5th International Congress

ECWATECH-2002

WATER: ECOLOGY AND TECHNOLOGY

ABSTRACTS

Moscow, 4-7 June 2002

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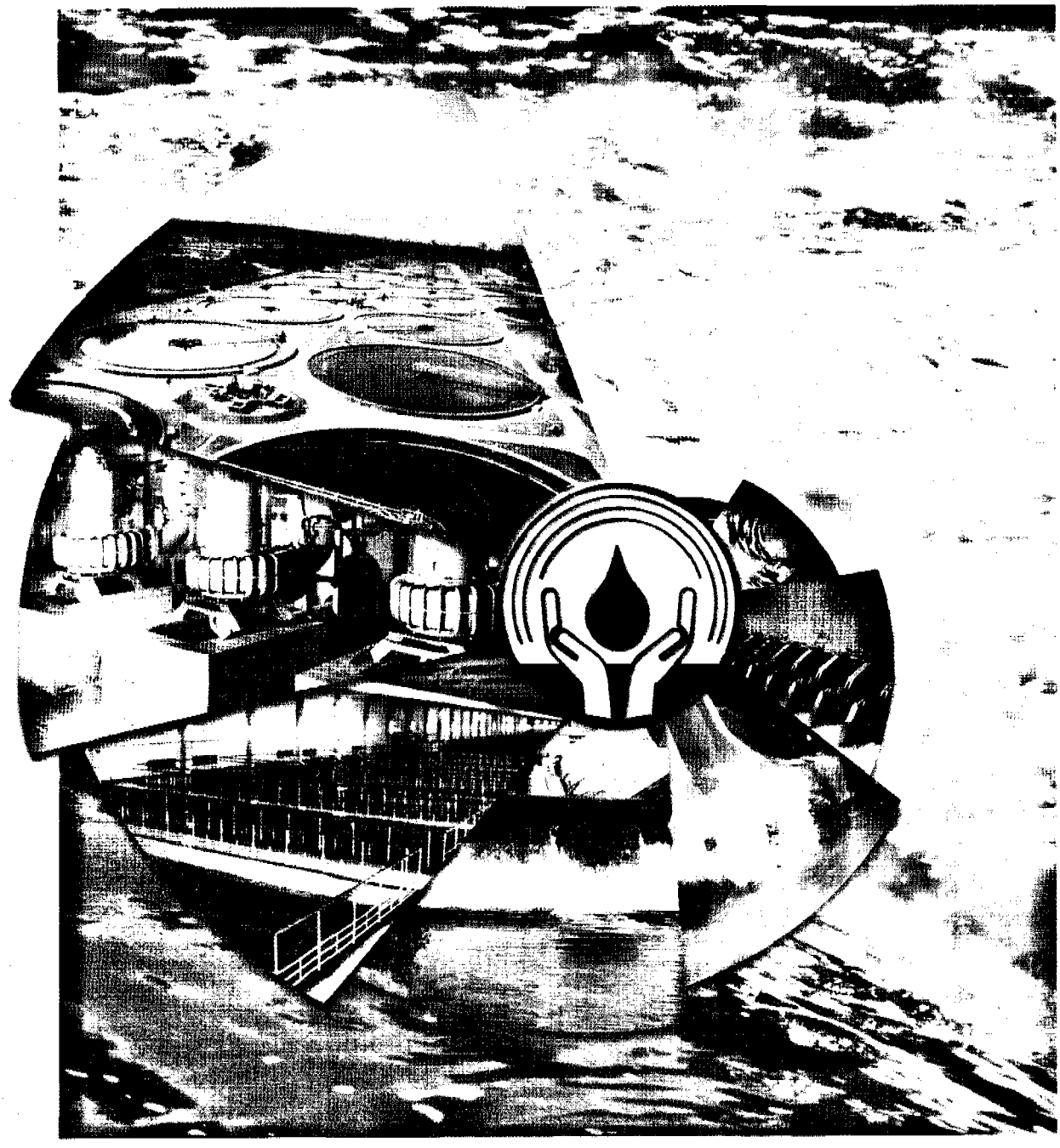

