 C), marked with an appendix nitrification inhibitor	mg O_2 / l min. % reduction	40 –	25 or 70-90	25 or 70 - 90	15 or 90	15 or 90
2	Chemical oxygen demand ($ChZT_{Cr}$), determined by the dichromian method	mg O_2 / l min. % reduction	150 –	125 or 75	125 or 75	125 or 75	125 or 75
3	Suspended solids	mg / l min. % reduction	50 –	35 or 90	35 or 90	35 or 90	35 or 90
4	Total Nitrogen (sum of Kjeldahl nitrogen (NN_{org} + NNH_4), Nitric nitrogen and nitrogen nitrate)	mg N / l min. % reduction	30[4)] –	15[4)] –	15[4),6)] 15[4,)7)] or 35[5),6)] 70-80[5),7)]	15 or 70-80	10 or 70 -80
5	Total Phosphorus	mg P / l min. % reduction	5[4)] –	2[4)] –	2[4),6)] 2[4),7)] or 40[5),6)] 80[5),7)]	2 or 80	1 or 80

Explanations:

1) The maximum permissible values for pollution indicators set out in the annex or the minimum percentage of pollution reduction:

- five-day biochemical oxygen demand (BOD5), chemical oxygen demand determined by the method Dichromate (CODCr) and general suspensions - refer to the values of these indicators in daily average samples, except that in the case of municipal sewage treatment plants with RLM less than 2000 and with a periodic discharge of sewage, the simplified procedure is allowed method of sampling of waste water if it can be shown that the results of the tests will be representative of the quantities discharged pollution,

- Total nitrogen refers to the average annual value of this indicator in wastewater, calculated for daily average samples taken in given year. It is possible to set requirements for removal of nitrogen compounds on the basis of daily average tests, if It can be demonstrated that the same level of protection has been achieved. In this case, the total nitrogen concentration in any of the mean daily samples of effluent from the effluent from the

biological reactor when the temperature of these effluents is equal to or higher than 12 ° C, can't exceed 20 mg N / l. The criterion based on the determination of the limit temperature can be replaced by the appropriate one time limit, taking into account local climatic conditions,

- total phosphorus - refers to average annual value of this indicator in wastewater,

- the minimum percentage of pollution reduction is determined in relation to the pollutant load in the wastewater entering treatment plant.

2) At the time of start-up of the newly built, expanded or rebuilt plant and in the event of a failure of essential equipment for the implementation of a water permit the maximum permissible values of pollutants are increased to the maximum 50 %, and the required reduction of pollutants is reduced to no more than 50 % from the values given in the Annex.

3) Analyses shall be made from homogenised, non-decanterated and unfiltered samples, except for outflows from biological ponds, in which the BOD5, CODCr, total nitrogen and total phosphorus are to be prepared from the filtered samples. Samples taken from drainage from biological ponds should be pre-filtered, however, the total slurry content of the samples unfiltered should not exceed 150 mg / l irrespective of the size of the treatment plant.

4) Values required only in wastewater entering lakes and their tributaries and directly into artificial reservoirs water located in flowing waters.

5) Minimum reduction percentage does not apply to waste water entering the lakes and their tributaries directly to the artificial water reservoirs located in flowing water and to the soil.

6) The maximum values for pollution indicators or the minimum percentage of pollution reduction shall be applicable until 31 December 2015.

7) The maximum values for pollution indicators or the minimum percentage of pollution reduction shall be applicable from 1 January 2016.

Table 28. Highest limit values of pollution indicators or minimum reducing rate of pollution for wastes introduced to water or earth from treating plants in agglomeration[1)].

No.	Indicator name[3)]	Unit	Maximum values of indicators Impurities or minimal reduction percentage pollution of sewage entering the waters or to land from the sewage treatment plant in the agglomeration:			
			For agglomeration RLM[2)]			
			From 2000 to 9999	From 10000 to 14999	From 15000 To 99999	100000 And above
1	1 5-day biochemical oxygen demand (BOD_5 at 20^0 C), marked with an appendix nitrification inhibitor	mg O_2 / l min. % reduction	25 or 70-90	25 or 70-90	15 or 90	15 or 90
2	Chemical oxygen demand ($ChZT_{Cr}$), determined by the dichromian method	mg O_2 / l min. % reduction	125 or 75	125 or 75	125 or 75	125 or 75
3	Suspended solids	mg / l min. % reduction	35 or 90	35 or 90	35 or 90	35 or 90
4	Total Nitrogen (sum of Kjeldahl nitrogen (NN_{org} + NNH_4), Nitric nitrogen and nitrogen nitrate)	mg N / l min. % reduction	15[1)] –	15 or 70-80[5)]	15 or 70-80	10 or 70-80
5	Total Phosphorus	mg P / l min. % reduction	2[4)] –	2 or 80[5)]	2 or 80	1 or 80

Explanations:
1) The maximum permissible values for pollution indicators set out in the annex or the minimum percentage of pollution reduction:

- five-day biochemical oxygen demand (BOD5), chemical oxygen demand determined by the method Dichromate (CODCr) and general suspensions - refer to the values of these indicators in daily average samples, except that in the case of municipal sewage treatment plants with a periodic discharge of sewage, the simplified procedure is allowed method of sampling of waste water if it can be shown that the results of the tests will be representative of the quantities discharged pollution,

- Total nitrogen refers to the average annual value of this indicator in wastewater, calculated for daily average samples taken in given year. It is possible to set requirements for removal of nitrogen compounds on the basis of daily average tests, if It can be demonstrated that the same level of protection has been achieved. In this case, the total nitrogen concentration in any of the mean daily samples of effluent from the effluent from the biological reactor when the temperature of these effluents is equal to or higher than 12 ° C, can't exceed 20 mg N / l. The criterion based on the determination of the limit temperature can be replaced by the appropriate one time limit, taking into account local climatic conditions,

- total phosphorus - refers to average annual value of this indicator in wastewater,

- the minimum percentage of pollution reduction is determined in relation to the pollutant load in the wastewater entering treatment plant in the agglomeration.

The maximum permissible values for pollution indicators or the minimum percentage of pollution reduction shall apply from 1 January 2016.

2) At the time of start-up of the newly built, expanded or rebuilt plant and in the event of a failure of essential equipment for the implementation of a water permit the maximum permissible values of pollutants are increased to the maximum 50 %, and the required reduction of pollutants is reduced to no more than 50 % from the values given in the Annex.

3) Analyses shall be made from homogenised, non-decanterated and unfiltered samples, except for outflows from joints biological, in which the BOD5, CODCr, total nitrogen and total phosphorus are to be prepared from the filtered samples. Samples taken from drainage from biological ponds should be pre-filtered, however, the total slurry content of the samples unfiltered should not exceed 150 mg / l irrespective of the size of the treatment plant.

4) Values required only in wastewater entering lakes and their tributaries and directly into artificial reservoirs water located in flowing waters.

5) Minimum reduction percentage does not apply to waste water entering the lakes and their tributaries directly to the artificial water reservoirs located in flowing water and to the soil.

Table 29. Sanitary conditions for wastes used for agricultural use.

No:	Indicator	Permissible value
1	Salmonella pathogenic bacteria	Undetectable in 1 l
2	Presence of living parasitic eggs (Ascaris sp., Trichuris, Toxocara sp.)	Absent in 1 l

Table 30. Limit content of heavy metal in soils in layer 0-30 cm.

Element	Unit	Content in soil			
		Very light	light	medium	heavy
Lead (Pb)	mg/kg dry matter	20	40	60	80
Cadmium (Cd)	mg/kg dry matter	0.5	1	2	3
Mercury Hg)	mg/kg dry matter	0.7	0.8	1.2	1.5
Nickel (Ni)	mg/kg dry matter	10	20	35	50
Zinc (Zn)	mg/kg dry matter	60	80	120	180
Copper (Cu)	mg/kg dry matter	20	25	50	75
Chrome (Cr)	mg/kg dry matter	30	50	75	100

Table 31. Conditions for location of land for agricultural sewerage use and devices and installations used for storage and preparation of wastes for agricultural utilization.

Location of land	Min. distance
Distance of land on which agricultural waste is used:	
1) from objects intended for human stay, at	
Sewage distribution:	
a) gravitational,	100 m
Bb by means of an irrigation plant;	200 m
2) from public roads and railway lines at	
Sewage distribution:	
a) gravitational,	20 m
b) by means of an irrigation plant;	70 m
3) from the shoreline of the flowing waters, at the slope of the terrain:	
a) up to 2 %,	30 m
b) from 2 to 10 %,	50 m
c) more than 10 %;	70 m
4) from water tanks, fish ponds not intended to supply sewage, from shore line to lake, at drop of land:	
a) up to 2 %,	50 m
b) from 2 to 10 %,	80 m
c) more than 10 %;	100 m
5) from the capture of surface or underground waters, a source of water supply Intended for consumption.	250 m[2)]
Location of equipment and installation	**Min. distance**
Distance of equipment and installations for the storage and preparation of sewage for agricultural use:	
1) from objects intended for human stay, in quantity treatment:	
a) up to 100 m3 / day,	100 m
b) up to 5000 m3 / day,	300 m
c) over 5000 m3 / day;	500 m
2) from the shoreline of the flowing waters, at the slope of the terrain:	
a) up to 2 %,	50 m
b) over 2 %;	80 m
3) from water reservoirs, fish ponds not intended for supply of sewage, from lake shore lines, with a drop of land:	
a) up to 2 %	100 m
b) over 2 %;	150 m
4) from the capture of surface or underground waters, This is the source of the population's supply of water for consumption	250 m[2)]

Explanations :

1) In justified cases confirmed by the opinion of the state voivodeship sanitary inspector, the authority competent to issue a water permit may fix distances smaller than those specified in the annex.

2) If the coverage area of the well protection site exceeds the required minimum distance of land, equipment and installation, a distance equal to the coverage of the direct prote.

Table 32. Polish legislation on domestic wastewater treatment plants localized on the outside of agglomerations.

Characteristics	Wastewater treatment plant – situation 1	Wastewater treatment plant – situation 2
Location	Outside of an agglomeration	Outside of an agglomeration
The type of wastewater treatment plant	Individual, domestic	Individual, domestic
The discharge place of wastewater	To the ground, **on** ones own land	To the ground, **out of** ones own land
Population equivalents	-	< 2000
The amount of wastewater	< 5 m^3 /day	-
BOD_5	at least 20% reduction	40 mg O_2/l - maximum concentration
Suspended solids	at least 50% reduction	50 mg/l - maximum concentration
Chemical oxygen demand	-	150 mg O_2/l - maximum concentration
Total nitrogen	-	30 mg N/l - maximum concentration
Total phosphorus	-	5 mg P/l - maximum concentration
The discharge conditions	The discharge place has to be separated by a layer of soil of at least 1.5 m thickness from the highest level of groundwater aquifers	-
Legal basis	"Regulation of the Minister of the Environment from 18 November 2014 on the conditions to be met for the discharge of sewage into water or soil and on substances particularly harmful for the water environment " **§13 point 5.**	"Regulation of the Minister of the Environment from 18 November 2014 on the conditions to be met for the discharge of sewage into water or soil and on substances particularly harmful for the water environment **" §4 point 1, Table 27**

Full law available only in Polish:http://isip.sejm.gov.pl/DetailsServlet?id=WDU20140001800

3.5.2. Environmental Protection Act

The user of the environment shall keep records, updated every quarter of the year, containing information on the quality, condition and composition of wastewater discharged into waters and to land

This Act, which is composed of nine sections, lays down the general principles of environment protection in Poland, creates a framework for administration, planning and decision-making at the national level, and regulates various matters related to environment protection. The Act is composed of the following Sections: (1) General provisions; (2) Protection of environmental resources, i.e. air, water, land, noise pollution, electromagnetic pollution, animals and plants; (3) Pollution prevention; (4) Serious damages; (5) Financial and legal assets; (6) Liability in environment protection; (7) Authorities and institutions of environment protection; (8) Adaptation programmes; (9) Final provisions.

The general principles of law in the Polish legal system reflect the principles commonly known in international and EU environmental law. The most important one, the principle of sustainable development, has been introduced into the legal system in the Constitution of Poland 1997 (Art. 5). In the Environmental Law Act, it is subsequently explained and confirmed. Among other principles, the principle of comprehensive protection closely connected to the ecosystems approach, as well as the prevention principle, precautionary principle, polluter pays principle and the principle of environmental policy integration within sector policies can be identified in the Polish environ-mental law.

Today's environmental law in Poland is a very complex area of law. It contains almost 100 acts of law along with many other regulations and ordinances. Environmental regulations are also present in legal acts which regulate different areas of law than environmental protection. This law is also very instable as the Environmental Law Act 2001 is changed 10-12 times a year.

In accordance with the Environmental Protection Act, businesses are required to pay for the emission of gas and dust into the atmosphere, the discharge of wastewater into the environment (water or soil), the extraction of water, and for the landfilling of waste.

Article 287
1. The user of the environment shall keep records, updated every quarter of the year, containing, respectively:
3) information on the quality, condition and composition of wastewater discharged into waters and to land,
4) information on the size, type and use of the area wherefrom the wastewater referred to Article 3, subparagraph 38, letter c, is discharged.

Act amended by
- Act amending the Environment Protection Act. 2006-02-24
- Act amending Environment Protection Act. 2007-04-26
- Act amending Energy Law, Environment Protection Ac and the Act on conformity assessment system. 2008-05-30
- Act amending Wastes Act and amending some other acts. 2010-07-22
- Act amending the Wastes Act. 2010-10-29
- undefined 2011-08-31
- undefined 2012-04-13

- undefined 2014-07-11
- undefined 2007-01-12
- undefined 2005-07-29
- undefined 2006-03-10

The Environmental Protection Law Act of 27 April 2001 - (Journal of Laws 2001, No. 62, item 627, as amended), Available only in Polish:

http://isap.sejm.gov.pl/DetailsServlet?id=WDU20010620627

3.5.3. Water Law Act

Protection of water resources against pollution covers the reduction of emissions from point sources, using accepted emission limits, and reduction of emissions from non-point sources (mostly rural areas) through the application of best available techniques.

The Water Law Act of 18 July 2001 (Journal of Laws 2001 No. 115 Item 1229) creates a framework for the sustainable development of water resources. The Law is composed of ten Chapters: General provisions (1); Use of water (2); Water protection (3); Water building (4); Prevention from flood and drought (5); Management of water resources (6); Water companies (7); Liability for damages (8); Penal provisions (9); Final provisions (10). The aims of management of water resources are in particular: supply of appropriate quantity and quality of water for the population; prevention of water resources from pollution and wrong exploitation; management and improvement of water ecosystems; prevention from flood and drought; supply of water for agriculture, industry, tourism, sports and recreation; creation of conditions for the use of water in electric industry, transport and fishery.

Water Law establishes for all water users (entities, municipal users, legal and natural persons) the same rules for the use of water resources, i.e.:

1. the users disposing waste into water or soil are required to ensure the protection of waters against pollution, in particular through the construction and operation of facilities used for protective purposes (art. 42, section 1),

2. buildings or their complexes, whose use is associated with discharging sewage to water or soil, cannot be put into operation if they do not meet the requirements of environmental protection (art. 42, section 2 and art. 76 of the Environmental Protection Law).

The construction of equipment used for water supply is carried out simultaneously with the solution of issues of wastewater management, in particular through the construction of sewer systems and wastewater treatment plants (art. 42, section 3) in the areas where the construction of sewer systems would not benefit the environment or may result in excessive costs. In this case individual systems should be used or other measures ensuring protection of the environment (art. 42, section 4).

The Act on collective water supply and sewage disposal addresses a number of issues related to the proper functioning of water sewage companies. In the field of wastewater treatment, the Act imposes on these companies the obligation to ensure the proper functioning of sewage treatment

plants operated by companies and what is inextricably linked with that - the obligation to proper wastewater treatment.

The investor of sewage system and collective wastewater treatment in the cities as well as urban settlements and rural areas is a commune, which must meet the collective needs of the community, including the construction of devices protecting from water pollution. The commune is responsible for providing funds for investment, delivery of equipment, work contractors, etc., and then for developing rules for the use of collective sewage systems and obtaining a building permit for investments as well as permit for discharge of wastewater.

The control and keeping the records of the frequency of emptying holding tanks is one of the municipality duties, as well as the control of the liquid waste haulers.

Amended by

- Act amending Water Law. 2010-03-04
- Act amending the Water Law and certain other acts. 2011-01-05
- Ordinance on announcement of the consolidated text of Water Law. 2013-01-04
- undefined 2005-11-18

Law available only in Polish: http://extwprlegs1.fao.org/docs/pdf/pol60008.pdf

3.6. Sweden

3.6.1. The Environmental Code, SFS 1998:808

'Environmentally hazardous activities' shall mean the discharge of wastewater onto land or into water areas or groundwater

In Sweden, legislation has been a key tool of environmental policy for years. **The Environmental Code, (Miljöbalken, MB)**, **SFS 1998:808** modernized and updated Swedish environmental legistlation. The Code gathers key environmental laws and objectives. The Code consists of sixteen environmental quality standards, the milestone targets and generational goal. The environmental quality standards focus on the final results e.g. on the quality of water. In the 9th chapter, first article of The Environmental Code the waste water is classified as dangerous act and therefore it is ordered to be transferred or cleaned in a way that does not threaten the healty of environment or human health. The Code does not specify limits on emissions. Limits are set by the Government or Government agencies.

