

Seagull Water, WP 2

Brief description of water resources, March 2003

Kaliningrad region

Statistics from Kaliningrad region (information's taken from [2])

In 1945, in accordance with the decision of the Potsdam Conference, the three powers (USSR, USA and Great Britain) on the eradication of Eastern Prussia, an administrative and political unit of Russia was created in the north-eastern part of that region – a new region with the town of Kaliningrad (formerly Königsberg) as its administrative capital.

The region belongs to the Baltic region, which in addition to north-west Russia contains territory of the Baltic states, Finland, Sweden, Denmark, Poland and Germany.

It is situated between latitude 54° and 55° north in a temperate continental climate belt. The dominant type of land relief is plains: the soil is turf and podzol. 22% of the land of the region is occupied by mixed conifer and broad-leaved forest, a third is pasture and 7% is peat bog.

The area of the region is 15,100 km² (0.09% of the territory of the Russian Federation), of which 1,800 km² lies on a bay of the sea. The region extends for 205 km from east to west and for 108 km from north to south.

On 1st January 1995 the population numbered 926,000 inhabitants (0,6% of the population of Russia). More than 78% of the population is Russian.

The density of population is 61 persons per square kilometer. 78 % of the population of the region live in towns and 22% live in rural areas.

There are a total of 22 towns in the region. The largest of them are the regional capital Kaliningrad (419,000 inhabitants), Sovetsk (43,000), Chernyakhovsk (42,000) and Gusev (28,000).

The principal natural resources of the region are forest (overall area 300,000 m³), peat (overall area 2.5-3.0 billion cubic metres), rock salt, lignite (about 50 billion tonnes), raw materials for the building materials industry (clay, non-metallic building materials, mineral water and medicinal mud).

The principal industrial sectors are fishing, cellulose and paper, industrial engineering and metalworking.

More than 2/3 of industrial manufacturing output is concentrated on the large towns of Kaliningrad, Sovetsk, Gusev and Chernyakhovsk.

The principal area of agricultural production is dairy and meat farming.

Land for agricultural use makes up 58 % of all land of the region, of which 44 % is cultivated.

The transport infrastructure in the region is well developed. There are 756 km of general purpose railway and 4,600 km of surfaced roads.

After the disintegration of the former USSR the region is separated from the main territory of the Russian Federation; in the north and east it has borders with Lithuania, and in the south with Poland.

The situation of today

Basins description (information is taken from [3])

Kaliningrad Oblast is situated in an area of excessive water content, which determines a large amount of surface water resources: 4.49 m³. 65% of this volume originates from the runoffs in this region, and 35% comes as the runoff of surface waters from the territory of Poland. A part of local surface-water run-off, 16% flows to Lithuania [19]. A considerable part of precipitations (71%) goes with evaporation. The surface-water runoff through the rivers makes up 23% of the annual volume of precipitations. The marine waters of the Baltic Sea adjoin Kaliningrad Oblast. The sea area in the region is 9.6 thousand km², out of which:

- *internal sea waters: 1.8 thousand km² (the Curonian lagoon — 1.3 thousand km² and the Vistula lagoon - 0.472 thousand km²);*
- *RF territorial waters: 2.8 thousand km²;*
- *RF economic zone: 5.0 thousand km².*

The area of the region is 15.13 thousand km², out of which nearly 2 thousand km² are occupied by the adjoining parts of the Curonian and Vistula lagoons, rivers, and lakes. The climatic conditions in the region are characteristic of high dynamics and are mainly determined by the influence of air masses, which are formed over the Atlantic Ocean and Europe. The average annual air temperature varies from 7.5 °C in the south-west to 6,5 °C in the north-east. The average minimum air temperatures in summer vary from 19 to 23 °C, and the minimum winter temperatures from -2.0 to -7.2 °C. [13] The average annual volume of precipitations in the region is 750 mm, out of which 450 mm evaporate. The rest of the precipitations forms the surface-water run-off, a part of which gets into underground water bodies, and the remaining part flows into the rivers, lakes and swamps. The run-offs of the rivers, in a year with an average water content, is 22.5 km³, out of which:

- *Neman river: 19.7 km³;*
- *Pregola river: 2.6 km³;*
- *other rivers of the basins of the Curonian and Kaliningrad lagoons: 0.2 km³. [6-9]*