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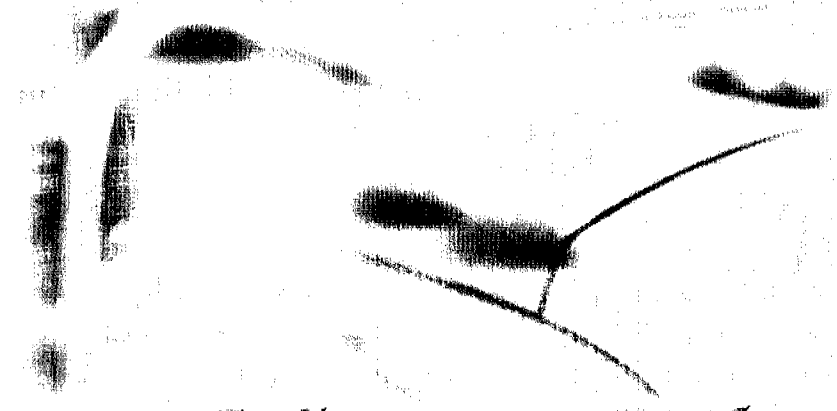

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- узнать последние новости ЭКВАТЭК;
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5TH INTERNATIONAL CONGRESS
"WATER: ECOLOGY AND TECHNOLOGY"

ECWATECH-2002

CONGRESS ABSTRACTS

Moscow
4 - 7 June 2002

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Edited by Prof. Elpiner L.I.

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Dear Colleagues!

For the fifth time the Russian capital will host the International Congress and Trade Fair "Water: Ecology and Technology" ECWATECH. Judging from the number and quality of the Congress delegates and Trade Fair participants, from the variety and topicality of the discussed problems, from the range of the equipment, technologies and services presented at the Exhibition, ECWATECH can be considered as major water forum in Russia and CIS.

The forum traditionally consists of the Congress with sectional meetings (water resources, water supply, water disposal and waste water treatment, economics and law, environmental monitoring, emergency situations and ecological safety) and special events, that are organised with the support of the leading international organisations (WHO, UN/ECE, OECD, GWP).

Congress is attended by the key-players of water industry who define the trends of its future development in political, economical and technical spheres. They are the representatives of the international organisations, federal, regional and local authorities, water utilities, industry, business, science and education.

Congress Abstracts clearly outline the tendencies of practices, researches and developments. Results of discussions that were held at the previous issues of ECWATECH are used at the drawing up of the official documents related to the conservation and protection of water recourses as well as public and industrial water supply.

Let me wish you successes in your work!

Valeriy P. Roshchupkin

First Deputy Minister of Natural Resources of the RF
Director, Water Service of the Russian Federation

Dear Colleagues!

Lately the issues of reforming and development of the municipal infrastructure in Russia have become the questions of vital importance. Arising problems cannot be solved without their exact formulation, preliminary research and discussion.

Detailed discussion of these problems within the framework of the major water event in Russia, ECWATECH, is one of the practical steps aiming at working-out of concrete measures and mechanisms to stabilise the situation and to guarantee sustainable development of water sector.

The essential part of Congress proceedings is devoted to the problems of water supply and sewage including waste water treatment, economic and management issues. The published material is a valuable informational resource for water professionals.

Of especial significance is the fact that Abstracts contain the papers of the foreign specialists. Practitioners and scientists from CIS and abroad shared their experience in solving water problems. It gives the opportunity to use in scientific research and day-to-day activity the best achievements of water supply and water disposal sectors from Russia and abroad.

Publication of full texts of papers on CD-ROM will be undoubtedly very useful. These materials represent to the readers all the details of the researches and surely will be in demand among the professionals.

I cordially welcome our forum and firmly believe in practical importance and benefit of ECWATECH-2002 Congress Abstracts.

Sergey I. Kruglik

First Deputy Chairman of the State Committee of the Russian Federation
for Construction and Municipal Infrastructure

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FOREWORD

This book contains abstracts of papers, prepared by specialists dealing with a wide range of water issues for the 5th International Congress "Water: Ecology and Technology" - ECWATECH-2002 (Russia, Moscow, 4-7 of June 2002).