The Environmental Code, available (in English):
https://www.government.se/49b73c/contentassets/be5e4d4ebdb4499f8d6365720ae68724/the-swedish-environmental-code-ds-200061

There is no legal definition of private sewage systems, but often they mean the sewage systems outside the municipal sewage networks. In Sweden, nearly one million households have no access to municipal sewage system. 80 % of small scale wastewater systems comply with the Environmental Code standards. Property owners are responsible for their sewate system. They must make a plan and get permission for the sewage system. Owner must be able to prove that they fill the requirements needed and that the system works properly.

There are no common requirements for the sewage systems, rather the principle of fairness is followed; the costs must not exceed the benefits received. The emphasis is on the result (how clean is the water after treatment) not how it is achieved (what kind of sewage system). In the basic requirements there is also high emphasis on the use, maintenance and life cycle issues of the sewage system.

Based on the area, the waste water must be treated differently. Municipalities have rights to set more detailed requirements and forbit the use of sewage system if it is not appropriate. Special requirements are set especially in vulnerable areas with dense population and lot of water resources.

The Environmental Code is interpreted in **Swedish Environmental Protection Agency's (EPA) General Recommendations for Small Scale Wastewater Treatment Systems (NFS 2006:7, Natuvårdverkets allmänna råd om små avloppsanordningar)**. It provides guidance for small-scale waste water systems up to 25 persons. In these general recommendations there are two different requirement levels for the waste water treatment:

1) the normal level

2) high level

High level is used in vulnerable areas. At the normal level, at least 90 % of the organic material and at least 70 % of the phosphorus must be removed. In the high level at least 90 % of the phosphorus and

50 % of the nitrogen must be removed (Table 33). The same levels are followed also in sewage systems up to 200 persons.

Table 33. Minimum requirements for nutrient removal in waste water treatment in Sweden.

	Normal level	High level
Organic material (BOD7), concentration	30 mg/l	
Organic material (BOD7), minimum percentage of reduction	90%	
Phosphorus (tot P), concentration	3 mg/l	1 mg/l
Phosphorus, minimum percentage of reduction	70%	90%
Nitrogen (N)		50%

The interpretation of the code, available in Swedish:
http://husagare.avloppsguiden.se/attachments/download/25/Lagar%20och%20regler%20for%20dig%20med%20enskilt%20avlopp_broschyr.pdf

The **Ordinance on environmentally hazardous activities and healt** (**Förordningen om miljöfarlig verksamhet och hälsoskydd (FMH), SFS 1998:899)** regulates the permissions and announcements for the private sewage.

Available in Swedish: http://www.notisum.se/rnp/sls/lag/19980899.htm

Swedish Agency for Marine and Water Management (SwAM) Havs- och vattenmyndighetens allmänna råd om små avloppsanordningar) (HVMFS 20016:17) gives general recommendations about the EU regulations for small-scale wastewater treatment systems and acts as a supervising authority.

Available in Swedish:
https://www.havochvatten.se/download/18.1d58828a15f50337fd4466c4/1509021275331/HVMFS-2016-17-ev.pdf

3.6.2. Public Water Supply and Wastewater Systems Act, SFS 2006:412

The Provisions of this Act are intended to ensure that water supply and sewerage are ordered in a wider context if necessary for the protection of human health or the environment.

Municipalities' responsibilities about the provisioning of water and wastewater are regulated by the **Public Water Supply and Wastewater Systems Act (SFS 2006:412) (Lagen om allmänna vattentjänster (LAV)).**

Each municipality must have a plan about the land use planning. These plans are not binding and the comprehensiveness varies depending on a municipality. Plans can include information about the most vulnerable areas, protection value of the water resources or plans to broaden the municipal sewage network. In some municipalities there can be a separate document to protect the most vulnerable water resources. In addition, nature protection areas can have their own plans.

In addition, there are other laws that regulate the waste water treatment in sparsely populated area are. Most important of those are:

- **Plan- och bygglagen (PBL), SFS 1987:10** that regulates buildings and the use of land and water.
- **Konsumenttjänstlagen, SFS 1985:716** that regulates the rights of the consumer when buying services
- **Konsumentköplagen, SFS 1990:932** that regulates the rights of the consumer when buying products

Summary of laws and regulations (in Swedish):
http://husagare.avloppsguiden.se/lagar-och-regler.html

4. International co-operation and agreements

4.1. The HELCOM Baltic Sea Action Plan

The overall goal of HELCOM is to have a Baltic Sea unaffected by eutrophication.

The Baltic Sea countries implement the 2007 HELCOM (the Baltic Marine Environment Protection Commission, known as the Helsinki Commission) Baltic Sea Action Plan (BSAP) with the aim to achieve a good environmental status of the marine environment by 2021. The Copenhagen HELCOM Ministerial Meeting is an occasion to assess the progress in and the status of the six-year long implementation of the Baltic Sea Action Plan and the follow-up commitments undertaken at the Moscow Ministerial Meeting in 2010. In order to operationalize the BSAP, National Implementation Programmes have been prepared by each contracting country, in Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russia and Sweden. National implementation programmes are implemented, among others, through various national policies, including under relevant European (EU directives, notably WFD and EU Marine Strategy Framework Directive MSFD) and global frameworks as appropriate. The BSAP programme includes 150 distinct measures. The main sections of the action plan tackle four themes: eutrophication, hazardous substances, the protection of biodiversity, and marine traffic.

Eutrophication is a major problem in the Baltic Sea. Excessive nitrogen and phosphorus loads coming from land-based sources, within and outside the catchment area of the Contracting States, are the main cause of the eutrophication of the Baltic Sea. About 75 % of the nitrogen load and at least 95 % of the phosphorus load enter the Baltic Sea via rivers or as direct waterborne discharges. About 25 % of the nitrogen load comes as atmospheric deposition.

One of the most important duties of the Helsinki Commission is to make Recommendations on measures to address certain pollution sources or areas of concern. These Recommendations are to be implemented by the Contracting Parties through their national legislation. Since the beginning of the 1980s HELCOM has adopted some 260 HELCOM Recommendations for the protection of the Baltic Sea.

For achievement overall goal - Baltic Sea unaffected by eutrophication, the principle of identifying maximum allowable inputs of nutrients in frame of the Baltic Sea Action Plan have been approved, which allows to reach good environmental status of the Baltic Sea and suppose that needed reductions of nutrients inputs should be distributed between HELCOM Contracting Parties on fair bases. In order to diminish nutrient inputs to the Baltic Sea to the maximum allowable level were agreed to take actions not later than 2016 to reduce the nutrient load from waterborne and airborne inputs aiming at reaching good ecological and environmental status by 2021 (Table 34).

Table 34. The country-wise provisional nutrient reduction requirements

Country	Phosphorus (tonnes)	Nitrogen (tonnes)
Denmark	16	17 210
Estonia	220	900
Finland	150	1 200
Germany	240	5 620
Latvia	300	2 560
Lithuania	880	11 750
Poland	8 760	62 400
Russia	2 500	6 970
Sweden	290	20 780
Transboundary Common pool	1 660	3 780

According to the Fifth HELCOM Pollution Load Compilation only several countries submit concerning values of the nutrient load coming from this source. Herewith for some countries shares of the scattered settlements input to the overall diffuse nutrient load constitute 30 %, and for several catchments scattered settlements provide half of the nutrient load. So scattered settlements might have significant input to the anthropogenic nutrient load.

According to the latest overview, the BSAP has yielded good results in several sectors, such as environmental protection in maritime transport, the conservation of biodiversity and the reduction of point-source pollution. The reduction of the phosphorus load has proven difficult. This will require enhanced measures targeted at problematic areas. Reducing the phosphorus load of agriculture and other diffuse-source pollution will need longer-term efforts.

4.1.1. HELCOM recommendation 28E/6

HELCOM Recommendation 28E/6 "On site wastewater treatment of single family homes, small businesses and scattered settlements" (transitional – 2017, final - 2021). Encourage educational cooperation and exchange of best practices and experiences of solving the problem of municipal sewage in smaller municipalities and scattered settlements.

In order to cut the nutrient load from waterborne inputs HELCOM recommendation 28E/6 'On site wastewater treatment of single family homes, small businesses and scattered settlements up to 300 person equivalents (P.E.) was adopted in 2007. The recommendation covers those on-site wastewater systems which receive domestic or similar wastewater from single family homes, small businesses or settlements outside urban wastewater collection systems,

Recommends to the Governments of the Contracting States that the following practices should be promoted in on-site wastewater treatment for single family homes, small businesses and settlements up to 300 p.e.:

1. Untreated wastewaters shall not be led directly to natural water systems in areas that are not connected to sewers.

2. Wastewaters from single family homes, small businesses and settlements should be treated so that emissions per capita to the environment reach at most the values set in Table 35.

For a high standard household with warm water, showers, laundry and dishwashing machines and flush toilets this would mean approximately a basic reduction of 80 % of BOD5, 70 % of total phosphorus and 29 % of total nitrogen.

Table 35. Maximum permissible daily load per capita for biological oxygen demand over five days (BOD5), total phosphorus (Ptot) and total nitrogen (Ntot) of the treated wastewater.

Load parameter	Permissible load of treated wastewater (g person-1 d-1)*
BOD5	8
Ptot	0.65
Ntot	10

*g person-1 d-1 is grams per person per day

Alternative 1: the requirements based on emissions per capita need not apply where it can be shown that an on-site wastewater treatment plant results in at most a concentration of BOD5 of 20 mg/l, Ptot 5 mg/l and Ntot 25 mg/l in the effluent of the treatment plant.

Alternative2: the requirements based on emissions per capita need not apply where it can be shown that an on-site wastewater treatment plant using the Best Available Technology (BAT) is installed and operated so that the treatment results in at most a concentration of BOD5 of 40 mg/l and 150 mg/l COD in the effluent of the treatment plant.

Alternative 3:

Mapping: Improved treatment shall be introduced in areas where the quality of the waterbody is below the desired quality, when – and only when - it can show that that the quality of the waterbody is poorer due to the influence of discharged wastewater.

Treatment: Improved wastewater treatment must be introduced when a house not connected to public sewer is situated in an area where the aforementioned conditions are present. The following Table 36 shows different levels of treatment, depending on the sensitivity of the waterbody:

Table 36. Different levels of treatment, depending on the sensitivity of the waterbody.

Receiving water sensitivity	Treatment type	BOD5 reduction (%)	Phosphorus reduction (%)	Nitrification (%)
Class 1	Enhanced OP treatment	95	90	90
Class 2	Enhanced O treatment	95		90
Class 3	OP treatment	90	90	
Class 4	O treatment	90		

O: organic matter

P: phosphorus. (P-reduction achieved in effluent)

Nitrification: chemical process transforming ammonium-nitrogen (NH4-N) into nitrate (NO3-N).

3. The two possible phases of minimisation of the discharges of wastewater to the environment are

- the use of dry toilets, phosphate-free detergents and minimisation of water consumption;
- Treatment of wastewater. The level of the treatment depends on the composition of the wastewater; black water needs a higher level of treatment than grey water.

Examples of wastewater generation and treatment options:

- Composting dry toilet with separation of urine in combination with on-site grey water treatment.
- Composting dry toilet in combination with on-site grey water treatment.

- Separation of grey water and black water, on-site treatment of grey water in combination with storage and transportation of black water to the municipal wastewater treatment plant for treatment.
- An on-site wastewater treatment system for all wastewaters.
- An on-site holding tank or cesspool with transportation to and treatment of wastewaters at a municipal wastewater treatment plant.

Drainage and storm waters should never be led to a wastewater treatment system.

For estimates of needed reduction levels for two different combinations of wastewater generation and treatment:

4. Attention should be paid to reducing sludge formation and to promoting systems which enable recycling of nutrients back to agricultural use. Sludge should be collected, stored and transported to a municipal wastewater treatment plant or a designated sludge handling unit in manner that avoids leakages. Sludge from septic tanks or activated sludge systems should not be dumped into waterbodies or close to them.

5. A transitional period of 10 years for the households (with water flush toilets and 14 years without water flush toilets) to implement the Recommendation from the date of adoption should be applied, recommends further that the Contracting Parties report on the implementation of the Recommendation to the Commission, based on reporting requirements developed by the Land-based Pollution Group.

Source: http://www.helcom.fi/Recommendations/Rec%2028E-6.pdf

4.2. EU water strategy (Blueprint)

Reuse of treated wastewater can be considered a reliable water supply, quite independent from seasonal drought and weather variability and able to cover peaks of water demand.

The European Commission published a Blueprint to Safeguard Europe's Water Resources in 2012. This Blueprint is based on a thorough assessment of the state of waters, water resources management plans made by Member States, and the competence of EU water legislation. The key conclusion of the Blueprint is that, while hardly any additional water-related legislation is needed, there is room for improvement in its implementation. The responsibilities of different sectors should be developed, as should the related funding instruments, in order to support the attainment of water-related objectives.

The Blueprint includes several measures for improving water efficiency and water conservation. Water accounting should be developed in order to obtain a better picture of the availability of water, and the needs related to water use and aquatic biota, including the availability under changing climate conditions. For example, the Commission proposes the establishment of water efficiency targets. The Blueprint emphasises improvement of the green infrastructure.

The potential role of treated wastewater reuse as an alternative source of water supply is now well acknowledged and embedded within international, European and national strategies. UN Sustainable Development Goal on Water (SDG 6) specifically targets a substantial increase in recycling and safe reuse globally by 2030. Water reuse is a top priority area in the Strategic Implementation Plan of the

European Innovation Partnership on Water, and maximisation of water reuse is a specific objective in the Communication "Blueprint to safeguard Europe's water resources".

Reuse of treated wastewater can provide significant environmental, social and economic benefits. According to the Blueprint, water reuse can improve the status of the environment both quantitatively, alleviating pressure by substituting abstraction, and qualitatively, relieving pressure of discharge from UWWTP to sensitive areas. Moreover, when compared to alternative sources of water supply such as desalination or water transfer, water reuse often turns out to require lower investment costs and energy, also contributing to reduce greenhouse gas emissions.

Reuse of treated wastewater can be considered a reliable water supply, quite independent from seasonal drought and weather variability and able to cover peaks of water demand. This can be very beneficial to farming activities that can rely on reliable continuity of water supply during the irrigation period, consequently reducing the risk of crop failure and income losses. Appropriate consideration for nutrients in treated wastewater could also reduce the use of additional fertilisers resulting in savings for the environment, farmers and wastewater treatment.

In addition, the Blueprint has a strong international dimension. Sensible management and protection of water resources is a matter of urgency, since water is becoming the most sought-after natural resource on the planet. It is important that the Blueprint leads to the more effective implementation of legislation and, in particular, to better management of water resources and the marine environment and flood risks. Additionally, geographical and regional differences in Europe must be taken into account.

Source: http://ec.europa.eu/environment/water/reuse.htm

4.3. River Basin Management Plan (RBMP)

Ensuring the best possible conditions, both for the population and for nature, independently of all political boundaries

River Basin Management Plans are a requirement of the Water Framework Directive and a means of achieving the protection, improvement and sustainable use of the water environment across Europe. This includes surface freshwaters (including lakes, streams and rivers), groundwater, ecosystems such as some wetlands that depend on groundwater, estuaries and coastal waters out to one nautical mile.

The Directive requires member states to aim to achieve at least good status in each water body within their river basin districts. Each member state must produce a plan for each of the river basin districts within its territory. Plans must include: objectives for each water body; reasons for not achieving objectives where relevant; and the programme of actions required to meet the objectives.

River Basin Management Plans were published for several member states in December 2010. The 2nd RBMPs have been adopted entirely in Finland, Sweden, Estonia, Latvia and Poland. The 2nd RBMPs have not yet been adopted in Lithuania.

http://ec.europa.eu/environment/water/participation/map_mc/countries/lithuania_en.htm

Finland is exempt from designating specific sensitive areas for the Nitrates Directive and the Urban Waste Water Treatment Directive, since it considers the whole territory sensitive or vulnerable respectively. The 2nd RBMPs were adopted on 3 December 2015. The organisation of river basin

management in Finland is covered by the Act on Water Resources Management (1299/2004), the Degree on Water Resources Management (1040/2006) and the related Decree on Water Resources Management Regions (1303/2004). This legislation forms part of Finland's ongoing implementation of the EU Water Framework Directive.

http://ec.europa.eu/environment/water/water-framework/pdf/3rd_report/CWD-2012-379_EN-Vol13_FI_fi.pdf

http://ec.europa.eu/environment/water/water-framework/pdf/3rd_report/CWD-2012-379_EN-Vol3_FI.pdf

4.4. Transboundary water cooperation

Cooperation and connectivity in the Baltic Sea region - the way towards UN Sustainable Development Goal

Approximately 40 % of the world's population live in transboundary river basins. With the shortages in water resources, it is becoming more important to conclude agreements on transboundary water cooperation to improve water security. The 1992 Water Convention of the United Nations Economic Commission for Europe (UNECE) provides a framework for regional transboundary water cooperation. The aim of the Convention is to prevent, control and reduce the actual or potential transboundary impacts of water pollution. UN Member States which do not belong to the UNECE may also join the Convention, according to an amendment which entered into force in February 2013. This Convention has significantly improved the protection of transboundary waters and strengthened the cooperation between the Parties to the Convention. It has also had other effects, such as a reduction in conflicts and improved security and it has promoted the sustainable use of water resources. Additionally, the Convention has a global impact as it strengthens transboundary water cooperation.