Rivers

The total number of rivers on the territory of Kaliningrad Oblast is over 4,000. Their total length is 12,720 km. They belong to the basins of the Neman and Pregola rivers, or flow directly into the sea or into the lagoons. More than 95% of the rivers are less than 10 km long, the rest belong to the group of small or medium-size rivers. The main water system in the region is that of the Pregola river. It flows from east to west, crossing the entire area of the region, and it has been subjected to all forms of anthropogenic impacts, which have changed its hydrographical network and hydrological regime. The Neman river is one of the largest rivers in the Baltic region. It flows 100 km along the northern border of Kaliningrad Oblast. The regimes of the Neman and Pregola rivers are influenced by easterly winds, which drive water downstream, and by westerly winds, which drive water from the lagoons back into the rivers. Sometimes, in autumn, during long periods of westerly winds, the water levels in the lower parts of the rivers, especially in the Pregola estuary rise so high, that floods occur. Besides the Neman and Pregol Rivers, seven other major rivers drain the oblast. Two of these rivers, Lava and Angrapa, are trans-boundary rivers with Poland. Some characteristics of the rivers are given in Table 1. The table shows only the lower

parts of some of the rivers flowing through the region's territory. Most of the area is low lay

Table 1

Some characteristics of the main watercourses in Kaliningrad Oblast [4]

№	Name	Length, km	Watercourse category
1.	Pregola	123	superior
2.	Neman	107/937	superior
3.	Sheshupe	114/308	1
4.	Instruch	101	1
5.	Angrapa	97/169	1
6.	Pissa	98	1
7.	Prohladnaya	77	superior
8.	Lava	65/289	1
9.	Golubaya	64	2
10.	Deima	37	superior

**Note: the first figure stands for the total river length, the second one is the river length within Kaliningrad Oblast.*

ing wetland protected by dikes and dams and flooding is frequently experienced in the downstream reaches of the Neman River. In order to release floods into the Pregol River a diversion canal has been constructed diverting water from the Pregol River to Corona Lagoon. The flooding is often aggravated in winter periods due to ice cover. Being a lowland area, the region was extensively drained at the beginning of the century and a comprehensive and complex irrigation and drainage network covers the catchment, see Fig. 1.



Fig 1. Main Rivers and tributaries, [3]

Lakes and other water reservoirs

The territory of Kaliningrad Oblast belongs to the north-western lake district, characteristic of lakes formed in the areas of cumulative activities of the latest glaciation period. There are more than 40 lakes and water reservoirs of 10 or more hectares. The number of smaller water bodies is several thousands. The water bodies are of different origin, and their morphological, hydro-chemical and hydrobiological parameters vary greatly. Since their formation, each of them has passed through obligate stages of development. The process is called 'limnogenesis'. The oldest lakes in the region are glacial. They can be subdivided into glacial/cumulative, dammed-up, and valley-type lakes. Thermokarst, saucer-lake, biogenic, and anthropogenic potholes were formed during the post-glaciation period. Each of these types of potholes has its specific features of the structure of the bottom relief, shoreline configuration, etc. The most plenteous of water bodies is the Varmisko-Vishtynetski lake area. The lakes in this area lie in deep potholes between hilly moraine ridges. Here lies the largest lake in Kaliningrad Oblast - Vishtynets lake. There are more than 20 water basins within Kaliningrad city and its environs. Many of them are artificial, made for a special purpose, others are natural but subjected to anthropogenic impacts. Some of the water basins are created for park landscapes or as a part of urban architecture (Verhni and Nizhni ponds, water basins in the "40th AUYCL anniversary" park). Many of the water bodies are eutrophicated and their condition is poor. Household and industrial wastewaters are frequently discharged into them, degrading their sanitary condition.

The Vistula and Curonian lagoons

Both lagoons are bays of the Baltic Sea, and their regimes depend on the interaction of the rivers' run-offs in the inflow of marine waters flowing in through the narrow channels. The lagoons are separated from the sea by sandbars, and their water salinity is different from that of sea water. The aquatic areas of the Vistula and Curonian lagoons are subjected to pollution by partly treated or untreated wastewaters from industrial and agricultural enterprises, and from utilities. As a result of anthropogenic pollution with different organic and inorganic substances, with oil and oil products, toxic compounds are accumulated, the concentration of oxygen decreases, the biota diversity is affected, and the productivity of economically valuable hydrobionts is degraded.