Presented papers evince the efficiency of the integrated, cross-sectoral and participatory approach to the consumption, conservation and restoration of natural resources, water supply and waste water treatment - the most crucial actual water problems. Since 1994, ECWATECH Congresses has proved that only on this basis it is possible to find the most rational and effective solutions in this field.

ECWATECH-2002 covers strategic and tactical issues of rational consumption and conservation of water resources, effective water management also selection of optimal administrative and economic approaches and new technical and technological solutions.

Presented Abstracts are divided, according to its topics, into several sections of ECWATECH Congress:

- Water Resources (Surface and Ground Water);
- Water Supply;
- Water Disposal and Waste Water Treatment;
- Economics, Law and Management;
- Environmental Monitoring;
- Water Quality Control and Analysis;
- Water Emergencies;
- Sustainable Water Management and Health;
- Water Preparation for Industry and Energy Sector;
- Energy and Resources Saving Technology, IT in Waterworks;
- Trenchless Pipe Laying and Pipeline Renovation. Water Facilities: Construction, Reconstruction and Operation;
- Water Bottling and Bottled Waters.

Congress Abstracts have been published in two volumes in Russian and English languages. The texts in English including those written by foreign authors are unabridged.

Abstracts are arranged in alphabetical order within each section. The works of the authors presented full papers for CD-ROM, are marked with .

Any paper can be easily found in Contents. Information about authors can be found in Authors Index. Number of Section is marked in Roman numerals, number of abstracts of this author - in Arabic numerals (in parenthesis).

While editing the texts, no principle alterations of the content were made. In Abstracts that exceeded our requirements for volume, some well-known points were shortened. The papers not corresponding to the Congress' themes were rejected by Organizers and were not included into this edition.

Papers that had not been sent in time were included into "Last Minute Submissions" section.

Organizers would like to express their gratitude to the sponsors of the Congress. This publication would not be possible without their help.

Congress Abstracts surely will be very useful for experts dealing with research, engineering, management and administration.

Prof. Leonid I. Elpiner

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WATER RESOURCES
SURFACE WATER

A METHOD FOR THE ASSESSMENT OF WATER PROTECTION MEASURES EFFICIENCY AND PRIORITY

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Petchnikov V.G.
MOSVODOKANALNIIPROJECT SUE, Moscow, Russia

For the solution of problems in the sphere of surface water pollution reduction, Russia has sufficient experience in the field of development of special purpose, federal and regional complex programs, such as "The Recovery of the Volga River", "The Improvement of Water Quality in the Water Supply Sources of Moscow", etc.

This experience undoubtedly witnesses some considerable difficulties in the implementation of these programs, despite the fact that they were developed in full compliance with official methodological directives for their forming. The methodology for the program approach must envisage the interaction of the program process with the organizational and economic environment of the implementation procedure. The differentiation between the of special-purpose complex programs development procedures and the procedures of their implementation is of purely temporal nature. If from the very beginning of a program development, the conditions and mechanisms of its implementation had not been taken into account, then the success in satisfactory settlement of the problem may be limited. Apart from that, certain economic difficulties experienced by a number of enterprises result in phasedowning environmental protection programs than have evident loss-making nature and this fact results in the necessity large-scale problems in the sphere of searching for financial sources and expedient patterns for the implementation of measurements. The necessity to develop some methodological apparatus is evident and this apparatus should make it possible to find an efficient trend for environmental protection investments and to substantiate the necessity to invest water protection measures while observing the principle in accordance with which a subject of economic activity should be interested in their implementation.

The method for water protection measures priority determination envisages the ranking of water objects' pollution sources on the basis of the method of pairwise comparisons. The essence of the method is the singling out of potential sources of impacts on water use objects and giving them some ranks characterizing the level of their impact. The singling out of such sources determines the priority of water protection measures and the prediction of subsequent impact on aqueous environment and water use objects. The method for pairwise comparisons takes into account the system of surface water pollution factors, in particular, the classes of their hazard and some physical factors, the geographic location of pollution sources regarding the water use objects, the duration of pollution sources impact on water use objects, etc.