The 1997 UN Convention on the Law of the Non-Navigational Uses of International Watercourses, of which Finland was the initiator, also provides a framework for intergovernmental transboundary water cooperation. This Convention enters into force on 17 August 2014, when it has been ratified by the required 35 states. The Convention aims to promote the balanced and reasonable use of transboundary watercourses and protect ecosystems in international river basins.

The 2013 amendment to the UNECE Water Convention and the 1997 UN Convention, which enters into force in August, complement each other. Finland has supported the enforcement and implementation of these two agreements in order that an international framework for transboundary water cooperation can be created. These global agreements lay the foundation for regional cooperation mechanisms and for the establishment of commissions for transboundary riverbasin.

The UNECE Water Convention's Protocol on Water and Health was signed in 1999, and entered into force in 2005. Its purpose is to promote the protection of human health and well-being in line with the principles of sustainable development, through better water use and management, including the protection of aquatic ecosystems, and by preventing, controlling and reducing water-related diseases.

Finland shares numerous transboundary water areas with Sweden, Norway and Russia. Its transboundary water cooperation with its neighbours is based on treaties. Finland concluded a

bilateral agreement on transboundary water management with Russia in 1965, with Norway in 1981 and with Sweden in 1971.

- Agreement between Finland and Sweden Concerning Transboundary Rivers
- Finnish–Swedish Border River Commission
- Agreement between Finland and Russia concerning frontier waters
- Agreement between Finland and Norway on the Transboundary Water Commission (N:o 32/1981, Finlex, in Finnish)

According to the EU Water Framework Directive, Finland shares two international river basin districts: the Tornio River Basin District (the rivers Tornio and Muonio), together with Sweden, and the Teno-Näätämö-Paatsjoki River Basin District, which discharges into the Arctic Ocean together with Norway. The Finnish-Russian transboundary water agreement covers all water bodies which cross Finland's eastern border. This cooperation is overseen by the joint Finnish-Russian Commission on the utilization of Frontier Waters.

Transboundary Cooperation between Estonia and Latvia in the frame of River Basin Management Planning in Gauja/Koiva River Basin District

http://www.envir.ee/sites/default/files/2016.07.08_est-latbg_signed_koik.pdf

GWP Lithuania and Poland take part in a consortium led by Stockholm International Water Institute to support sustainable water resources management of international rivers shared by countries in the Eastern part of the Baltic Sea. Goal of the project "Building a framework for collective action in the management of the transboundary waters in Kaliningrad, Russia, Lithuania and Poland (Baltic Sea region)" is to increase investments into sound management of the transboundary rivers in Kaliningrad Oblast, Lithuania and Poland and promote smart and green growth.

5. Availability data of different technologies

5.1. Existing technologies available in member countries

Sewage treatment is the process of removing contaminants from wastewater, primarily from household sewage. It includes physical, chemical, and biological processes to remove these contaminants and produce environmentally safer treated wastewater. A by-product of sewage treatment is usually a semi-solid waste or slurry, called sewage sludge, that has to undergo further treatment before being suitable for disposal or land application.

On-site wastewater management aims to achieve the sustainable treatment and return of wastewater to the environment, while avoiding adverse effects on the environment or public health. There are many different types of on-site wastewater treatment systems, each providing different levels of treatment. The level of treatment includes:

- Primary treatment consists of temporarily holding the sewage in a quiescent basin where heavy solids can settle to the bottom while oil, grease and lighter solids float to the surface (such as from septic tanks).
- Secondary treatment removes dissolved and suspended biological matter. Secondary treatment is typically performed by indigenous, water-borne micro-organisms in a managed habitat. Secondary treatment may require a separation process to remove the micro-organisms from the treated water prior to discharge or tertiary treatment (such as aerated wastewater treatment systems).
- Advanced secondary treatment systems, includes textile filters and sand filters.
- Tertiary treatment is sometimes defined as anything more than primary and secondary treatment in order to allow ejection into a highly sensitive or fragile ecosystem. Treated water is sometimes disinfected chemically or physically.

5.1.1. Holding tank

Holding tanks are used for collecting and temporarily storing residential wastewater in places where the use of wastewater treatment systems is limited or impossible.

Holding Tank is a closed, watertight structure (Figure 2). Holding tanks are used for collecting and temporarily storing residential wastewater in places where the use of wastewater treatment systems is limited or impossible. Holding tanks are designed and constructed to hold wastewater to be transferred to the municipal wastewater treatment plant for purification. In this way it does not strain the local water systems.

It is often ordered that black-water be directed into cesspools, because the main part of the nutrients that strain the environment (70 - 80 %) comes from water closets. Holding tanks are also well suited for important groundwater areas[1].

Depending on the area of use, differently sized and shaped holding tanks are needed. Manufactures have a broad selection of plastic holding tanks in different sizes. Some tanks come with a filling alarm.

[1] Talokaivo: http://en.talokaivo.fi/tuote-kategoriat/wastewater-treatment-systems/cesspools/

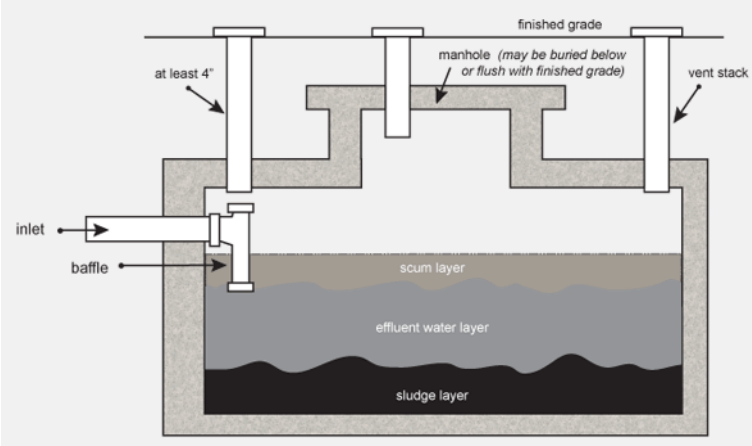


Figure 2. Schematic of a holding tank (Source: http://danssewerservice.com/mm_uploads/holding_tank.gif).

5.1.2. Septic tanks

Septic tanks provide primary level of wastewater treatment. They are normally installed to receive and clean wastewater before a secondary system or they can be included as a primary treatment chamber within a package treatment plant.

Septic tanks are used for accumulation, sedimentation, and subsequent withdrawal of partially treated wastewater without suspended particles for the final stage of treatment. The final treatment can be for example combination of biological package plant, the infiltration bed or soil filter. Wastewater is lead through the septic tanks so that flow speed is decreasing allowing for solids to settle. Semi solid slurry, sludge, forms into the bottom of the tank, composing of different kind of organic substances and nutrients. The excess liquid drains from the outlet into the leach field (Figure 3).

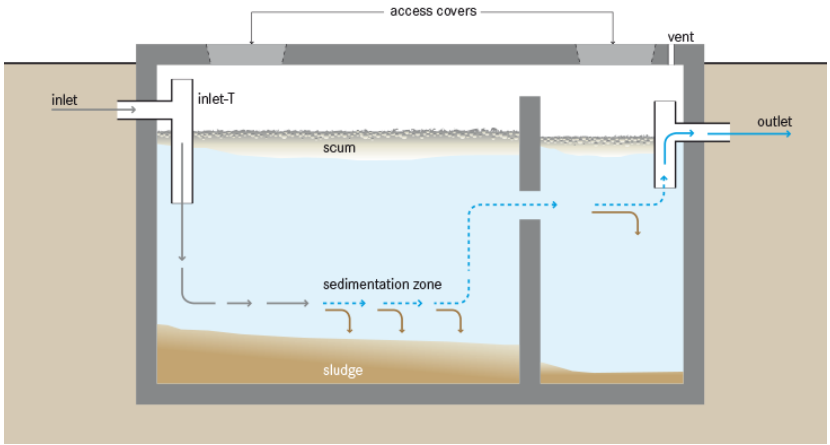


Figure 3. Schematic of a septic tank (Source: Wikipedia).

The septic tank is an airtight container. It can be made of different material: concrete, fibreglass, PVC or plastic. However, the material should be selected by considering all its technical characteristics: first of all, it is its susceptibility to corrosion (metal and concrete containers have this disadvantage), and secondly the mechanical resistance to soil pressure, i.e. strength. It should be noticed that the strength of polypropylene containers have fault despite stiffness ribs on the body.

Process in septic tanks is anaerobic. The term "septic" refers to the anaerobic bacterial environment that develops in the tank which decomposes or mineralizes the waste discharged into the tank.

Settling and anaerobic processes reduce solids and organics, but the treatment is only moderate[2]. The treated liquid effluent is commonly disposed in a septic drain field which provides further treatment. However, groundwater pollution may occur and can be a problem. Treatment efficiency of the septic tanks is ca 50 % of BOD. Septic tank additives have been promoted by some manufacturers with the aim to improve the effluent quality from septic tanks, reduce sludge build-up and to reduce odors[2].

Septic tanks do not require everyday maintenance. The entire septic system can operate by gravity alone or, where topographic considerations require, with inclusion of a lift pump. Certain septic tank designs include siphons or other devices to increase the volume and velocity of outflow to the drainage field. These help to fill the drainage pipe more evenly and extend the drainage field life by preventing premature clogging or bioclogging.

The rate of accumulation of sludge is faster than the rate of decomposition. Therefore, the accumulated sludge must be periodically removed which is commonly done with a vacuum truck. How often the septic tank must be emptied depends on the volume of the tank relative to the input of solids, the amount of indigestible solids, and the ambient temperature (because anaerobic digestion occurs more efficiently at higher temperatures), as well as usage, system characteristics and the requirements of the relevant authority. A properly designed and normally operating septic system is odor-free and, besides periodic inspection and emptying of the septic tank, should last for decades with minimal maintenance.

Septic tanks can be coupled with other onsite wastewater treatment units such as biofilters or aerobic systems involving artificially forced aeration.

5.1.3. Package plants

Packaged wastewater treatment plants are suitable for onsite applications, especially for wastewater disposal at outlying areas and places where no central municipal sewer or sewage collection and treatment system is available. Secondary and advanced secondary treatment systems are often supplied as a ready-made package plant. Wastewater flows from the house to the wastewater treatment system. The treatment system uses physical and biological processes to reduce the level of contaminants in wastewater discharging it into the ground.

The packaged plant treatment system is normally a type of bio-chemical treatment for domestic waste using the extended aeration process, however also completely biological processes are developed especially for larger treatment volumes. Physical treatment processes include the gravity settlement of solids and the filtering of wastewater to remove suspended solids. Precipitation of phosphorus is frequently a chemical process. Biological treatment occurs through the digestion of wastes by bacteria. Bacterial digestion is an aerobic process (in the presence of air), such as within an aerated treatment plant.

Packaged plants are compact, self-contained, and factory prefabricated (Figure 4). The packaged sewage treatment plants are usually delivered to the customer ready to install as Plug & Play and ready use. Typical packaged plants include screening, flow equalization, aeration, clarification, sludge digestion, and effluent disinfection. Tank sizes and internal flow rates are custom-designed to meet the treatment requirements of wastewater. Pre-filters, post-filtration and other treatment systems can be added to meet specific site conditions or effluent requirements.

[2] Wikipedia: https://en.wikipedia.org/wiki/Septic_tank

Figure 4. Schematic of a packaged wastewater treatment plants (Source: http://www.graf-water.com/wastewater-treatment.html).

Aerated wastewater treatment systems use air pumps and blowers to create conditions for the growth of aerobic bacteria. Such a method of water treatment is very effective. A disc filter must be installed to reduce the level of solids within treated wastewater.

Some available packed plant systems can be delivered with phosphorous or nitrogen removal kits and with hygiene package or UV-tertiary treatment units.

The packaged plant treatment systems are typically installed in ground after a septic tank. Some of the systems can be installed either in or above ground.

After the installation, the wastewater treatment plants require minimum service and effort to maintain, without losing its ability to clean the incoming wastewater and sewage.

SBR (Sequencing Batch Reactor) is an example of advanced secondary treatment package plant system. Usually the SBR systems are intended for larger municipalities or businesses, but some manufactures bring the SBR solution to smaller and middle-sized users. The SBR system processes wastewater batches through a timed sequence of operations within a reactor tank(s). The system is very easy to use, since all aspects of the wastewater treatment sequence are controlled by the control unit. This unit also informs the user about the state of the cleaning process[3].

5.1.4. Soil treatment and other natural treatment systems

It is advisable to use the after treatment by soil when installing a septic tank as part of the treatment plant. Design of the soil purification structure depends on the type of soil, waste water discharge condition (quality purification requirements), groundwater level, climatic zone, topography, site plan. Location of the treatment plant is determined at the design stage with individual connection to the building in terms of plan and height, subject to the availability of the following information and site characteristics: hydrogeological conditions in the place to be posting purification plant, soil filtering capacity, karstic rocks presence, protection of the underground aquifer, height of groundwater.

If the discharge of domestic clarified sewage after passing through a septic tank without after purification system according to construction and sanitary standards is not allowed, extra installation

[3] Pipelife: http://www.pipelife.com/com/products/eco_systems/sbr_system/sbr_how_it_works.php

of absorption trench or area is possible. An infiltration system or a subsoil processing system is the name of the method where the wastewater is cleaned by processing it in the ground.

5.1.4.1. Infiltration field

The infiltration bed is a pipeline consisted of drain pipes, laid under a crushed stone layer in a thickness of the sand. The water is filtered through the sand, gets to the crushed stone layers and then soaks into the ground.

The absorption area is a pipeline made of perforated material. Water passing through the pipeline enters into the soil, then passing through a porous filtration layer of soil, contributes to the ideal development of bacteria of a natural character (Figure 5.). The absorption trench is used in sands and loamy sands and represents a system of perforated water drip pipes, made at a depth up to 0.9 m and 1 m above the ground water level. The spraying system is a system of perforated pipes laid sloping 0.001-0.003[4].

To ensure rigidity at the base of the tubes, they should be laid above the layer of crushed stones, brick, gravel or slag of small fractures (20-40 mm). At the end of the water drip system, you must run the ventilation riser (vent) with a total length of not less than 0.7 m. The possible effect of purification in terms of suspended solids on filtering fields is up to 98 %[4].

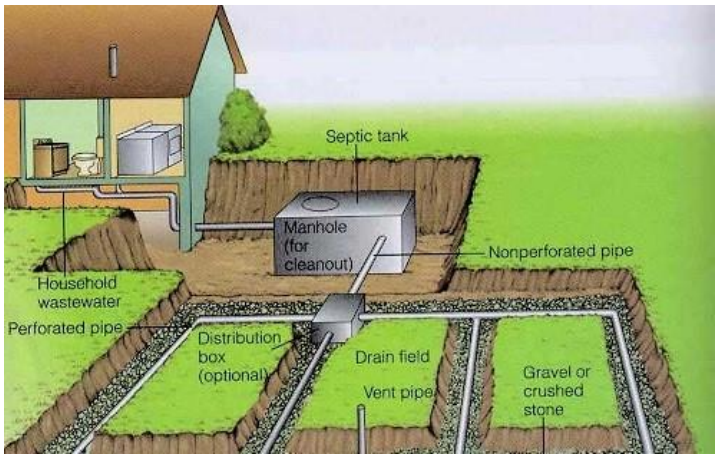


Figure 5. Conventional septic tank system with infiltration field (Source: www.osawaterworks.com).

The filtering trench is built in the soils with low filtering characteristics (loam and clay), making out artificial formed soil layers, where a drainage and drip water network is made. It is recommended to place this filtering trench near the trenches and deepening where purified domestic waste water enters by gravity or arrange pumping of clarified sewage entering to a water intake well. Space between drainage and drip pipe network is filled with crushed stone and sand. Sand-gravel filter differs from filtering trenches that the drainage and water drip pipes are placed in the pit in parallel.

The underground filtering field or the filtering trench is placed in the slope of local terrain. The recommended length of one line of water drip and drainage network is not more than 12 m; the slope in the water movement direction is 0.01. The plane configuration (beam, linear, parallel) depends on the general layout and terrain of the area, its size, the existing and planned landscaping. If the number of lines of water drip network more than one the distribution well is pre-arranged, which ensures a uniform distribution of sewage on the lines. Parallel trenches are placed separately

[4] Final Report Pilot activity regarding treatment of wastewater from small and scattered communities in the Leningrad and Kaliningrad Oblasts, St. Petersburg, 2014. Baltic Marine Environment Protection Commission HELCOM. http://www.helcom.fi/Lists/Publications/Treatment%20of%20waste%20water%20from%20scattered%20settlements%20in%20Leningrad%20and%20Kaliningrad%20regions.pdf

(usually in the sandy-loam soil) or two or three water drip pipeline are combined in one wide trench, observing the distance between the axis. Under the drip water pipes in a wide trench one or two drain pipes are placed in the space between the drip water pipes. Then the filtered water flows into the drain pipes and enters into the ditch or ravine[4].

BOD and nitrogen removal efficiency is high; phosphorus removal efficiency is high only during first years. You can combine this field with plants (see illustration) and in this case the structure can operate for longer time. Due to silting of the fields users have to find a new location for the filtering field every 3-4 years.