Water usage

In the whole throughout the region in 2000 the total intake of fresh water from the surface water bodies and subsurface sources was 218,18 millions of m³ – that exceed similar indicator in 1999 on more than 21,0 millions of m³ (Table 2).

Table 2 (taken from [3])

Water usage in Kaliningrad region in 2000, millions of m³

Indicator	Kaliningrad region	Including		
		Industry	Agriculture	Housing and communal services
Water taken from the natural reservoirs total	218,8	100,21	9,11	106,51
Including:				

Indicator	Kaliningrad region	Including		
		Industry	Agriculture	Housing and communal services
Fresh water taken from surface water bodies	127,18	64,19	0,06	61,12
Fresh water taken from subsurface sources	74,38	19,48	9,05	45,39
Water taken from the sea	16,62	16,53	-	-
Fresh water used totally	187,75	87,74	8,36	88,78
Including:				
For economy and drinking water supply	85,47	2,28	1,68	80,57
For industrial needs	95,39	84,82	0,45	8,20
For irrigation	-	-	-	-
For agricultural needs	6,25	-	6,23	0,01
For other needs	0,64	0,64	-	-
Looses over transportation	15,48	0,01	0,0	15,47
Loading on surface water bodies totally	179,52	89,65	1,78	86,30
Including:				
Polluted waters	152,28	63,76	1,78	86,30
Pure waters normatively	27,24	25,89	-	-
Treated waters normatively	-	-	-	-

Water quality

The problems of surface water bodies in Kaliningrad Oblast arise as a result of anthropogenic impacts on them, and as a result of natural phenomena. The most acute environmental problems, due to a high level of water pollution, are created in the estuary parts of Neman and Pregola rivers, where the largest urban agglomerations Neman, Sovetsk, and Kaliningrad (nearly 60% of the region's population) are situated. The highest concentrations of pollutants are registered in those areas, because the pollution accumulated upstream is added to local wastewaters here. Within Kaliningrad city, in summer, when water temperature is high, the organic substances quickly decompose, the oxygen dissolved in water is fully consumed, and in the anaerobic (oxygen-free) environment, hydrogen sulphide is formed. As a result, unhealthy water conditions cause serious losses of fish and other aquatic organisms, and the gas spreads in the districts adjacent to the Pregola river. The problem of the hydro-chemical pollution of the Pregola is aggravated by the hydrological problems related to the backwater phenomena. During windy periods, when winds of certain directions stop polluted waters at the estuary and drive them with the brackish lagoon water upstream, the waters reach water extraction points of water-supply plants, hydraulic-engineering structures are destroyed, industrial plants, residential houses, and agricultural lands are flooded. During this period water-supply utilities have to use a larger quantity of chemicals (including chlorine) for water treatment. It should also be

noted that some populated localities, using water from rivers, have no water treatment facilities. For these reasons, drinking water in many populated areas does not always meet sanitary State Norms. Great expectations are laid in Kaliningrad Oblast on underground water deposits, planned to be used for water supply in the nearest future. However, it should be remembered that one of the most important properties of water

on Earth is its integrity, i.e. continuous water exchange between all water environment elements is taking place: between the seas and the oceans, between surface and ground waters, and, sooner or later, the pollutants getting into the atmosphere or into surface waters, may well penetrate into ground waters, and finally into drinking-water supply systems.

Another aspect of the chemical pollution of surface waters is the deterioration of the quality of habitat of the hydrobios. For this reason, aquatic organisms may feel depressed or simply die. Even if they survive, they may accumulate all kinds of toxic substances and, through trophic chains, transfer them to each other, and to humans. In both cases, harm is done to mankind.

Eutrophication

Eutrophication is the accumulation of biogenic elements in water bodies caused by anthropogenic or natural factors. Biogenic elements (biogens) are substances (including chemical elements) which are required for the existence of living organisms and necessarily make part of their bodies. Eutrophication is a widespread phenomenon in sweet-water ecosystems. This is a natural process, when, oligotrophic (poor in nutrients) lakes gradually turn into lakes, enriched with biogens (eutrophic lakes). The rate of eutrophication depends on numerous factors and may take thousands of years. However, human activities accelerate the process, and today it is becoming a global problem, which is particularly typical for marine water bodies, e.g.: the Baltic Sea [5, 10-12]. The main consequences of an excessive influx of biogens (first of all, nitrogen and phosphorus) in a water body are as follows:

- *the concentration of biogens in the recipient water body increases;*
- *the content of primary products grows (the biomass of phytoplankton increases and filamentous algae intensively develop);*
- *this is followed by physical, chemical, and biological changes (e.g.: the deterioration of light penetration, lack of oxygen, and fishkill).*

Eutrophication can reduce the value of the water body for recreation and the potential of its use for fishery, bathing, etc. Therefore, it can lead to social and economic problems. The basis of eutrophication is photosynthesis. It is a long chain of reactions, starting with the absorption of light energy by chlorophyll and other green-plant pigments, and finishing with the synthesis of organic compounds out of carbon dioxide and water.

Algae and other green plants mainly consist of carbon, hydrogen, and oxygen (which often constitute more than 98% of their raw mass). The sources of these elements are carbon dioxide and water. In addition to those construction blocks, the synthesis of organic matter requires some other elements, or nutrients, first of all metals such as calcium, magnesium, and potassium, and non-metals like sulphur, nitrogen, and phosphorus. They all are often called 'macroelements'. Very small quantities of other elements are also required. They are copper, zinc, boron, manganese, and selenium. Respectively, they are called microelements.

The lack of any of the main elements constrains (limits) the development of plants. The role of a limiting factor for aquatic ecosystems is usually played by nitrogen and/or phosphorus. Nitrogen makes up an important part of protein cells, and phosphorus plays the key role in the energy transfer. Both of the elements are required in different proportions, depending on the specific needs of different types of plants. In the organic matter of phytoplankton, there is an average of 16 atoms of nitrogen per 1 atom of phosphorus (i.e. the correlation is 16N : 1P). This proportion – the so-called

Redfield indicator - approximately characterizes the rate of consumption of nitrogen and phosphorus by the algae.

The main sources of influx of biogens into surface water reservoirs and into the sea are:

- 1) *ground-based point sources (discharge pipes of wastewater treatment plants and industrial enterprises);*
- 2) *ground-based non-point (diffused) sources (run-offs from urban territories, from agricultural lands and forested areas);*
- 3) *atmospheric precipitations;*
- 4) *release from benthal deposits.*

Some discharge of biogens from urban sewerage systems, with industrial effluents, rainwater run-off from urban territories, and the discharge due to diffused pollution originating in cities (leaks, overflows) will always take place despite any control measures.

A certain quantity of biogens daily gets into water from land, due to the consumption of food by man. For example, average daily consumption of phosphorus per person in industrialised countries is 1-1.5 g. Phosphorus is also used in cities as a component of fertilizers (in parks and gardens) and a component of chemicals (mostly detergents).

The development of agriculture during recent decades was connected, beside other methods, with an increased use of fertilizers. Fertilisers inevitably create a biogenic load on natural water bodies, in the form of diffused, or non-point sources. The sources also include biogens from pasture animals (and urine) and losses due to wind and water erosion processes. On the whole, the influx of biogens in rural areas originates in:

- *agricultural fields, (fertilisers, erosion);*
- *pastures (faeces and urine, erosion);*
- *dung-yards;*
- *dairy farms;*
- *sewerage waste (from the population).*

The character of the influx of biogens from rural lands is different in terms of nitrogen and phosphorus. Nitrogen is usually easily washed off as a component of highly mobile nitrate-ion, and phosphorus in the form of phosphate-ion can remain for a considerable period. Traditionally, forests are considered as nearly closed ecosystems, in which biogens circulate with almost no losses. Forest lakes usually are also oligotrophic (having a low content of biogens). However, in the recent years, some forestlands seem to have been 'over-fed' with nitrogen, because of high precipitation of it from the atmosphere. Due to this factor, it can be expected that nitrogen release will increase and its influx from the soil into water will also grow. Besides, losses of biogens may grow as a result of the use of modern forestry practices: the fertilization of forests, woodcutting, construction of forest roads, and construction of ameliorative ditches.

The atmospheric load in terms of biogens (in particular, nitrogen) noticeably grew up in the 50s of the last century. The anthropogenic influx of nitrogen into the atmosphere emission is caused by the emission of nitrogen oxides, resulting from:

- *burning of fossil fuels (oil, coal, etc.) in industrial production enterprises and electric power plants, as well as in the process of operation of transport vehicles (cars, trucks, ships, etc.)*
- *burning of biomass (wood, straw, etc.) to generate thermal and electrical energy*
- *evaporation of ammonia from manure in agricultural farms.*

Chemical pollution

The quality of surface waters under the anthropogenic impact is in a dissatisfactory state, and, as a rule, does not meet existing standards.