The essence of the pairwise comparisons method is that the assessment features priority is made for every criterion (factor). In this case the $E_i=(e_{ikj})$ matrix is filled for every criterion. The elements of this matrix (depending on criterion selection) are determined based on the following conditions:

$$e_{ikj} = \begin{cases} 1, \ if \ X_k > X_j, \ or \ X_k \sim X_j \\ 0, \ if \ X_k < X_j \end{cases}$$

After that the sum of matrices is determined for all categories. The summing up is made by the matrix elements and may be represented by the following formula:

$$Z_{kj} = \sum_{i=1}^{n} e_{ikj}, \ \ where \ \ k, j = \overline{1,n}$$

The R resultant matrix is composed and every element of this matrix is determined by the following formula:

$$r_{kj} = \begin{cases} 1, \ if \ Z_{kj} \geq n/2 \\ 0, \ if \ Z_{kj} < n/2 \end{cases}, \ \ where \ \ k, j = \overline{1,n}$$

And the sum of numbers for every K feature is determined:

$$b_k = \sum_{j=1}^{m} r_{kj}, \ \ where \ \ k, j = \overline{1,n}$$

This method results in giving the ranks within the range of 1 to N (where N is the number of pollution sources).

The cost and functional analysis is carried our for the assessment of water protection measures efficiency. The purpose of this analysis is to determine the trends in the reduction of costs of water protection program implementation.

After that the procedure of selecting expedient approaches from the available alternative variants takes place. In this case the correlation between the cost and result serves as a quality criterion for the cost and functional analysis. If it is less than 1, we should hardly doubt the quality of the data or verify the costs and measures. In case this ratio exceeds 1, then it is necessary to verify initial information and to change the set of measures. The value of prevented detriment caused by the implementation of measures may be also considered as a result.

A MODEL FOR THE CONTROL OF A RIVER BASIN WATER RECOURSES CONDITION

Yudin V., Segals H.
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Water recourses management of a river basin where economic activity is actively developing is a complicated ecological-economical task that is impossible to fulfill without an operative control.

Different branches of economy have contradictive interests , all of them may come in conflict with ecological demands. A daily task for people and organizations which carry out water recourses management is to find a reasonable and mainly permissible compromise. It is solved mainly on the basis of specialists experience and intuition enlisting available hydrographic and meteorological information. The result is different - from rather exactly guessed situation up to rough errors.

A mathematical model elaborated on the basis of water balance equation and general formulas of river bed hydraulics is aimed to put in order the working out of forecasts about water levels and discharges in different points of river basin hydrological network. The model allows to define effectively the changes of water level and its discharge in any place of the considered water network that arise when making local changes in some part of the basin. For example, a large water intake is built. Water discharge will diminish, water level and velocity will go down below the intake. The model gives possibility to determine quickly - how exactly. When having data about permissible values of main hydrological parameters (levels, discharges and velocities of flow), it is possible to compare them with the results obtained on the model and make corresponding decisions.

The offered for the specialists' attention model of water recourses condition control is notable for its simplicity, sufficient preciseness , possibility to make easily changes and additions that are connected with nature phenomena and economic activity.

Of course, a definite preparation must proceed the control introduction into the process of a river basin water recourses management. In particular, it is necessary to have the river longitudinal profile, to know its cross-section in sites that are limiting separate designed parts, to know the area of reservoirs water bodies (reservoirs, lakes, ponds) in the basin as well as its connection with water level, to have full information about all big water consumers and also about water releases; if there exist interbasin water transfers they of course also must be taken into account. Any competent water recourses management requires the same information, therefore, it can't be said that the use of the offered mathematical model is connected with a considerable additional information collection. Nevertheless, it will be necessary to define the roughness coefficient of separate bed sections (it is changeable within a year due to overgrowing in summer and ice presence in winter), to determine norm of run-off and evaporation with the help of appropriate cartogram etc.

In 2002 it is planned to finish the check-up of the model work effectiveness on the part of the Daugava basin that experiences a considerable antropogenic load. If it is successful it will be offered for wide use. It is possible to see it in details in Scientific Institute of Water Management and Land.