5.1.4.2. Soil filter

Soil filters are suitable for a location, where infiltration does not work for instance because of the amount of clay in the ground. Soil filters are technological devices belonging, like as constructed wetland wastewater treatment plants, to the group of natural technologies of water treatment. Like the other devices, they can be divided into filters with vertical, horizontal and radial flow, but soil filters are without vegetation, often realized in underground. It is necessary to ensure that the flow of treated wastewater is uniform throughout the whole filtration process.

A soil filter is made into a ditch or larger pit, which is filled with different layers of washed stone and sand with different levels of penetration, provided with water-resistant sealing plastic at the bottom and all sides. Two pipe layers are built into the filter bed, **an infiltration- and collector pipe layer**. If ground infiltration is not allowed, the filter bed is isolated from the ground with a waterproof layer, for instance with construction plastic[5].

The wastewater is cleaned when it is filtered through the sand filter layer. A bio-layer of bacteria is formed in the sand in the same way as in the infiltration system. The purified wastewater is gathered through the collector pipes to the collection chamber, from where it is led to the terrain or an open ditch. The collection chamber can also be used as a sampling shaft. To improve the phosphorus reduction, a separate phosphorus filter or a chemical phosphorus trap can be installed in the filter bed.

The advantages of soil filters include the organic character of the device, the possibilities of favourable integration into the environment, a simple technological design, relatively low investment and operating costs, minimal energy needs, possibilities of binge overload, relatively good treatment effect from the beginning of the operation, the ability to short-term and long-term shutdown, and treatment of organically low-loaded wastewater that cannot be cleaned with the usage of other intensive methods such as activation dry treatment. The disadvantages of soil filters include clogging, less effect on ammonia removal and relatively large surface intensity[6].

Soil filters are designed according to the use and the type of loading or the operation according to the following division[6]:

- For a year or growing (frost-free) operation
- To clean mechanically treated wastewater or for treatment of mechanically- biologically treated wastewater
- With vegetation (grasses, wetland vegetation) and without vegetation
- Single and multiple –stage arrangement

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[5] Infiltration systems. Talokaivo: http://en.talokaivo.fi/tuote-kategoriat/wastewater-treatment-systems/infiltration-systems/

[6] Miloš Rozkošný, Michal Kriška, Jan Šálek, Igor Bodík, Darja Istenič. Natural Technologies of Wastewater Treatment. Global Water Partnership Central and Eastern Europe, 2014. http://www.gwp.org/globalassets/global/gwp-cee_files/regional/natural-treatment.pdf

- With uniform filling, pulse overflow, splashing on the filter surface
- With various filter material - homogenous, heterogeneous, arrangement in layers
- With various means of filter environment regeneration (regeneration of the upper inlet layer, the entire filling, back flushing, aeration, the use of enzymes)
- Continuous operation, intermittent operation, periodically intermittent operation (short-term, long – term) with the simultaneous aeration
- Alternatively vertical flow upwards in a saturated filtration environment, pulse emptying of the upper part of the filtration environment
- With artificial aeration
- With buffer tank allowing the uniform loading of the filter

Soil filters can be realized in several material variations, focusing on isolation from the subsoil (Figure 6)[6]:

- The foil – PP, PE, PVC, rubber – always cover from both sides of geotextile and sand underlayer with a thickness at least 5.0 cm
- Concrete tank – the establishment of the concrete slab thickness of 15 cm, establishment of pre-cast concreting of the tank or on the spot
- Plastic tank – the product from PP, extruded PP, PE – similar to the sumps or septic tanks, square and cylindrical shapes
- Sealing by natural material – clay seal with a thickness of 30 cm – should be applied moist

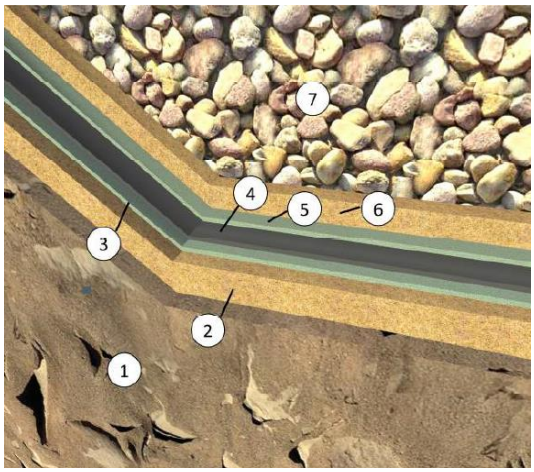


Figure 6. Composition of Foil Seal: 1 – original terrain, 2 – sand underlayer thickness 5 cm, 3 – geotextile, 4 –foil, 5 – geotextile, 6 – sand backfill, 7 – coarse filter material[6].

In some areas a more effective phosphorus removal system is required as part of the filter bed system. This can be implemented with a separate phosphorus filter or with a dispensing pump.

5.1.4.3. Constructed wetland

Constructed wetlands treat the sewage water using highly effective and ecologically sound, design principles that use plants, microbes, sunlight and gravity to transform wastewater into gardens and reusable water. The water treatment mechanisms are biological, chemical and physical, these include physical filtration and sedimentation, biological uptake, transformation of nutrients by bacteria that are anaerobic (bacteria that flourish in the absence of oxygen) and aerobic (oxygen-needing bacteria), plant roots and metabolism, as well as chemical processes (precipitation, absorption and decomposition) that purify and treat the wastewater.

Constructed wetlands can be used after a septic tank for primary treatment, in order to separate the solids from the liquid effluent. Vegetation in a wetland provides a substrate (roots, stems, and leaves) upon which microorganisms can grow as they break down organic materials. The community of microorganisms and natural chemical processes are responsible for approximately 90 % of pollutant removal and waste breakdown[7].

The plants remove about seven to ten percent of pollutants, and act as a carbon source for the microbes when they decay. Different species of aquatic plants have different rates of heavy metal uptake, a consideration for plant selection in a constructed wetland used for water treatment. Constructed wetlands are of two basic types: subsurface flow and surface flow wetlands.

Different types of constructed wetlands can be combined in order to achieve a higher treatment efficiency by using the advantages of individual systems. Most hybrid constructed wetlands combine vertical filter and horizontal filter stages (Figure 7 and Figure 8). At present, hybrid constructed wetlands are in operation in many countries around the world. They need expert design, but they can be built mostly with locally available material and the community can be trained for operation and maintenance. The effluent can be used for e.g. irrigation and aquaculture or safely be discharged to receiving water bodies[7].

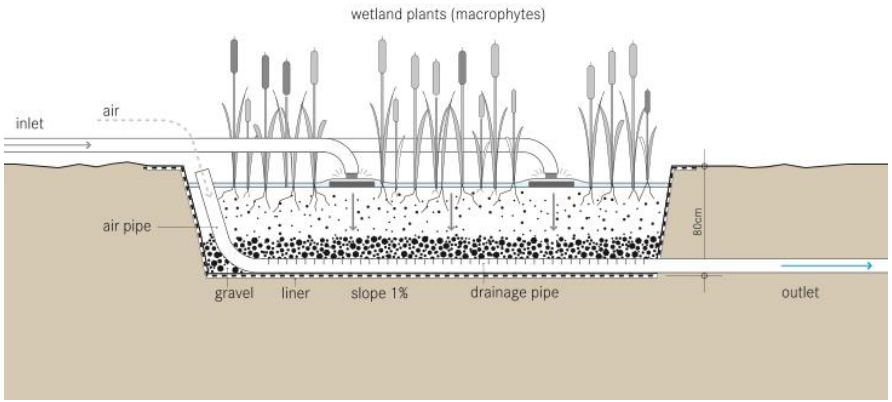


Figure 7. Schematic of a vertical subsurface flow constructed wetland: Effluent flows through pipes on the subsurface of the ground through the root zone to the ground[8].

[7] Wikipedia: https://en.wikipedia.org/wiki/Constructed_wetland

[8] Tilley, E., Ulrich, L., Lüthi, C., Reymond, Ph., Zurbrügg, C.(2014) - Compendium of Sanitation Systems and Technologies - (2nd Revised Edition). Swiss Federal Institute of Aquatic Science and Technology (Eawag), Duebendorf, Switzerland

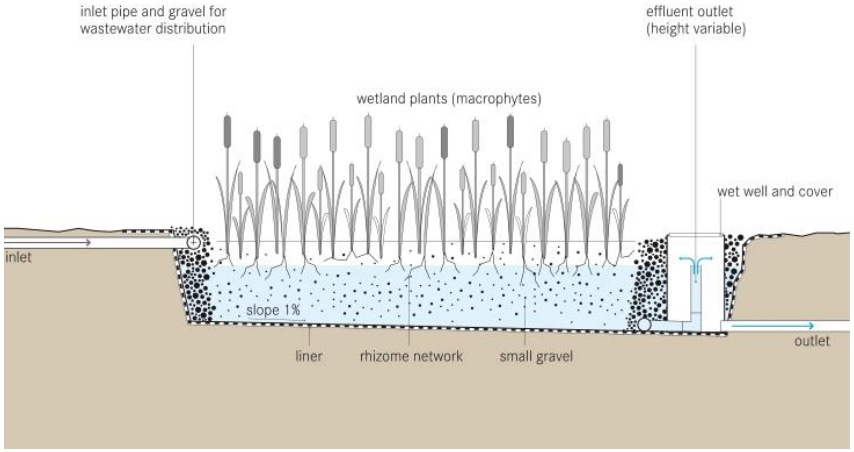


Figure 8. Schematic of the Horizontal Subsurface Flow Constructed Wetland: Effluent flows horizontally through the bed[8].

5.1.5. Other technological solutions

Septic filter

Protect the septic effluent infiltration bed or soil filter from clogging. Basic septic effluent filter is a simple tee and filter installed at the septic tank outlet.

Pump Stations

Basically there are two types of pump stations on the market, dry-pit and wet-pit. Dry-pit stations consist of two separate elements, the storage chamber or wet well and the dry well. Wastewater enters the wet well, which is connected to the dry well by horizontal suction pipes. Normally dry-pit stations are more complex and larger than wet-pit stations. Centrifugal pumps are usually used in dry-pit stations. The main advantage of these stations is the availability of a dry area for personnel to perform routine and maintenance pump and pipe work.

The submerged pumps are well adapted to handling wastewater and permit easy maintenance due to easy pump removal. The pumps are available in various sizes depending upon the duty required.

6. Technological solutions and functionalities of existing systems

The data has been mined for small-scale treatment technologies. The technologies explored are mostly covered with all relevant solutions for small-scale waste water treatment currently available on the market in Estonia, Finland, Lithuania, Latvia, Poland and Sweden. They are applicable to separate solutions for individual end-users or to joint solutions for several end-users. They are meant just for waste water purification or for aggregated solutions, in which nutrients or matter of the output of the purification is further utilized.

Technical data, collected for each technology instance identified, include 1) the capacity and the expected purifying efficiency (BOD, P, and N reduction), 2) dimensions and space requirements, including land area and underground volume in construction (gross) and in use (net), 3) supplies, articles and equipment needed for construction and implementation 4) material and energy inputs into the process and their rates, 5) outputs from the process and their rates including removed sludge, 6) technical drawings and specifications, 7) description of the treatment process and 8) user manual. Technical data include also 9) characteristic requirements for the waste water load to be treated, such as total flow, peak flow, duration of flow, temperature range, pH range and impurity concentration ranges, 10) requirements for the implementation environment, such as the inclination of the surface, soil type, level of ground water, 11) estimates on the expected service-life, 12) estimated service needs as materials, spare-parts, and frequency and nature of service calls including sludge removal, as well as 13) estimated dependency of the purification efficiency on the ageing of the system. Process input and output rates are given on yearly basis. Purifying efficiency is given as yearly average, respectively. (APPENDIX 1.)

6.1. The amount of technologies

The technological survey is still ongoing and the answers have been caught from 42 manufacturers in different counties so far (Table 37). They are distributed to different types of technology as follows: 374 of them are package plants, 82 holding tanks, 78 septic tanks, 3 constructed wetlands, 49 infiltration beds, 18 soil filters and 38 other technologies or equipment packages (Figure 9).

The summary of available wastewater treatment systems in Estonia, Finland, Latvia, Lithuania, Poland and Sweden is presented in APPENDIX2.

Table 37. List of manufacturers and the number of technologies collected until the end of June 2018.

Manufacturer/Constructor	Estonia	Finland	Latvia	Lithuania	Poland	Sweden	Total
ARTAS		1					1
ASIO, spol. s r.o.			9				9
ATB Umwelttechnologien GmbH/ JSC ,, Eneka" Lithuania				1			1
August	22			14	4		40
BioKube			9			12	21
Biorock	14	12	5		16		47
BIOTEX, SIA			1				1
BIONOR Sp. z o.o.					1		1
ECCUA OÜ	4						4
Ecotech AB		5				5	10
Ekoservis Lat			7				7
EkoStandarts Tehnolo?ijas			8				8
Eloy Water s.a.	12						12
FANN					1	81	82
Feliksnavis				6			6
Fertil OÜ	53						53
Green Rock		9	5			9	23
Haba RL					1		1
Institute of Technology and Life Sciences in Tylicz					1		1
Jita Oy		1					1
Keskkond & Partnerid OÜ	2						2
Klaro	1						1
Klärtechnik Reinhardt GmbH		23					23
LABKO			2				2
Otto Graf GmbH	25		19		4	22	70
Oy Vevi-va Ab		1					1
Pipelife		12					12
Puhastid OÜ	12						12
Reinhardt GmbH / BAT Systems Oy		2					2
Rewatec GmbH			10				10
Roth GmbH			4				4

Rotons SIA			1				1
Sapara	3						3
SKT Suomi		5					5
Sotralentz			4		4		8
Talokaivo Oy		15					15
The Institute of New Technologies in Enviromental Engineering					2		2
Traidenis				18	8		26
Traidenis UAB			4				4
Uponor		19	1			19	39
Wavin-Labko Oy	11	20				17	48
Vesmaco OÜ	22						22
Grand Total	181	125	89	39	42	165	641

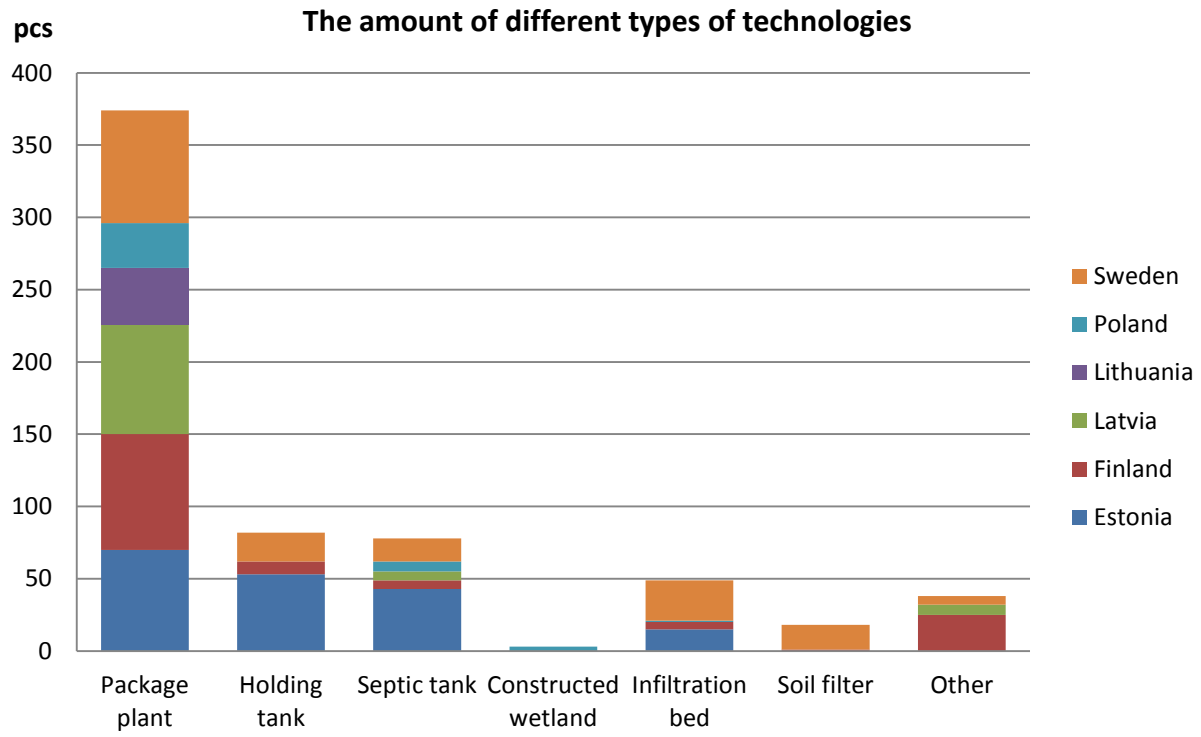


Figure 9. The amount of collected technologies by the end of June 2018.

6.2. Capacities

Package plant capacities vary from very small plants (0.6 m^3/d) to very big plants (135 - 300 m^3/d) (Figure 10). All countries have small package plants, under 1 m^3/d, available, but information of bigger ones was more limited. For example, in Latvia half of the package plants included to the data collection so far, had capacity under 3 m^3/d, and the bigger than that was only one with 300 m^3/d capacity. In Finland, the most of the plants were under 5 m^3/d, but package plants exist up to 150 m^3/d. In Lithuania, the biggest package plant size is 45 m^3/d. However, usually bigger wastewater treatment systems are custom-built according to customers' requirements so the models are not ready-made. Many technologies are also available in the other countries although are here presented under one country.