The dynamics of the discharge of pollutants (in tons), as shown in Table 3, are described below.

In 2000, in the region as a whole, the discharge of pollutants dropped: chlorides by 20 %, total phosphorus by 17%, nitrites by 26%, and fats by 25%. The de-

Table 3 ("Condition of the natural environment in Kaliningrad Oblast in the year 2000", Report by Committee of natural Resources in Kaliningrad Oblast, 2001)

Dynamics of discharges of pollutants with wastewaters in Kaliningrad Oblast (tons)

Ingredients	1996	1997	1998	1999	2000
BOD	2347,00	19570,00	16900,00	17700,00	21670,00
Oil products	90,00	70,00	70,00	90,00	120,00
Suspended matter	13080,00	11940,00	9300,00	9130,00	11030,00
Dry residue	120330,00	120230,00	88810,00	94310,00	106430,00
Chlorides	13180,00	11430,00	14620,00	12200,00	9840,00
Sulphates	11210,00	9790,00	8790,00	7530,00	10140,00
Total nitrogen	2005,74	2839,36	2206,93	2401,84	2484,82
Ammonia nitrogen	2101,31	2232,47	1854,70	1739,84	2323,87
Nitrate nitrogen	324,95	241,73	183,51	170,00	183,64
Nitrite nitrogen	13,91	24,22	10,37	8,93	6,62
Phosphates	285,79	236,98	301,61	265,07	218,43
SSAS	27,91	23,01	102,11	80,7	86,33
Fats	1764,76	1659,88	1091,54	1045,21	784,29
Iron	71,27	66,24	92,69	82,26	88,00
Copper	3,14	0,01	0,01	0	
Nickel	1,43		0,01		
Acetone	44,89	9,64	0,36	0,26	0,50
Methanol	794,86	705,82	609,18	744,93	815,26
Hydrogen sulphide	213,47	126,39	91,96	78,99	78,61
Phenols	1,3	0,88	1,03	1,00	1,15

Ingredients	1996	1997	1998	1999	2000
Formaldehyde	39,66	28,86	31,36	53,78	
Furfurol	14,36	6,87	10,14	67,92	
Chloroform		0,37	2,42	2,07	
Chromium	4,19	0,02	0,01	0,01	0,02
Zinc	6,09	0,01	0,20	0,02	
Lignin substances	10534,28	10987,03	8900,51	4228,38	5475,56

crease in the quantity of some pollutants discharged with wastewaters is the result of a decline in production and economic instability. At the same time, the quantity of the main pollutants discharged last year grew: BOD total by 22%, suspended matter by 21%, ammonia nitrogen by 43%, and substances specific for wood-pulp production: formaldehyde by 71%, phenols by 15 %, methanol by 9 %, lignin substances by 18 %, mainly resulting from the fast reactivation of production by paper mills. With wastewaters, the pollutants are carried into the Baltic Sea by the main watercourses of the Neman and the Pregola directly through the Kaliningrad and Curonian lagoons. Out of the total quantity of organic matter in terms of BOD_{total}, 42 % gets into the Primorskaya bay in Kaliningrad lagoon with the wastewaters from Kaliningrad city, 18 % into the Pregola, and 30 % into the Neman river. Major problems arise when industrial enterprises use or produce chemical compounds, which cannot be biologically decomposed. It is characteristic of paper-mills to produce ligno-sulphonic acid salts, chlorinated phenol, fatty and resin acids. Chlorinated phenols are particularly known for being absolutely resistant to biological decomposition. Oil producers and road construction enterprises produce polycyclical hydrocarbons, and the fishsmoking process is accompanied by the release of phenols as undesirable by-products. These compounds, which cannot be biologically decomposed, remain in the environment and are accumulated in aquatic microorganisms. The biological balance will be disturbed by the direct impact on the fish population and an indirect influence on the fish processing industry.