A MODEL FOR WATER MOVEMENT IN FRESHWATER WETLANDS: VOLGA RIVER DELTA AND SHALLOW MOUTH STRETCH

Kazmiruk V.D., Kazmiruk T.N.
Water Problems Institute of RAS, Moscow, Russia

The Volga river delta and shallow mouth stretch (45.2 to 46.7 $^{\circ}$N, 47.4 to 49.3 $^{\circ}$E) are situated in southern Russia, near the border with Kazakhstan. On the shallow mouth stretch of the Volga, beds of higher aquatic vegetation occupy about 80 % of the entire water area. Overgrowth of the shallow mouth stretch is promoted by its freshwater character, small depths (<2 m), soil fertility, and comparatively high water temperature during the growing season.

The vegetation cover is characterized by a large degree of species and spatial inhomogeneity. Inhomogeneity of the vegetation cover is caused by inhomogeneity of the external environment, which promotes or counteracts the growth of various species.

To describe the horizontal structure of the vegetation cover, we will use the concept "coverage" - the proportion (percent) of the soil surface occupied by the projection of the aboveground parts of plants. The coverage method is convenient in that, in addition to ground investigations, it makes it possible to use aerial and satellite photographic methods. If we assume that the average distances between plants in the direction of movement of the water and in the cross-sectional plane are equal, which corresponds to reality, the coverage method can be used for characterizing the number of plants in the cross section of the flow.

The authors examined 14 species of higher aquatic vegetation which dominate on the Volga river delta and shallow mouth stretch. Observations of the depth and soils of the vegetation, fresh phytomass, distances between plants in the association, midsection area of the plants and their

number per 1 m^2 of surface, volume of the submerged part of the plants, species inhomogeneity of the horizontal structure of the vegetation cover, spatial distribution of the flow velocities in the association, and slopes of the water surface were carried out.

The investigations show that, depending on the morphological characteristics of higher aquatic vegetation, the maximum water velocity on the vertical can be at the surface, in the middle zone, and at the bottom. An inverse relation is observed between the density of the plants over the depth of the flow and water velocity. The higher aquatic vegetation can be divided into four groups according to the effect on the from of the vertical velocity distribution: rigid above-water, bottom, soft in the water column, soft with leaves floating on the water surface.

The model for water movement in wetlands formulation is based on the shallow water equations. The finite element procedure employs linear triangular elements and linear shape functions with Galerkin's methods of weighted residuals. The time integration is carried out implicitly and the scheme is unconditionally stable.

The model is take into account of roughness of the bottom, density of the vegetation cover, species inhomogeneity, resistance of flow past the plant, taking into account drag, side friction, and losses of energy of the flow on the formation of eddies at the tops of plants in the case of their complete submergence, blanketing effect of plants, velocity profile.

The empirical coefficients and parameters obtained enable using model in practice both in on-site ground investigations and with the use of remote-sensing aerial and satellite photographic methods.

A SURVEY OF WATER RESOURCES CONSUMPTION IN KHABAROVSK TERRITORY

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The stable water consumption being of strategic importance is aimed to provide ecologically safe and economically optimal level of water supply for the population. In fast proper and perfect water supply for the industries of national economy depends first and foremost on the state of water resources, with the Khabarovsk Territory being supplied sufficiently by surface water due to the well developed hydrographic incorporated network system.

As a result of the economic instability in Khab. T. there was a falling production in the form of cutting sewage system volume, that is the main reason of water pollution but this decrease of polluted waters did not improve the ecological state of regional water resources. They are characterized by such categories terms as "polluted", "very polluted" and "extremely polluted" waters as to the pollution index.

According to ht Federal State Statistics of Khab. T. in 2002 (made by Ladonenco N.A., Egorova A.I., Korkina N.V., Pantaleeva S.E.) water intake accounted for 545,5 mln. cubic meters from natural water resources, of these 447,14 mln. cubic meter taken from surface water resources and 98,26 mln. cubic meters from underground water resources.

The level of water supply and its consumption actually was stable beginning from 1996 up to 2000 and it accounted for 83% due to the circulating water supply.

In 2000 water removing into the surface water resources was 420,14 mln. cubic meter, out of this 230,9 mln. cubic meter being polluted, besides 63,12 mln. cubic meter were not purified and 167,78 mln. cubic meter were not purified sufficiently.

The residual volume of sewage water is normally pure or normally purified, the capacity of purification equipment being 229,91 mln. cubic meter in 2002.