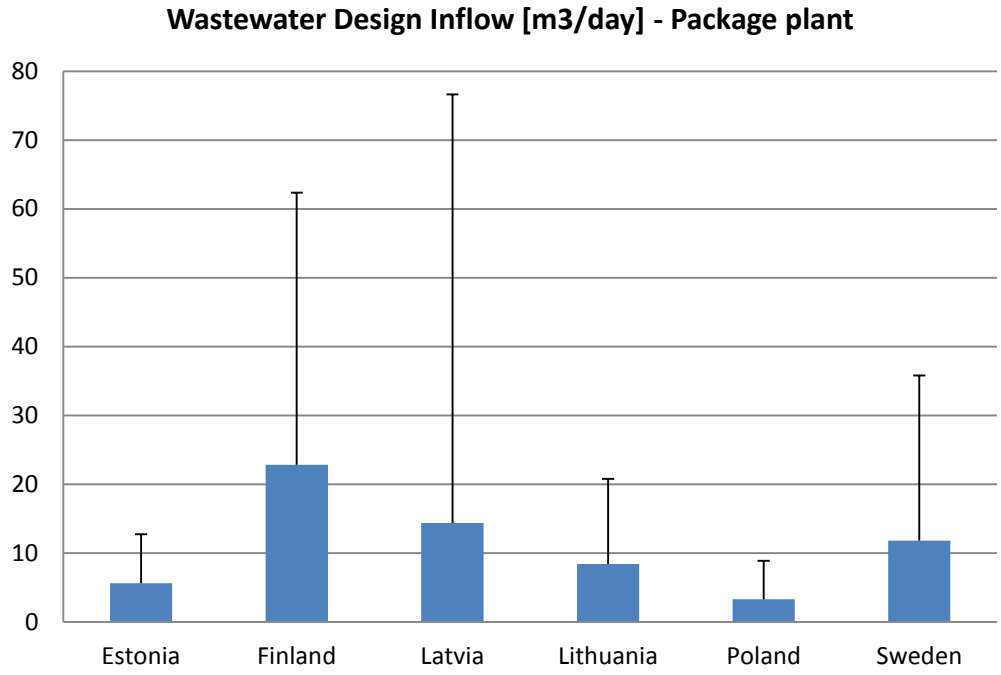


Figure 10. Average package plant capacities and ranges (m^3/d) in different countries. Also different sizes could be available, but data was not obtained yet.

Average capacities of biofilters, soil filters, constructed wetlands and infiltration beds were lower than package plants, being mainly below 1,5 m^3/d (Figure 11). Soil filter and infiltration beds capacities are usually 1.5 m^3/d, when septic tanks can have capacity of 3 m^3/d. Constructed wetlands had the lowest capacity, 0.8 m^3/d, compared to other technologies included to the study.

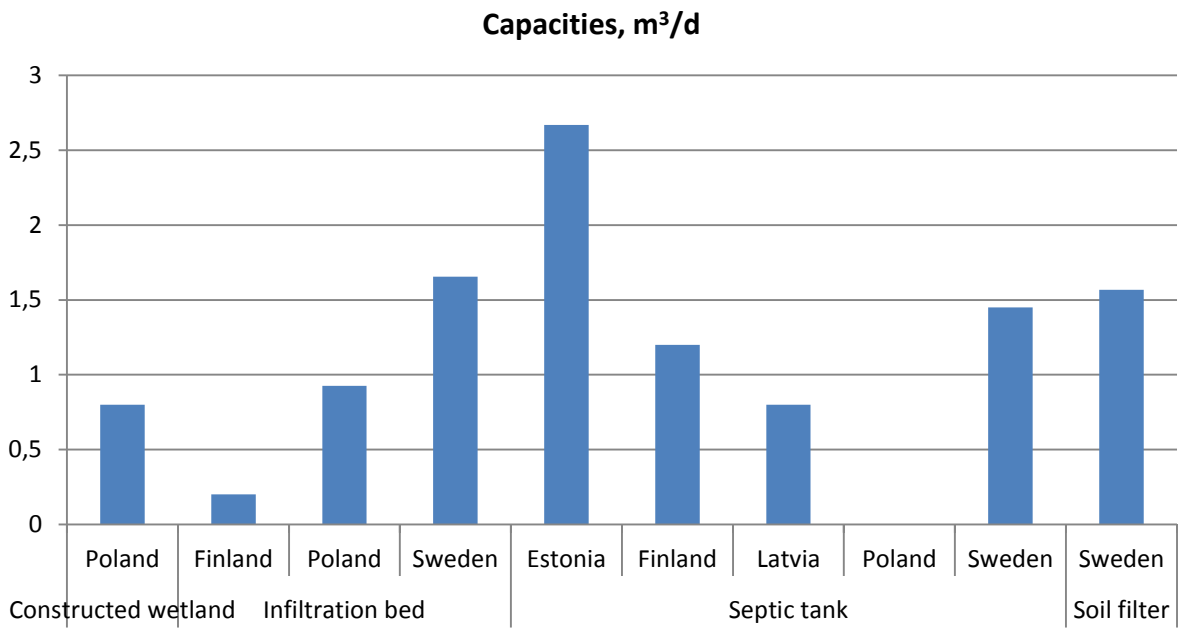


Figure 11. Average capacities for different kind of waste water treatment systems in different countries (m^3/d) and ranges when applicable. Also different sizes could be available, but all data was not obtained yet.

Information of holding tanks has been obtained from Estonia, Finland and Sweden (Figure 12). The volumes are between 1.5 and 64 m^3. In Finland, the biggest volume in collected data was only 12 m^3 thus far, but Swedish holding tanks are also available in Finland.

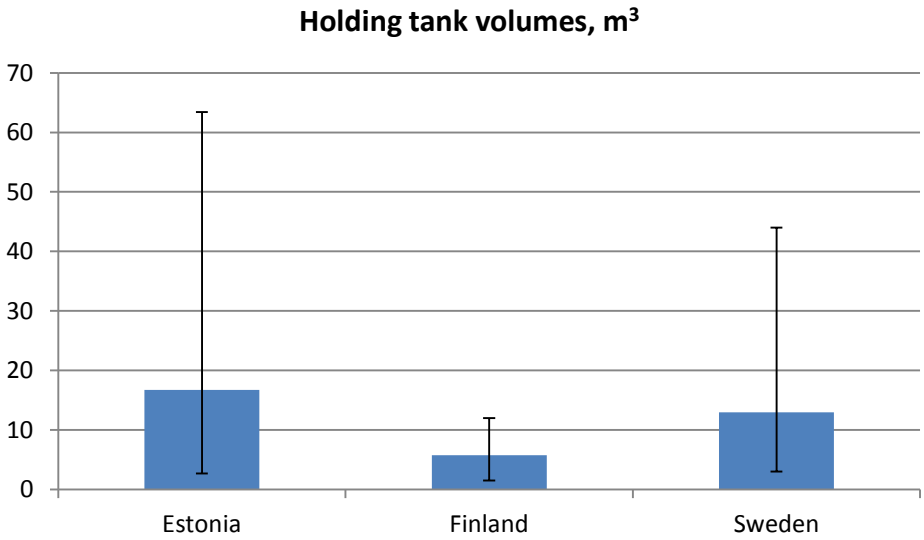


Figure 12. Holding tank volumes (m^3) in different countries. Also different sizes could be available, but data was not obtained yet.

6.3. Purification efficiencies – averages and variations for different technologies in different countries

Purification efficiencies differ between countries and technologies. However, for all technologies the purification efficiency was not available. BOD purification efficiency was quite similar to all countries and technologies, e.g. for package plants it was an average 96 % for all countries with variation between 90 % and 99 % (Figure 13). The lowest BOD purification efficiency was for septic tank in Estonia where the efficiency was 25 %. However, septic tanks should be coupled with other onsite wastewater treatment units such as soil filter or infiltration bed.

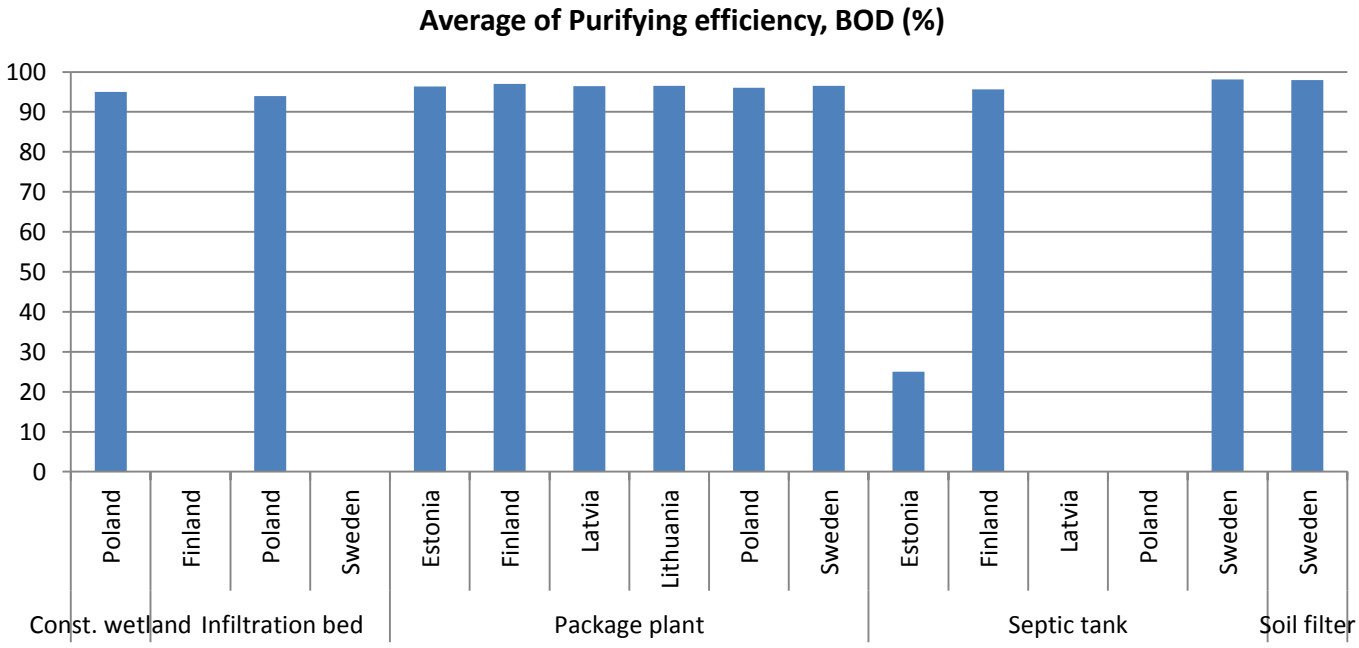


Figure 13. Average BOD purification efficiencies for different technologies in different countries. Including only data that was currently available.

Nitrogen purification efficiency has higher variation between technologies and countries, and even between similar technologies, compared to BOD purification efficiency. The highest nitrogen purification could be reached with Polish package plant, over 93 % (Figure 14). However, also some Lithuanian package plant technologies can reach as high, nitrogen purification efficiency 92 %. Septic tank in Estonia has the lowest nitrogen purification efficiencies, under 10 %. Usually package plants have the nitrogen purification efficiency about 60 - 70 %, septic tanks about 30 %, constructed wetland and infiltration beds about 70 % and soil filters about 50 %.

Also phosphorus purification efficiencies vary a lot between technologies and countries, and even between similar technologies. The highest phosphorus purification efficiency is with soil filters in Sweden, 99 % (Figure 15). Package plants in Estonia have an average only 60 % phosphorus purification efficiency, but variation is big, between 30 % and 95 %. All other countries and technologies, the phosphorus purification efficiency is around 80 % on average, package plants about 81 %, septic tanks about 38 %, constructed wetland and infiltration beds 80 % and soil filter 99 %.

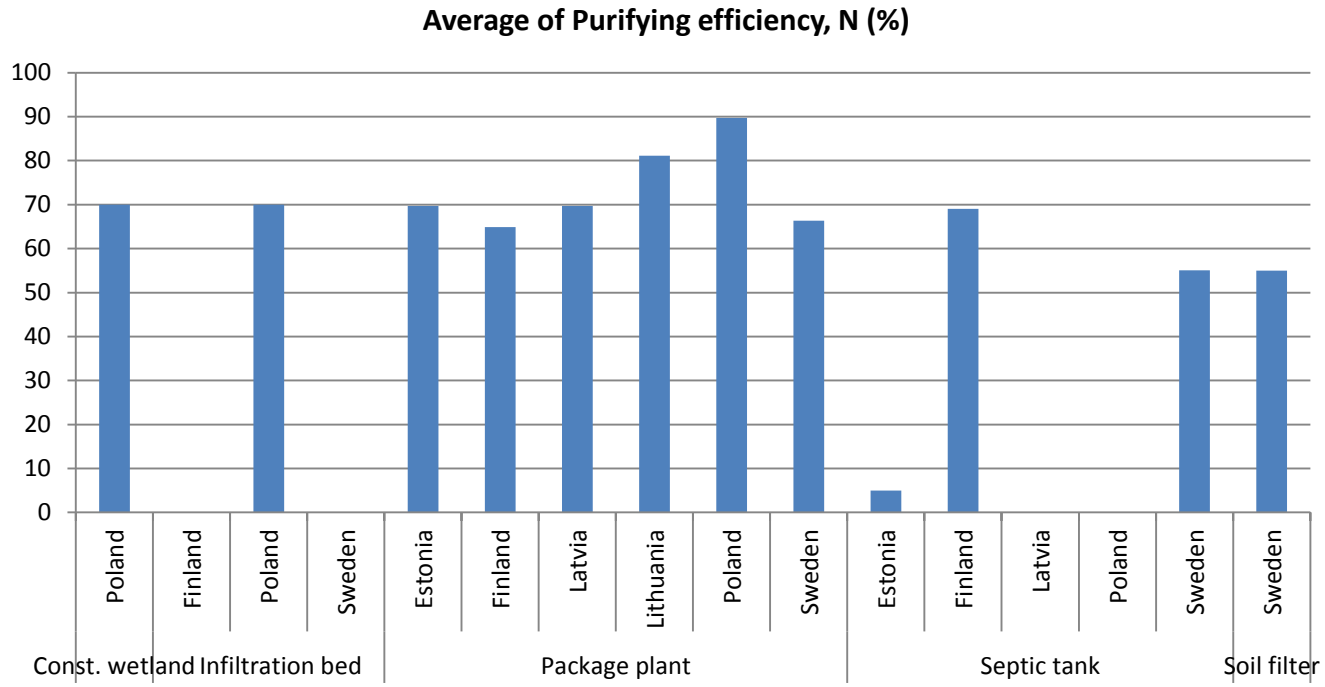


Figure 14. Average nitrogen purification efficiencies for different technologies in different countries, and range when applicable. Including only data that was currently available.

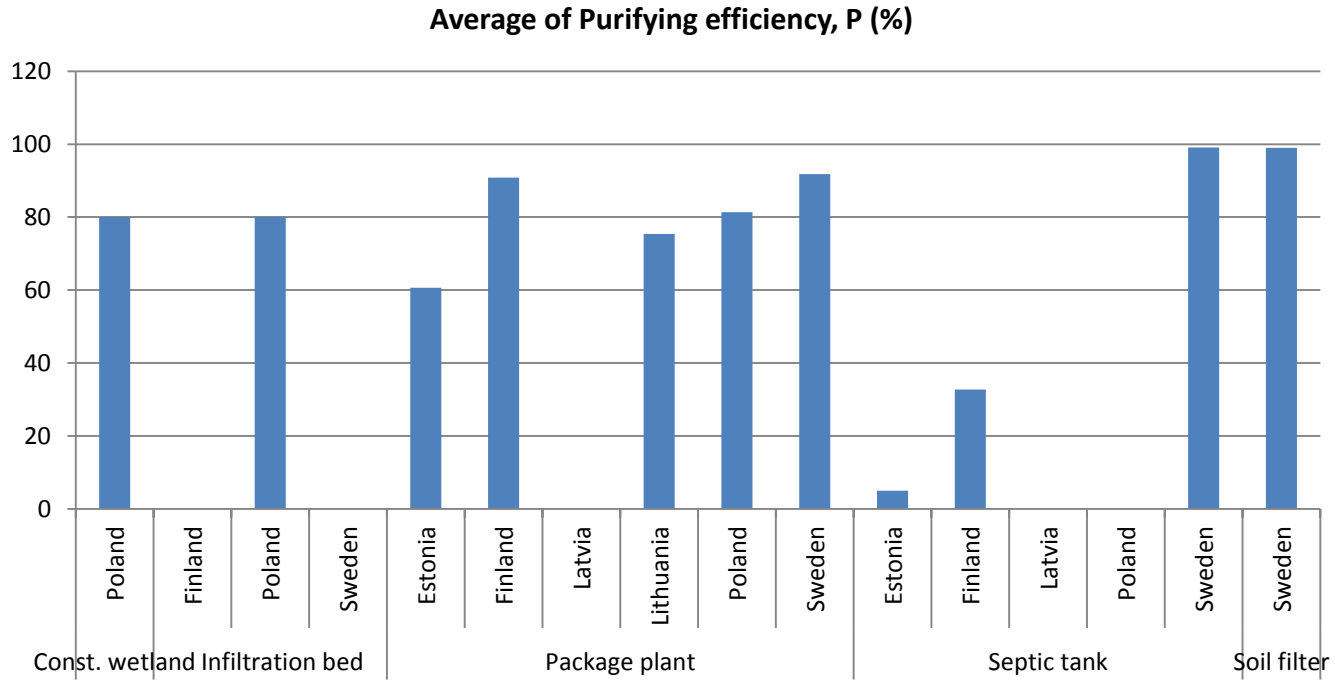


Figure 15. Average phosphorus purification efficiencies for different technologies in different countries, and range when applicable. Including only data that was currently available.