Another impact of these chemical substances is their accumulation in ground and surface waters, and in drinking water. The most evident effect of their impact is demonstrated in the smell and taste of water, in the deterioration of the quality of - for instance - bathing waters. In this case, drinking-water production turns into a complicated and expensive treatment process. The effluents of other industrial enterprises, which mainly produce organic wastewater with biologically decomposable substances, are not so environmentally hostile. The capability of selfpurification of surface waters allows, to a certain degree, a reduction in the concentration of pollutants arriving with wastewaters. Nevertheless, there remains the impact on the quality of drinking water and bathing water in terms of water taste, smell, and microbiological contamination. The quality of bathing water downstream from the discharge point will be reduced, but the effect of accumulation and conservation will be excluded. The pollution caused by agricultural activities in the framework of this review is related to the use of fertilizers and pesticides. These

chemicals usually belong to the diffusible type of pollutants. Their annihilation takes place mainly in spring and in autumn. The impact of fertilizers (nitrogen, phosphate, potassium, ammonia, and urea) on water quality may be indirect when they infiltrate the soil, or direct, through drainage canals. Improper use of fertilisers results in water eutrophication. During the spring period, it was observed that a certain quantity of fertilizer components were washed off into drinking-water supply lakes, and the concentration of the substances increased. In this connection, it can be assumed that there is a direct impact of the use of fertilizers on the quality of bathing and fishery waters. Modern agricultural pesticides are easily decomposable by biological reactions, and only slightly affect the ecosystems. The environmental impact of old-type pesticides is double: pesticides such as DDT, atrazin, lindan, etc. have a low selfdecomposing capability. They are apt to accumulate in the biological system and penetrate into surface and ground water bodies, and into drinking water. Their total break-up period may be up to 30 and more years. Their impact tells most seriously on the quality of fishery and drinkingwater supply water bodies. Some pesticides are poisonous for fish, which may result in a reduction of fish reserves. Drinking-water production plants can reduce the content of pesticides by means of an expensive process of water filtration through activated carbon.

Water management system

The Ministry of Natural Resources is a federal organ, which "carries out the management and protection of water resources, the state environmental examination, the protection, control, and regulation of the use of the wild world and its environment".

In November 2000, by the Order of the Minister of Natural Resources, a Specialised Marine Inspectorate was set up and assigned the responsibility for the use and protection of the environment in the sea and river deltas. Other federal authorities with a wide range of responsibilities for water monitoring and sustainable use of water resources are: the Federal Service for Hydrometeorology and Environmental Monitoring (RosHydroMet), the Federal Sanitary/Epidemiological Service (SanEpidNadzor), the Fishery Committee, the Land Committee, and other organisations which are involved in environmental monitoring activities.

There are federal agencies in the region which are primarily accountable to their ministries or committees, but not to the regional administration.

Some time ago, the Committee of Natural Resources for Kaliningrad Oblast, which is a territorial agency of the Ministry of Natural Resources, assumed the responsibilities of the abolished Committee of Environmental Protection and Environmental Safety.

A Department of Environmental Protection and Environmental Safety was established within the Committee of Natural Resources.

The Centre of Sanitary/Epidemiological Control in Kaliningrad Oblast supervises and enforces the observance of standards for drinking and bathing water quality in the region.

The Kaliningrad Regional Centre for Hydrometeorology and Environmental Monitoring (HydroMet) conducts the long-term monitoring of natural water bodies. With a precise and regular frequency, HydroMet carries out measurements of hydrological and hydro-chemical parameters of water samples taken at 17 permanent monitoring points. These sampling points are located at the Pregola, Angrapa, Instruch, Lava, Deima, Nelma, Neman, Sheshupe, and Matrosovka rivers.

As for the structures of local authorities there are two main departments: Department of use of natural resources, subsoil and land resources of the Administration of Kaliningrad Region (DUNRS) and Ecological Committee in Duma. Environmental Department in Kaliningrad and inspectors in municipalities are also local structures which are responsible for the environmental monitoring.

In addition to the above-mentioned organisations in Kaliningrad Oblast, there are a number of institutions which have considerable scientific potential and necessary equipment for independent monitoring: the Atlantic Research Institute of Marine Fisheries and Oceanography (AtlantNIRO), the Atlantic Branch of the P.P.Shirshov Institute of Oceanology of the Academy of Sciences of Russia, the "ZapVodProject" Design Institute, Kaliningrad State Technical University with the Department of Bio-Resources and Use of Natural Resources, the local "Vodokanal" utilities.

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