Analyzing the Amur river basin in 1999 and in 2000 we came to the conclusion that its state had become much more poor because of its low water content and some other pacts. Hydrochemical indices indicators showed the poor quality of water in Amursk due to the annual average total content of phenol, iron, oil products, zinc and copper. In Nikolaevsk on the Amur the same picture was observed because manganese and iron content and all total in all it was connected with substandard underground water dumping into the Amur river.

For the recent to 40-50 years of active and intensive development of natural resources, setting up new and razing productive capacities of agriproduction enterprises, with the appearance of new towns and settlements, creating artificial ponds and water resources, felling areas, the poor influence on geoecological systems of water supply systems became greater and more evident and or its antropogent degradation in particular.

The volume of fresh water consumption in Khab. T. was reduced to 7,5% 1996 to 2000 because of production and agriproduction fall and population decrease. The consumption of drinkable and public water utilities decreased to 2,2% as compared to the level of 1996.

Power industry is the main water consumer in Khab. T., e.g. in 1996 the volume of water resources consumed was 263,61 mln. cubic meter (78%) but in 2000 it was 265,5 mln. cubic meter (86%) and this growth was caused by nodal

transfers of energy by Interconnected Power System "Khabarovskenergo" to Primorye Territory.

Since 1996 up to 2000 the volume of water resources consumed has been reduced in such industries as ferrous and non-ferrous metallurgy, machine-building, oil processing, agriculture and in fish-breeding factories.

At the same time new programs are being worked out to arrange and realize into life urgent socio-technical measures for the stable and efficient water resources consumption in Khab. Territory.

ABOUT BWO "AMUDARYA" ROLE IN WATER RESOURCES MANAGEMENT WITHIN AMUDARYA BASIN

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BWO "Amudarya", Urgench, Uzbekistan

Amudarya River basin covers broad area - about 1 mln. 327 th.km^2, of which Central-Asian states take 1 mln. 18.6 th.km^2.

In Amudarya basin complex irrigation system was created, that counts big quantity of canals, pumping stations, collectors, irrigation outlets. On average basin irrigated area is within 3.8-4.0 mln.ha.

BWO "Amudarya" being ICWC executive body for 10 years, working in absolutely new political and economic conditions, successfully enough fulfills task charged to it in issues of transboundary water management, maintenance of hydrostructures, interstate canals according to their status.

To reach pointed goals and tasks BWO fulfils following functions:

- development of water intake plans, reservoirs cascade operation regimes, amplification and coordination of ICWC seasonal water consumption limits for basin states;
- implementation of middle-term planning, joint water resources development and conservation, agreed with water and power departments of basin state, participation in prospective planning;
- water supply to state-water consumers, Aral Sea, and Priaralie;
- operative-dispatch Amudarya basin water resources management and operative control of keeping water intake limits;
- providing of monthly information on water resources use to ICWC members;
- creation and realization of Automated Amudarya basin water resources management system, fulfillment of works on organizing water account and measurement on headwork water intake structures, their equipment with means of automation and telemechanics;
- jointly with national hydromet services fulfillment of control water measurements on boundary gauges of territorial divisions to carry out river flow balance account;
- monitoring of Amudarya basin water systems' ecological state as well transboundary water resources;
- undertaking of environmental measures within water conservation zones of transboundary rivers and reservoirs according to legislation of countries, and in coordination with local administration, on which territory their management is carried out;
- fulfillment of current repairs, reconstruction, and technical operation of hydrounits, headwork water intake structures, interstate canals, and other objects to maintain them in normal technical state;
- fulfillment of customer's functions on research works, design, construction of new and reconstruction of existing water objects, which are charged to BWO;
- development and implementation jointly with water organizations of states and other interested enterprises, and organizations on measures on accident free bypass of floods and protection of settlements as well as agricultural households from water logging, flood, and other disastrous water-related situations;
- providing control of financial-economic activity of subordinate organizations;
- fulfillment of works on selecting and placing staff in subordinate organizations on coordination with appropriate ministries;
- providing maintenance of requirements of labor protection and safety measures;
- providing assistance to non-affiliated organizations, juridical persons in developing normative documents, recommendations, regulations of operating water objects and systems, other services.