APPENDIX 1. Technology data collection form

Technology data

Guidance 1: Technology data is given on this form, one technology per form. Copy this form within this worksheet, or into a new workbook. You may name new forms (worksheets) and workbooks according to your own scheme, with the restriction that each workbook name should begin with the text 'Data form 2.1 Technology'. For plant uptake please specify the used plant species.

1. Basic information	
Manufacturer/Constructor	
Country	
Make	
Model	
Type of technology	
Description of treatment process	
Inoculated microbe species (for biological treatment)	

Guidance 2: For capacity, give the design flows, as well as allowed maximum and minimum flows. All these flows are continuous per day averages. Give also values for peak and low occupation inflows and their accepted durations. Use 'Notes' -fields to give additional information when needed.

2. Capacity	Waste water m3/day	BOD g/day	N g/day	P g/day	Acceptable duration days	Notes
Design inflow						Pumppauskapasiteetti yli
Maximum inflow						
Minimum inflow						
Peak inflow						theoretical maximum,
Low occupation inflow						theoretical minimum,

Guidance 3: For purifying efficiency and sludge formation, give values for the design, maximum and minimum flows given above. For sludge volume, give the storage volume in cubic meters. Use 'Notes' -fields to give additional information when needed.

3. Purifying efficiency and sludge formation	BOD %	N %	P %	Sludge m3/day	Sludge volume m^3	Notes
Design inflow						
Maximum inflow						parametres good to ask from manufacturer
Minimum inflow						parametresgood to ask from manufacturer

Guidance 4: For requirements for operation, give the design, maximum and minimum values for internal temperature, pH, and the concentrations of BOD, N and P in the inflow. Use 'Notes' -fields to give additional information when needed.

4. Requirements for operation	Temperature °C	pH abs.	BOD g/m^3	N g/m^3	P g/m^3	Notes
Design value						pH and temperature can be announced with range, actual values good to ask from manufacturer
Maximum						
Minimum						

Guidance 5: For requirements for implementation, give the design, maximum and minimum values for inclination, ground water level, and soil type. Use 'Notes' -fields to give additional information when needed. Soil type is asked, if there are soil types, which do not fit to the technology. Add unsuitable soil types to notes, if all soil types are suiteble, then add to the soil type word "All". Inclination means existing posibilities to install the system inclined.

5. Requirements for implementation environment	Inclination ‰	Ground water level m	Soil type	Notes
Design value				good to ask from manufacturer
Maximum				good to ask from manufacturer
Minimum				good to ask from manufacturer

6. Warranty, service-life and dependency of the purification efficiency on the ageing of the system

Guidance 6: For warranty give the period in years, as well as online and offline links to terms. For expected service-life and the effect of ageing, give the design, maximum and minimum values. Effects of ageing are given in ± % of the corresponding efficiency values. Use 'Notes' -fields to give additional information when needed.

Warranty, service-life, effect of ageing	Warranty			Expected service-life	Effect of ageing: At 1/2 service-life			At 3/4 service-life			At end of service-life		
	Period	Terms			BOD	N	P	BOD	N	P	BOD	N	P
	year	Online	Offline	year	%	%	%	%	%	%	%	%	%
Design value													
Maximum													
Minimum													

Guidance 7: Dimensions and space requirements are given as length, width and height (depth) for above and under ground part in construction and in use. In construction means the dimensios of the needed excavated area.

7. Dimensions and space requirements, including land area and underground volume in construction (gross) and in use (net)

Dimensions and space requirements	Under ground			Above ground			Notes
	Length m	Width m	Depth m	Length m	Width m	Height m	
In construction (gross)							
In use (net)							

8. Material and energy inputs needed for construction, implementation, use, and decommissioning

Guidance 8.1: Give below material and energy inputs, and their amounts, for construction, implementation, use and decommissioning. Construction covers both factory-made and on-site-made plant components. Inputs for implementation include materials and energy needed for preparing an operational plant out of the above-mentioned components. **Inputs for use** include materials and energy needed for normal use of the plant **per one year**. Inputs for decommissioning include materials and energy needed for decommissioning the plant on site, transports of the rests to terminal treatment, the actual terminal treatment, and landscaping the site of the decommissioned plant. Maintenance inputs are given separately, not included in the inputs of use here.
Guidance 8.2: Use the assisting list below for material and energy names. Apply own naming to items not on the list. Use notes field for additional information on the quality of the input etc.

Assisting list for items:

Polyester (PES)

Material and energy inputs for	Item	Unit	Quantity	Notes
Construction				
Use				
Decommissioning				

9. Supplies, articles and equipment needed for construction, implementation, use, and decommissioning

Guidance 9.1: Give below supplies, articles and equipment, and their amounts, numbers, and main material components and their relative quantities (to Notes), needed for construction, implementation, use and decommissioning. Construction covers both factory-made and on-site-made plant components. Inputs for implementation include items needed for preparing an operational plant out of the above-mentioned components. **Inputs for use** include items needed for normal use of the plant **per one year**. Inputs for decommissioning include items needed for decommissioning the plant on site, transports of the rests to terminal treatment, the actual terminal treatment, and landscaping the site of the decommissioned plant. Maintenance inputs are given separately, not included in the inputs of use here.
Guidance 9.2: Use the assisting list for names of supplies, articles and equipment. Apply own naming to items not on the list. Use notes field for additional information on the quality of the item etc.

Assisting list for items:

Supplies, articles and equipment for	Item	Unit	Quantity	Notes
Construction				

10. Material and energy inputs needed for optional accessories

Guidance 10.1: Give below material and energy inputs, and their amounts, for optional auxiliary types. Use dropdown list to select the auxillisary type. For an auxilliary type not explicitly on the list, select 'Other' and give the type name in the 'Notes field'.
Guidance 10.2: Use the assisting list below for material and energy names. Apply own naming to items not on the list. Use notes field for additional information on the quality of the input etc.

Assisting list for items:

Cement

Accessory type	Item	Unit	Quantity	Notes
Anchoring				
Other				

11. Materials, energy, supplies, articles and equipment needed for maintenance

Guidance 11.1: Give below materials, energy, supplies, articles and equipment and their amounts, needed for maintenance. Items are given by maintenance measures, and per one time of each measure. Use dropdown list to select the maintenance measure. For a measure not explicitly on the list, select 'Other' and give the measure name in the 'Notes field'. All different kinds of measures should be mentioned here, and given the frequency value, even though some of them would have no material or energy inputs, like sludge removal.
Guidance 11.2: Use the assisting list below for item names. Apply own naming to items not on the list. Use notes field for additional information on the quality of the input etc.

Assisting list for items:

Electric energy

Maintenance measure	Frequency times/year	Item	Unit	Quantity per one time	Notes
Sludge removal		Diesel oil	dm^3		
Regular technical maintenance					

12. Outputs from construction, implementation, use, and decommissioning

Guidance 12: Guidance 12.1: Give below recycled and waste material outputs, and their amounts, from construction, implementation, use and decommissioning. Construction covers both factory-made and on-site-made plant components. Outputs from implementation include recycled and waste materials from preparing an operational plant out of the above-mentioned components. Outputs from use include recycled and waste materials for normal use and maintenance of the plant, such as sludge and wastes of technical maintenance. Outputs from decommissioning include recycled and waste materials from the actual decommissioning the plant on site, transports of the rests to recycling or terminal treatment, the actual terminal treatment, and landscaping the site of the decommissioned plant.
Guidance 12.2: Use the assisting list below for the names of recycled and waste materials. Apply own naming to items not on the list. Use notes field for additional information on the quality of the input etc.

Assisting list for items:

organic waste (Sludge)

Outputs from	Name	Quantity	Unit	Notes
Construction	construction waste(Mixed)			
	waste soil (Mixed)			
Implementation	electronic waste(Mixed)			
Use	organic waste (Sludge)			specify how often or how much per year

13. Technical drawings and specifications

Guidance 13: Online and offline links to technical drawings and specifications are given here. There may be more than one link of each. Add rows as needed.

Online	Offline	Notes

14. User manual

Guidance 14: Online and offline links to user manual are given here. There may be more than one link of each. Add rows as needed.

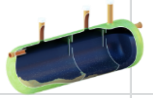
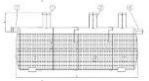
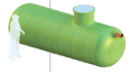
Online	Offline	Notes

APPENDIX 2. Available wastewater treatment systems

Estonia (1/5):

Manufacturer	Country	Make	Model	Type of technology	Description of treatment process	Capacity BOD (g/pv) design inflow or min-max	Size (PE)/ other info	Pictures	Link:
ASIO Ltd.	Czech Republic	AS-VARIOcomp	AS-VARIOcomp 5K, 5K ultra, 8K, 8K ultra, 12K, 15K, 15K ultra, 20K, 20K ultra	Package plant	Aeration, Microbiological degradation, Sedimentation, Pumping	300, 240, 480, 480, 720, 900, 900, 1200, 1200	8 - 20 PE		http://www.asio.cz/en/as-variocomp-k
Vesmaco OÜ	Estonia	Bioseptic BioPure	BioPure-5, 8, 12	Package plant	Sedimentation, microbiological degradation, nitrogen removal	430, 690, 1040	Biopure 5 (up to 5 persons), Biopure 8 (up to 8 persons), and Biopure 12 (up to 12 persons)		http://www.vesmaco.ee/en/products/bioseptic-biopure
Sapara	Czech Republic	EKOL	EKOL 1, 2.5, 4, 6, 9, 12, 15	Package plant	Sedimentation, Aeration, Microbiological degradation, Secondary settling (Rotating Biological Contractor)	400, 4800, 1000, 1600, 2400, 3600, 4800	1 - 2.5 - 4-6 - 9 - 12 - 15 m3 / day of wastewater, ie 8, 15, 25, 40, 60, 80, 100 PE	 	http://www.separa.cz/en/products/sewage-treatment-plant/for-hotels/
Separa	Czech Republic	EKOL	EKOL 1, 2.5, 4, 6, 9, 12, 15	Package plant	Sedimentation, Aeration, Microbiological degradation, Secondary settling (Rotating Biological Contractor)	400, 1000, 1600, 2400, 3600, 4800, 6000	8, 15, 25, 40, 60, 80, 100		http://www.separa.cz/en/products/sewage-treatment-plant/for-hotels/
SOTRALENTZ HABITAT	France, Spain and Poland	Epurbloc	Epurbloc 1500, 2000, 3000	Septic tank	Microbiological degradation, sedimentation	250, 360,	3, 4, 6	 	http://habitat.sotralentz.com/index.php/en/

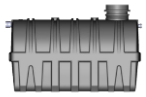
Continue: Available wastewater treatment systems, Estonia (2/5).

Manufacturer	Country	Make	Model	Type of technology	Description of treatment process	Capacity BOD (g/pv) design inflow or min-max	Size (PE)/ other info	Pictures	Link:
Klaro	Germany	Klaro	Klaro-SBR	Package plant	Sludge storage and buffer, biological treatment (SBR) phosphate precipitation (optional), biological treatment	3000	50 PE		http://www.puhastid.ee/biopuhasti-klaro-eramutele-ja-turismitaludele/
Eloy Water s.a.	Belgium	Oxyfix C-90	Oxyfix C-90 1-5, 6-7, 8-9, 10-13, 14-16, 17-20, 21-25, 26-35, 36-50, 51-65, 66-85, 86-120 PE	Package plant	Sedimentation, Microbiological degradation, Aeration, Clarification (Submerged Aerated Fixed Film (SAFF) technology)	300, 420, 540, 780, 960, 1200, 1500, 2100, 3000, 3900, 5100, 7200	1 to 120 PE	 	http://www.eloywater.com/en/
Vesmaco OÜ	Estonia	Septic tank	Three chamber septik tank 2, 3, 5, 6, 8, 10, 12, 15, 20 m3	Septic tank	Sedimentation, microbiological degradation	130, 215, 350, 410, 560, 690, 840, 1100, 1400	2 m³ (up to 4 people) or 3 m³ (4-7 people)	 	http://www.vesmaco.ee/en/products/septic-tanks
Vesmaco OÜ	Estonia	Sewage tank	Holding tank 2, 3, 5, 6, 8, 10, 12, 15, 20, 50 m3	Holding tank	Other	113, 170, 260, 225, 300, 375, 375, 375, 750, 750	In order to collect wastewater from a single family home, we recommend sewer capacities of 8-12 m³	 	http://www.vesmaco.ee/en/products/tanks
SOTRALENTZ HABITAT	France, Spain and Poland	SL-FS	SL-FS 1000, 1500	Septic tank	Microbiological degradation, sedimentation	480, 720	8, 12		http://habitat.sotralentz.com/index.php/en/

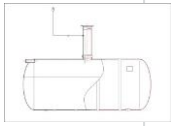
Continue: Available wastewater treatment systems, Estonia (3/5).

Manufacturer	Country	Make	Model	Type of technology	Description of treatment process	Capacity BOD (g/pv) design inflow or min-max	Size (PE)/ other info	Pictures	Link:
Otto-Graf GmbH	Germany	Carat S	Septic tank CARAT S 2.7, 3.75, 4.8, 6.5 m3	Septic tank with anaerobic biofilter Carat S 2.7/ 3.75/ 4.8/ 6.5 m3	Sedimentation, microbiological degradation, absorption field	240, 360, 480, 600	5, 7, 9, 13		http://www.puhastid.ee/biofiltriga-iseankurduv-septik-carat-s/
Otto Graf GmbH	Germany	one2clean one-tank	one2clean one-tank 3, 5, 7, 9	Package plant (SBR, two cycles per day)	Microbiological degradation (aerobic)	180, 300, 420, 540	3, 5, 7, 9		http://www.puhastid.ee/one2clean-biopuhasti-eramutele/
Otto Graf GmbH	Germany	Klaro one-tank	Klaro Easy E 5 (Carat 2.7 L), E 8 (Carat 3.75 L), E 10 (Carat 4.8 L),E 14 (Carat 6.5 L)	Package plant SBR	Microbiological degradation, sedimentation	260, 420, 520, 730	3-5, 5-8, 7-10, 9-14		http://www.puhastid.ee/biopuhasti-klaro-eramutele-ja-turismitaludele/
Otto Graf GmbH	Germany	Klaro	Klaro-SBR	Package plant	sludge storage and buffer, biological treatment (SBR) phosphate precipitation (optional), biological treatment	3000	1500		http://www.puhastid.ee/klaro-biopuhastid-vaikeettevotetele-ja-asulatele-kuni-1500-elanikku/
Otto-Graf GmbH	Germany	Platin	Holding tank Platin	Holding tank Platin 1.5/ 3/ 5/ 7.5 m3	Other - Holding tank	120, 240, 420, 630	2, 4, 7, 10		http://www.puhastid.ee/madala-paigaldussugavusega-mahuti-platin/
Otto-Graf GmbH	Germany	CARAT S	Holding tank CARAT S	Holding tank CARAT S 2.7, 3.75, 4.8, 6.5 m3	Other - Holding tank	260, 420, 520, 730	3-5, 5-8, 7-10, 9-14		http://www.puhastid.ee/iseankurduv-mahuti-carat-s/
Otto-Graf GmbH	Germany	Herkules	Holding tank Herkules	Holding tank Herkules 1.6 m3	Other - Holding tank	120	2		http://www.puhastid.ee/maaalune-vaikemahuti-hercules/

Continue: Available wastewater treatment systems, Estonia (4/5).

Manufacturer	Country	Make	Model	Type of technology	Description of treatment process	Capacity BOD (g/pv) design inflow	Size (PE)/ other info	Pictures	Link:
Puhastid OÜ	Estonia	ECCUA	Holding tank ECCUA 10.0 m3, 12.0 m3, 15.0 m3, 20 m3, 25 m3, 3.0 m3,4.0 m3, 5.0m3, 50.0 m3, 6.0 m3, 70.0 m3, 8.0 m3		Holding tank				http://www.puhastid.ee/
Keskkond & Partnerid OÜ	Estonia		Individual project, On-site made plant	Package plant, SBR	Microbiological degradation, chemical fixation of P, sedimentation				http://mahutid.ee/index.php/est/
Biorock Wastewater Treatment	Luxemburg	Biorock	Biorock-PT-15000, 10 000, 2000, 3000, 5000, 7500	septic tank	Sedimentation				http://biorock.com/products/primary-tanks/pt-1-15000
Biorock Wastewater Treatment	Luxemburg	Monoblock	Monoblock-2-700, 800, 900, Monoblock-3-800	Package plant	Sedimentation, microbiological degradation, filtration				
Biorock Wastewater Tre	Luxemburg	Biorock	Ecorock-1500, 2000, 3000	Package plant	Sedimentation, microbiological degradation, filtration				

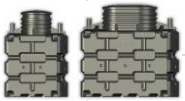
Continue: Available wastewater treatment systems, Estonia (5/5).

Manufacturer	Country	Make	Model	Type of technology	Description of treatment process	Capacity BOD (g/pv) design inflow	Size (PE)/ other info	Pictures	Link:
AugustEstFin OÜ	Estonia	ATC	ATC-P-10, 12, 6,8	Package plant	Sedimentation, microbiological degradation, nitrogen removal				http://www.augustbio.ee/
AugustEstFin OÜ	Estonia	ATO	ATO-30, 40, 50	Package plant	Sedimentation, microbiological degradation, nitrogen removal				
AugustEstFin OÜ	Estonia	AT	AT-12, AT-100, AT-120, AT-15, AT-150, AT-20, AT-200, AT-250, AT-30, AT-40, AT-50, AT-6, AT-75, AT-8	Package plant	Sedimentation, microbiological degradation, nitrogen removal				
Fertil OÜ	Estonia	BioKem	Holding tank 10m3	Holding tank				 -	http://www.fertil.ee/mahutid/
Wavin-Labko Oy	Finland	BioKEM	Labko BioKem 20EN, 10EN, 15EN, 30EN, 40EN, 50EN, 6EN,70EN,80EN,90EN	Package plant	Aeration, Chemical fixation, Sedimentation, N removal, Pumping				https://www.wavin.com/et-ee

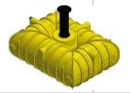
Finland (1/5):

Manufacturer	Country	Make	Model	Type of technology	Description of treatment process	Capacity BOD (g/d) design inflow or min-max	Size (PE)/ other info	Pictures	Link:
Klärtechnik Reinhardt GmbH	Germany	ISOLOKATON (Klärmax ideal)	ISOLOKATON	Package plant	Microbiological degradation, chemical fixation of P, sedimentation				http://reinhardt-gmbh.net/en/klaertechnik/klaermaxklaeranlagen.html
Klärtechnik Reinhardt GmbH	Germany	LOKATON (Klärmax ideal)	LOKATON	Package plant	Microbiological degradation, chemical fixation of P, sedimentation	250	1 - 10		http://www.batsystems.fi/jateveden-puhdistus/lokaton
OyVevi-va Ab	Finland	Vevi	6	Package plant	Sedimentation, Micro-biological degradation, Sedimentation with chemical fixation	900 l/d	6		http://www.vevi.fi/pienpuhdistamo.htm
Pipelife oy	Finland	Umpisäiliö	Umpisäiliö 5000	Holding tank	Other				https://www.puhdastulevaisuus.fi/media/materiaalipankki/esitteet/3625427_pipelife_umpisailio_5000_e
Pipelife oy	Finland	Suodatus-kasetti-paketti	Suodatuskasetti-paketti 5, 7, 10	imeytys	Sedimentation, greywater filter		1-5, 1-7, 1-10		https://www.puhdastulevaisuus.fi/media/materiaalipankki/esitteet/suodatuskasettipaketit_esite_2017.pdf
Pipelife oy	Finland	Imeytyspuh-distuspaketti	3000, 3010	imeytys	Sedimentation, greywater filter				http://www.pipelife.fi/media/fi/tekniset_kuvat/ymparisto/pdf/3010-maaimeytys.pdf

Continue: Available wastewater treatment systems, Finland (2/5).

Manufacturer	Country	Make	Model	Type of technology	Description of treatment process	Capacity BOD (g/d) design inflow or min-max	Size (PE)/ other info	Pictures	Link:
Pipelife oy	Finland	Pisara	Pisara	Other: gray-water filter	Greywater filter				https://www.puhdastulevaisuus.fi/media/materiaalipankki/esitteet/3625413_pisara_esite_2017.pdf
Pipelife oy	Finland	V6 / V12	V6, V12 (Klärmax/ Pipelife SBR)	Package plant	Sedimentation, Microbiological degradation, Chemical fixation, SBR (Sequencing Batch Reactor)		2-6, 6-12	 	http://www.pipelife.com/com/products/eco_systems/sbr_system/sbr_system_main.php
Pipelife oy	Finland	Cleanbox	Cleanbox SBR	Septic plant	Sedimentation, microbiological degradation, SBR (Sequencing Batch Reactor)				http://www.pipelife.com/com/products/eco_systems/septic_tank/septic_tank_main.php
Putki-Parainen Oy	Finland	Biorock & Sakokaivo	Biorock 10 & Sakokaivo Biorock-10-ST-2000/ Biorock-10-ST-	Continuous biofilter + septic tank	Biofilter, Sedimentation		1 - 6 / 1 - 10	 	http://www.putkiparainen.fi/tuotteet.html
Putki-Parainen Oy	Finland	Biorock & Sakokaivo	Biorock 15 & Sakokaivo Biorock-5-ST-2000/ Biorock-5-ST-3000	Continuous biofilter + septic tank	Biofilter, Sedimentation		1 - 15		http://www.putkiparainen.fi/tuotteet.html
Putki-Parainen Oy	Finland	Biorock & Sakokaivo	Biorock 6 & Sakokaivo Biorock-5-ST-3000	Continuous biofilter + septic tank + connction to infiltration	Biofilter, Sedimentation, connection to infiltration field	300	6	 + 	http://www.putkiparainen.fi/tuotteet.html

Continue: Available wastewater treatment systems, Finland (3/5).

Manufacturer	Country	Make	Model	Type of technology	Description of treatment process	Capacity BOD (g/d) design inflow or min-max	Size (PE)/ other info	Pictures	Link:
SKT Suomi	Finland	Pumppaamo	LPS2000D/Q, LPS2000D_Q_LRES, LPS2000EIV_Lres	Other: Pump station	Low Pressure Sewer				http://www.kommunalteknik.se/wp-content/uploads/2015/05/LPS2000DQ_FI_Broschyr_2015-05-04.pdf
Talokaivo Oy	Finland	Sakosetti	2-300	Filtering veil	Septic tank, Soil filter		For summer houses		http://www.talokaivo.fi/
Talokaivo oy	Finland	Umpisetti	2000, 3000, 6000	Holding tank	Other		2 m3 – 6 m3		http://www.talokaivo.fi/
Talokaivo oy	Finland	Umpisetti	12000_6600x2350	Holding tank	Other		12 m3		http://en.talokaivo.fi/tuote-kategoriat/wastewater-treatment-systems/cesspools/
Reinhardt GmbH / BAT Systems Oy	Germany / Finland	KLÄRMAX XL / ISOLOKATON	KLÄRMAX XL 1000 PE / ISOLOKATON 1000 PE	SBR (Sequencing batch reactor)	Biological cleaning process (Activated sludge process)	50000	1000		http://reinhardt-gmbh.net/de/klaertechnik/klaermaxklaeranlagen/klaermax-xl.html

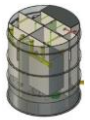
Continue: Available wastewater treatment systems, Finland (4/5).

Manufacturer	Country	Make	Model	Type of technology	Description of treatment process	Capacity BOD (g/d) design inflow or min-max	Size (PE)/ other info	Pictures	Link:
Talokaivo Oy	Finland	Sakosetti	2-1500, 2-1500ID	Infiltration system	Septic tank, Soil filter		For grey-water 750 l/d. The IN-DRÄN modules (ID)		http://www.talokaivo.fi/
Talokaivo Oy	Finland	Sakosetti	S-3-3000	Infiltration system	Septic tank, Soil filter		For all household sewage 1000 l/d		http://www.talokaivo.fi/
Talokaivo oy	Finland	Biosetti 5	5, 6, 10, 12	Package plant	Microbiological degradation, chemical fixation of P, sedimentation				http://www.talokaivo.fi/
Uponor	Finland	WehoPuts	300	Package plant, SBR-prosessi	Microbiological degradation, chemical fixation of P	15000, Max 45 m3/d			http://info.uponor.fi/

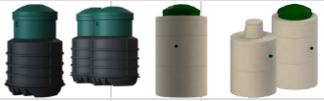
Continue: Available wastewater treatment systems, Finland (5/5).

Manufacturer	Country	Make	Model	Type of technology	Description of treatment process	Capacity BOD (g/d) design inflow	Size (PE)/ other info	Pictures	Link:
Jita Oy	Finland	Jita Kemik	Jita Kemik Package plant	Package plant	Sedimentation, Aeration, microbiological degradation	300	1-5 PE		http://www.jita.fi/fi/tuotteet/jatevesijarjestelmat/jita-kemik-
Biorock	Luxembourg	Biorock	Biorock 6,10, 15, 30	Package plant	Sedimentation, microbiological degradation			 	http://biorock.com/products
Biorock	Luxembourg	Biorock	Biorock-ST-2000, 3000	Septic tank					
GreenRock	Finland	IISI	IISI - S6, S10, B6, B10	Package plant	Primary clarifier, Microbio.degrad Clarification	60-360 (for all IISI-S models)	1-6, 1-10, 1-6, 1-10	  	http://www.greenrock.fi/jatevesi/
Green Rock	Finland	Iisi	IISI - Rock	Package plant	Microbiological degradation	60-300	1-5 PE		
Green Rock	Finland	Iisi	BSCS 55, 100, 200, 300	Package plant	Biostone-Chemstone system; 3-compartment pre-precipitation,		55, 100, 200, 300		
Wavin-Labko Oy	Finland	BioKEM	Labko BioKem 20EN, 10EN, 15EN, 30EN, 40EN, 50EN, 6EN,70EN,80EN,90EN	Package plant	Aeration, Chemical fixation, Sedimentation, N removal, Pumping			  	https://www.wavin.com/fi-fi
Wavin-Labko Oy	Finland	LOKA	Labko LOKA 10000	Holding tank					
Wavin-Labko Oy	Finland	SAKO	Labko SAKO-3 De Luxe -infiltration package	Septic tank + infiltration package	Septic tank (3 sections, higher installation depth) and 2 infiltration lines				

Latvia (1/3):

Manufacturer	Country	Make	Model	Type of technology	Description of treatment process	Capacity BOD (g/pv) design inflow or min-max	Size (PE)/ other info	Pictures	Link:
ASIO, spol. s r.o.	Czech Republic	AS-VARIOCOMP K	AS-VARIOcomp 5K, 5K ultra, 8K, 8K ultra, 12K, 15K, 15K ultra, 20K, 20K ultra	Package plant	Pre-sediment, Microbio.degrad, Clarification	300 (240 Ultra), 480, 720, 900, 1200	8 - 20 PE		http://www.asio.cz/en/as-variocomp-k
BioKube A/S	Denmark	Pluto	Pluto	Package plant	Buffer tank, Microbio.degrad Clarification	65	5	 Pluto	https://www.biokube.com/wp-content/uploads/2015/03/Factsheet-Pluto.pdf
BioKube A/S	Denmark	Venus	Venus 1850, 1850 S, 1850 Small Lid, 2200, 2200 S	Package plant	Buffer tank, Microbio.degrad Clarification	300-600 (1850), 600-900 (2200), 900-1200 (2200 S)	5-10, 5-10, 5-10, 10-15, 15-20	 Venus 1850  Venus 2200	https://www.biokube.com/wp-content/uploads/2015/03/Fact-Sheet-Venus.pdf
BioKube A/S	Denmark	Mars	Mars 1, 2, 3	Package plant	Buffer tank, Microbio.degrad Clarification	1800, 2400, 3000	for single households or smaller residential groups producing up to 30 m³ wastewater a day	 Mars 2000  Mars 3000  Mars 5000	https://www.biokube.com/wp-content/uploads/2015/03/Fact-Sheet-Mars-3000.pdf
BIOROCK S.à.r.l.	Luxemburg	Monoblock - 2	Monoblock -2 -700, 800, 900; Monoblock -3 -800, 900	Package plant	Primary clarifier, Microbio.degrad (non-electric)	240, 300, 360, 300 (3-800)	4, 5, 6, 8, 10, 15 & 30 person systems. If installed in parallel the treatment units can also cater for 60, 90, 120 people and so on.	 	http://biorock.com/products/biorock-monoblock-systems
BIOTEX, SIA	Latvia	BIO	BIO	Package plant	Primary clarifier, Microbio.degrad Clarification	Missing data	2 - 50		http://www.biotex.lv/produkti/biologiskas-attirisanas-iekartas-1/

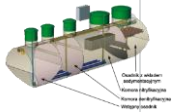
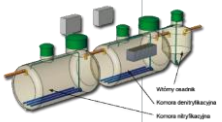
Continue: Available wastewater treatment systems, Latvia (2/3).

Manufacturer	Country	Make	Model	Type of technology	Description of treatment process	Capacity BOD (g/pv) design inflow or min-max	Size (PE)/ other info	Pictures	Link:
EkoStandarts Tehnoloģijas	Latvia	ASD B	ASD B 1,5-8, 2-12, 2-20	Equipment pack for manhole D1500	Primary clarifier, Microbio.degrad Clarification	120-360, 360-660, 660-900, 900-1500	Population (CE) 2-6, 6-11, 11-15, 15-25		http://www.ekostandarts.lv/en/products/biological-wastewater-treatment/
EkoStandarts Tehnoloģijas	Latvia	ASD PCK	ASD PCK 1,5-4, 1,5-8, 2.0-12, 2.0-20	Package plant	Primary clarifier, Microbio.degrad Clarification	120-360, 360-660, 600-900, 900-1500	2-6, 6-11, 11-15, 15-25		http://www.ekostandarts.lv/en/products/biological-wastewater-treatment/
GreenRock	Finland	IISI	IISI - Rock	Equipment pack for manhole/septic	Microbio.degrad	60-300	1-5 PE		http://www.greenrock.fi/jatevesi/
GreenRock	Finland	IISI	IISI - S6, S10, B6, B10	Package plant	Primary clarifier, Microbio.degrad Clarification	60-360 (for all IISI-S models)	1-6, 1-10, 1-6, 1-10		http://www.greenrock.fi/jatevesi/
LABKO	Finland	BioKEM	BioKEM 6 EN, 10 EN	Package plant - SBR	Primary clarifier, Microbio.degrad Clarification	120-360, 120-360	2-6, 6-10		http://labko.wavin.com/web/ratkaisut/jatevesituotteet-ja-erottimet/hajaasutusalueet.htm
Otto Graf GmbH	Germany	Klaro one-tank	Klaro one-tank 3-5, 5-8, 7-10, 9-14	Package plant SBR	Primary clarifier, SBR	180-360, 300-480, 420-600, 540-840	3-5, 5-8, 7-10, 9-14		http://en.klaro.eu/fileadmin/files/Broschueren_2016/101-EN-0516_KLARO_main_brochure_-_Mail.pdf
Otto Graf GmbH	Germany	Klaro multi-tank	Klaro multi-tank 7-10, 12-16, 16-22, 20-28, 25-32, 32-44, 45-50	Package plant SBR	Primary clarifier, SBR	420-600, 720-960, 960-1320, 1200-1680, 1500-1920, 1320-2640, 1320-2640	7-10, 12-16, 16-22, 20-28, 25-32, 32-44, 45-50		http://www.graf-water.com
Otto Graf GmbH	Germany	one2clean one-tank	one2clean one-tank 1-3, 4-5, 6-7, 8-9	Package plant SBR	Primary clarifier, SBR	60-180, 240-300, 360-420, 480-540	1-3, 4-5, 6-7, 8-9		http://www.graf-water.com/wastewater-treatment/wastewater-treatment-
Otto Graf GmbH	Germany	one2clean multi-tank	one2clean multi-tank 1-7, 8-10, 11-14, 15-18	Package plant SBR	Primary clarifier, SBR	60-420, 480-600, 840-660, 900-1080	1-7, 8-10, 11-14, 15-18		http://www.graf-water.com/wastewater-treatment/wastewater-treatment-systems.html

Continue: Available wastewater treatment systems, Latvia (3/3).

Manufacturer	Country	Make	Model	Type of technology	Description of treatment process	Capacity BOD (g/pv) design inflow or min-max	Size (PE)/ other info	Pictures	Link:
Rewatec GmbH	Germany	Fluido	Fluido 4E-35, 6E-50, 4E-15_15, 8E-30_30, 12E-50_50, 16E60_60, 20E-75_75, 26E-90_90, 28E-75_75+75, 36 E-90/90+90	Package plant SBR	Primary clarifier, SBR	120-180, 240-360, 120-180, 360-480, 120-180, 600-960, 720-1200, 840-1560, 840-1680, 1080-2160	2-3(4), 4-6, 2-4, 6-8, 8-12, 10-16, 12-20, 14-26, 14-28, 18-36		http://www.rewatec.de/
Roth GmbH	Germany	Micro-Step XL SBR-Hybrid	Micro-Step XL SBR-Hybrid - 4, 6, 8, 12	Package plant SBR	Primary clarifier, SBR	240, 360, 480, 720	4, 6, 8, 12		http://www.roth-umwelttechnik.com/de/1476.htm
Rotons SIA	Latvia	RS	RS2000	Septic tank	Anaerobic digest.	300			http://www.rotons.lv/en/produkti/wastewater-treatment/septic-tanks-biological-treatment-plants
Sotralenz	France	EPURBLOC	EPURBLOC 3000, 4000, 2000W-086, 3000W-097	Septic filter	Anaerobic digest. Filtration	60-204, 360-480, 60-240, 360-480	6, 8, 4, 6		http://habitat.sotralentz.com/files/ANC/A64-II-08-11.pdf
Traidenis UAB	Lithuania	NV	NV-1a, 2a, 3a, 4a	Package plant	Primary clarifier, Microbio.degrad Clarification	240, 480, 840, 1140	4, 8, 14, 19		http://www.traidenis.lt/en/products/biological_treatment_plants_of_domestic_wastewater_for_private_houses_/
Uponor	Finland	BioClean	BioClean 5	Septic filter	Anaerobic digest.	60-420	1 - 6		https://www.uponor.pl/en/infra/solutions-infra/sewer-waste-water-treatment.aspx

Lithuania:

Manufacturer	Country	Make	Model	Type of technology	Description of treatment process	Capacity BOD (g/pv) design inflow or min-max	Size (PE)/ other info	Pictures	Link:
Traidenis	Lithuania	NV	NV-1, 2, 3, 4	Extended aeration activated sludge technology	Extended aeration actvated sludge process, nitrification and denitrification, sedimentation	240, 480, 840, 1140	4,8,14,19		
Traidenis	Lithuania	HNV-P	HNV-P-45	Extended aeration activated	Extended aeration actvated sludge process, nitrification and denitrification, sedimentation	18000	300		
Traidenis	Lithuania	HNV-N	HNV-N-40	Extended aeration activated	Extended aeration actvated sludge process, nitrification and denitrification, sedimentation	15960	266		http://www.traidenis.lt/en/
ATB Umwelttechnologien GmbH/ JSC ,, Eneka" Lithuania	Germany/Lithuania	AQUAmax	AQUAmax PROFESSIONAL	SBR (Sequence Batch Reactor) XL2-A3.0	Activate sludge with batch feed; Carbon reduction, nitrification and denitrification, N and P removal	15000	50 to 400		http://www.atb-belgique.be/wp-content/uploads/2014/09/E-20120427-AQUAmax-PROFESSIONAL-XXL1.pdf
August ir ko, UAB	Lithuania	AT250	AT250	Vertical flow labirinth technology (VFL)	Aeration, sedimentation, biological nitrogen and phosphorus removal. Wastewater flows into anaerobic fermentation zone, mixes with activated sludge and flows into denitrification zone. Then wastewater overflows into aeration zone where proceed wastewater oxidation and nitrification processes and finally, the mixture of activated sludge flows into sedimentation section.	15000	75-250	 	http://www.august.ge/index.php/en/

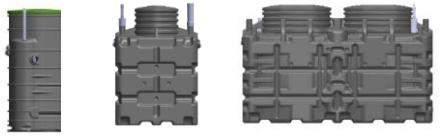
Poland (1/4):

Manufacturer	Country	Make	Model	Type of technology	Description of treatment process	Capacity BOD (g/d) design inflow	Size (PE)/ other info	Pictures			Link:
The Institute of New Technologies in Enviromental Engineering (main author of tehe technology)	Poland	The Institute of New Technologies in Enviromental Engineering	Household Sewage Treatment Plant	constructed wetland	Mechanical part: sedimentation, flotation, fermentation; Biological part: phosphorus binding, nitrogen removal, organic compounds removal	480					
Institute of Technology and Life Sciences in Tylicz	Poland	Poland, Municipality of Krynica-Zdrój		Biological filter bed and ground-vegetation bed	1. **Pretreatment** takes place in the three-chamber flow septic tank with interchamber separation of floating and easily falling pollution. Sedimentation of sediments and suspensions, anaerobic biochemical decomposition of organic matter resulting in organic nitrogen ammonification and sulfur compounds formation also occurs. 2. **Biological wastewater treatment** takes place in vertical flow trickling filter bed filled with light expanded clay aggregates in a tight casing. There is intensive biochemical aerobic decomposition of organic wastewater pollutants (BOD5, COD) and advanced nitrification of ammonium ions. 3. **Tertiary treatment** occurs in the horizontal flow slope ground-vegetation bed as a filter strip isolated from the ground. There are physical filtration of suspensions, mineralization of residues of organic matter (BOD5, COD), nitrification and denitrification of nitrogen compounds as well as physical and chemical sorption with precipitation and immobilization of phosphorus compounds in the bed's mineral filling and rhizosphere.	600					http://www.itp.edu.pl/en/

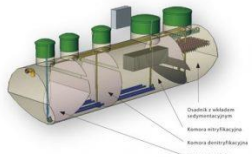
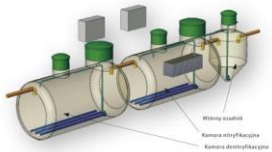
Continue: Available wastewater treatment systems, Poland (2/4).

Manufacturer	Country	Make	Model	Type of technology	Description of treatment process	Capacity BOD (g/pv) design inflow or min-max	Size (PE)/ other info	Pictures	Link:
Haba RL	Poland (Treatment plants are produced in Poland)		The manufacturer offers following solutions: 1) biological sewage treatment plants with activated sludge (SBR, flow treatment plants, biological and chemical treatment plants), 2) drainage treatment plants 3)modernization of septic tanks to biological treatment plants 4) modernization of drainage treatment plants to biologicla teatment plants	Package plant	1) Biological treatment plants with activated sludge. Consist of a primary settling tank and an aeration tank. Both tanks are connected. The wastewater is kept from 48 to 72 h in the aeration tank. The inflow, aeration and outflow processes are automated. It is possible to extend the variant with the coagulant dosing (chemical treatment process). Finally depending on the variant the wastewater is pumped to the plant filter, or to an absorbing well, or to a ditch drainage, or to a drainage system, or a drainage tunnel. 2) Filter drainage wastewater treatment plant. Consist of a septic tank with a filter connected with a drainage system. Anaerobic processes take place in the settling tank. The filter is designed to filter the wastewater from the slurry before it leaves the settler. In the drainage system biological processes take place, with the participation of aerobic bacteria.	od 300 do 3000			http://haba.com.pl/serwis/
FANN POLSKA Sp. z o.o., ul. Śląska 88, 40-742 Katowice	Sweden/ Poland			Infiltration sysytem In-Dran	The wastewater treatment process consists in decomposition of pollutants through naturally occurring microorganisms. The main stage of wastewater purification is aerobic microbiological process in the IN-DRÄN modules and in the filtration bed, assisted by the root system of macrophytes. Septic tank: The septic tank performs function of preliminary mechanical treatment of wastewater. There is sedimentation of solids of sewage that fall down to the bottom of the sedimentation tank, where they undergo fermentation. From septic tank wastewater flows gravity to the control well and further onto special filter IN-DRÄN modules. IN-DRÄN modules: They consist of a folded biotextile as a structural material on which the biological clogging layer grows. Between the folds are cores of thermoplastics. Wastewater trickles down the folds which are open upwards, passes through the biological clogging layer, down into the ground. The biological clogging layer in one fold gets the air (oxygen) from the folds next to it. Horizontal flow filtration bed: Filling the filter (a mix of gravel and sand) is isolated from the ground with PE foil. The filter surface is partly planted with hydrophytes. During the wastewater flow through the bed, the following processes occur: physical, chemical and biological sorption of suspensions and colloids, aerobic degradation of organic compounds (BOD5) and inorganic ones (nitrification and partial denitrification). In the vegetation period, the plants assimilate some of the dissolved inorganic biogenic compounds in their biomass. Bacteria developing in the rhizosphere affect the effectiveness of biochemical processes, also in winter. Infiltration trench: After filtering through the bed, the purified liquid flows into the stony trench, from where it infiltrates into the soil.	300			http://pro.fann.se/sv/broschyrer/laggningsanvisningar

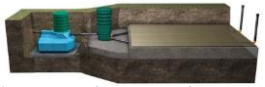
Continue: Available wastewater treatment systems, Poland (3/4).

Manufacturer	Country	Make	Model	Type of technology	Description of treatment process	Capacity BOD (g/d) design inflow	Size (PE)/ other info	Pictures			Link:
Otto Graf GmbH	Germany	Klaro Easy	5,8,10,14	Package plant	Microbiological degradation, sedimentation	520					https://en.klaro.eu/
Soltralentz	Poland	EKODREN	Actiblock 4, 6, 8, 12	Package plant			1-4 PE, 5-6 PE, 7-8 PE, 9 - 12 PE				http://www.ekodren.pl/
Biorock Wastewater Treatment	Luxemburg	Monoblock	Monoblock-2, Monoblock 3	Package plant	Sedimentation, microbiological degradation, filtration	0.6-0.9, 0.75-0.9	4-6, 5-6				http://biorock.com/products/biorock-monoblock-systems/monoblock-2
Biorock Wastewater Treatment	Luxemburg	Ecorock	Ecorock-700, 800, 900, 1500, 2000, 3000, 5000	Package plant	Sedimentation, microbiological degradation						http://biorock.com/products/small-sized-systems/ecorock-700
Biorock Wastewater Treatment	Luxemburg	Biorock	Biorock-ST1-2000, 3000, 5000, 7500, 10000, 15000	Septic tank	Sedimentation						http://biorock.com/products/primary-tanks/biorock-st1-2000

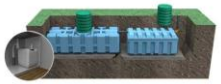
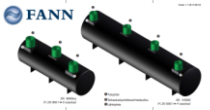
Continue: Available wastewater treatment systems, Poland (4/4).

Manufacturer	Country	Make	Model	Type of technology	Description of treatment process	Capacity BOD (g/d) design inflow	Size (PE)/ other info	Pictures	Link:
Traidenis	Lithuania	NV	NV-1, 2, 3, 4	Extended aeration activated sludge technology	Extended aeration actvated sludge process, nitrification and denitrification, sedimentation	240, 480, 840, 1140	4,8,14,19		http://www.traidenis.lt/en/
Traidenis	Lithuania	HNV-P	HNV-P-45	Extended aeration activated sludge technology	Extended aeration actvated sludge process, nitrification and denitrification, sedimentation	18000	300		
Traidenis	Lithuania	HNV-N	HNV-N-5, 10, 15, 25, 40	Extended aeration activated sludge technology	Extended aeration actvated sludge process, nitrification and denitrification, sedimentation	15960	266		
August ir ko, UAB	Lithuania	AT	AT6, 8, 10, 12	Package plant	Aeration, sedimentation, biological nitrogen and phosphorus removal.	0,6, 0,8, 1,2, 1,6	AT6 (for 1-4 PE), AT8 (for 1-6 PE), AT10 (for 3-8 PE), AT12 (for 4 - 10 PE)		https://www.august.lt/en/products/#nuoteku-valymo-irenginiu-serija-at

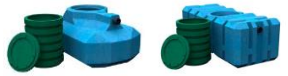
Sweden (1/5):

Manufacturer	Country	Make	Model	Type of technology	Description of treatment process	Capacity BOD (g/d) design inflow or min-max	Size (PE)/ other info	Pictures
Ecotech	Sweden	Ecobox	BDT	Other		300		
Ecotech	Sweden	Ecobox	Bio 2, 3, 4	Filter + septic tank				
Ecotech	Sweden	Ecobox	Small	Other				
FANN	Sweden	1G	FANN 1G imeytys 5, 5WC, 10, 10WC, 15, 15WC	Infiltration bed	Septic tank, Infiltration bed			
FANN	Sweden	1G	FANN 1G maasuodatus 5, 10, 15	Soil filter	Septic tank, soil filter			
FANN	Sweden	IN-DRÄN	IN-DRÄN 2G maasuodatus 5, 10 WC	soil filter	Septic tank, soil filter	560, 238		
FANN	Sweden	IN-DRÄN	IN-DRÄN Plus 2G imeytys 5, 10, 10 WC, 15	Infiltration bed	Septic tank, Infiltration bed	420, 630, 840		
FANN	Sweden	IN-DRÄN	IN-DRÄN Plus 3G imeytys 5, WC, 10, 15	Infiltration bed	Septic tank, Infiltration bed	238, 714		

Continue: Available wastewater treatment systems, Sweden (2/5).

Manufacturer	Country	Make	Model	Type of technology	Description of treatment process	Capacity BOD (g/d) design inflow or min-max	Size (PE)/ other info	Pictures
FANN	Sweden	Biosuodatin	In Drän 3 G biosuodatin 5ce	Septic tank + biosuodatin	Septic tank + biosuodatin	238		
FANN	Sweden	Umpisäiliö	ST 10000, 14000, 18000, 22000, 46000	Holding tank	Holding tank			
FANN	Sweden	IN-DRÄN	IN-DRÄN 3G Biosuodatin 5, 5ce WC, 10, 10ce WC, 15	Biofilter	Septic tank, biofilter	210, 238		
FANN	Sweden	IN-DRÄN	IN-DRÄN Plus 2G imeytys 5, 10, 15,	Infiltration bed	Septic tank, Infiltration bed	238, 595	5,10,15	
FANN	Sweden	IN-DRÄN	IN-DRÄN Plus 3G imeytys 5, 10, 15	Infiltration bed	Septic tank, Infiltration bed	476, 714, 840	5,10,15	
FANN	Sweden	Saunapaketti	Paketti IN-DRÄN Plus, 3G Sauna 340 l	Infiltration bed	Septic tank, Infiltration bed			
FANN	Sweden		SA 8000, 12000, 20000, 44000	Septic tank	Septic tank			
FANN	Sweden		Paketti SA 2006ce	Septic tank	Septic tank		5 PE, Wet volume 2m3	
FANN	Sweden		Paketti SA 906	Septic tank	Septic tank		Wet volume 1,2m3	

Continue: Available wastewater treatment systems, Sweden (3/5).

Manufacturer	Country	Make	Model	Type of technology	Description of treatment process	Capacity BOD (g/d) design inflow or min-max	Size (PE)/ other info	Pictures
FANN	Sweden		Paketti SA 3006ce	Septic tank	Septic tank		8 PE, Wet volume 3m3	
FANN	Sweden		Paketti SA 3012ce HD	Septic tank	Septic tank		Wet volume 3m3	
FANN	Sweden		Paketti SA 4006ce	Septic tank	Septic tank		10 PE, Wet volume 4m3	
FANN	Sweden		Paketti SA 6012ce	Septic tank	Septic tank		15 PE, Wet volume 6m3	
FANN	Sweden		Paketti ST 3000Ls	Holding tank	2-osainnen, rei'itetty väliseinä			
FANN	Sweden		Paketti ST 3006L, 40006L	Holding tank	2-osainnen, rei'itetty väliseinä			
FANN	Sweden		Paketti ST 6012Lsa, 9612Lsa	Holding tank				
FANN	Sweden	Virtsasäiliö	Paketti UT 906, 2006, 3006	Holding tank				

Continue: Available wastewater treatment systems, Sweden (4/5).

Manufacturer	Country	Make	Model	Type of technology	Description of treatment process	Capacity BOD (g/d) design inflow or min-max	Size (PE)/ other info	Pictures	Link:
Otto Graf GmbH	Germany	Klaro one-tank	Klaro Easy E 5, E 8, E 10, E 14	Package plant SBR	Microbiological degradation, sedimentation	260, 420, 520, 730	3-5, 5-8, 7-10, 9-14		https://en.klaro.eu/
BioKube A/S	Denmark	Pluto	Pluto	Package plant	Buffer tank, Microbio.degrad Clarification	65	5	 Pluto	https://www.biokube.com/wp-content/uploads/2015/03/Factsheet-Pluto.pdf
BioKube A/S	Denmark	Venus	Venus 1850, 1850 S, 1850 Small Lid, 2200, 2200 S	Package plant	Buffer tank, Microbio.degrad Clarification	300-600 (1850), 600-900 (2200), 900-1200 (2200 S)	5-10, 5-10, 5-10, 10-15, 15-20	 Venus 1850  Venus 2200	https://www.biokube.com/wp-content/uploads/2015/03/Fact-Sheet-Venus.pdf
BioKube A/S	Denmark	Mars	Mars 3000 2K, 3K, 4K	Package plant	Buffer tank, Microbio.degrad Clarification	3.0-6.0, 4.5-6.0, 6.0-7.5		 Mars 2000  Mars 3000  Mars 5000	https://www.biokube.com/wp-content/uploads/2015/03/Fact-Sheet-Mars-3000.pdf
Uponor	Finland	BioClean	BioClean 5	Septic filter	Anaerobic digest.	60-420	1 - 6		https://www.uponor.pl/en/infra/solutions-infra/sewer-waste-water-treatment.aspx

Continue: Available wastewater treatment systems, Sweden (5/5).

Manufacturer	Country	Make	Model	Type of technology	Description of treatment process	Capacity BOD (g/d) design inflow or min-max	Size (PE)/ other info	Pictures	Link:
Wavin-Labko Oy	Finland	BioKEM	Labko BioKem 20EN, 10EN, 15EN, 30EN, 40EN, 50EN, 6EN,70EN,80EN,90EN	Package plant	Aeration, Chemical fixation, Sedimentation, N removal, Pumping				https://www.wavin.com/sv-se
GreenRock	Finland	IISI	IISI - S6, S10, B6, B10	Package plant	Primary clarifier, Microbio.degrad Clarification	60-360 (for all IISI-S models)	1-6, 1-10, 1-6, 1-10		http://www.greenrock.fi/sv/avloppsvattenrening/
GreenRock	Finland	IISI	IISI - Rock	Package plant	Microbiological degradation	60-300	1-5 PE		http://www.greenrock.fi/sv/avloppsvattenrening/
Green Rock	Finland	Iisi	BSCS 55, 100, 200, 300	Package plant	Biostone-Chemstone system; 3-compartment pre-precipitation, biological treatment, chemical treatment, post-clarification, post-filtration		55, 100, 200, 300		http://www.greenrock.fi/sv/avloppsvattenrening/

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