To fulfill established tasks on transboundary water resources management on such enormous territory under BWO "Amudarya" four divisions were created on operation of water intake structures, hydrounits, interstate canals with centers in cities Kurgan-Tyube (Tadjikistan), Turkmenabad (Turkmenistan), Urgench (Uzbekistan), Takhiatash (Karakalpakstan).

BWO "Amudarya" according to common arrangement with basin states serves and manages not by whole Amudarya basin, but only trunks of following rivers: Pyanj, Vakhsh, Kafirnigan, and Amudarya.

Since BWO "Amudarya" has been formed, three basin states transferred to it for temporary use 88 hydrostructures (including 36 headwork river water intake structures), 169 hydroposts, 386 km main canals as well as big quantity of related communications (roads, communication, power supply, technical means etc.).

Obtained positive results in water resources management and allocation issues at interstate level allow to regulate successfully interrelations between states on integrated water resources use and management within basin.

ABOUT REGIONAL PROBLEMS OF THE WATER QUALITY STANDARDS OF THE WATER OBJECTS

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East Research Institute for Integrated Water Management and Protection, Chita, Russia

Imperfection of up to the present applicable standards of the water quality estimation was noted by many authors. The standards of maximum permissible concentration (MPC) and maximum permissible damps (MPD) is based on the human beings requirements or fish requirements (for fishing water objects) but not on special features of water quality formation in the natural landscape. This approach lead to the necessity to «purify» the whole water volume of the water object or its considerable part to the standards. It is impossible because of economical expenditure and it may react unfavorably upon flora and fauna of this drainage basin, which were adapted to natural water quality. Authors could give many examples of disparity between water quality and MPC for the territories of Chita region were economic activities are lacking.

The main defects of the above-mentioned system of the water quality standards should be single out:

First - it is a subjectivism of a designer, when he selects from the list some chemical substances for which the standards will worked out for the water objects.

Second - it is the subjective estimation of fishing inspection board when the class of water object is fixed (for the main part of the small-size and middle-size rivers the scientific researches into fish population are not carried out).

Third - there is no general and regional methods of selection the natural part from the hydrochemical composition.

Fourth - there is no part in the methods which should account the natural purificational capacity of the water drainage basin, it capacity to absorb pollutants or to transform its in other forms.

Fifth - there is no possibility in the methods to account the water quality in the most «tense» periods (this periods may be - freshet, low-water period, summer or winter periods and others).

Sixth -there is very thin network of monitoring posts, which gives no possibility to interpolate the hydrochemical composition between the posts (as our expeditional research shows the processes of pollution and selfpurification on the drainage basin have lesser linear scale then the distance between the posts).

Seventh - without account of the information about processes on the drainage basin it is impossible to achieve improvement in ecological situation only by observance of the MPC and MPD.

Authors could sign many defects of up to the present applicable standards of water quality estimation. It demands correction and could be the same:

The nowadays standards of MPC is the basic, and applies for estimation of water consumption standards for water objects, only for points were drinking water intake is carried out, and for water quality standards of waste waters.

For exact calculation of water quality standards the regional methods are applied, which account the quantitative and qualitative special features of water's composition forming of the water object or some objects in the region.

The regional methods should account the natural water composition, changes of the natural and anthropogenous parts of the water quality in different periods, man's activity on the drainage basin, the selfpurification capacity of the drainage basin and of the water object.

The monitoring of the water quality should be realized not only on stationary posts but on expeditional research of the water object.

ABOUT THE REDUCTION OF STATISTICAL PARAMETERS OF HYDROLOGICAL SERIES TO LONG-TERM VALUES

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Water Problems Institute of RAS, Moscow, Russia

1. At present the methodic of regression analysis is applied for the reduction of statistical parameters of hydrological series to long-term period.

2. The methodic of revealing and taking into account regression dependencies is based on using of one of the principles of evaluation of variables connectivity degree, namely, the minimization principle of sum of squares of deviations of observed values from estimated function line, and has specific character. It accepts, that:

a) Argument values in the statistical dependency result from smaller number of reasons, than function values,

b) The set of reasons, determining function values, completely includes the set of reasons, determining argument values,

c) Points spread on the plot of statistical dependency (relatively to the regression line) is caused by the set of reasons, forming function values, or more specifically, by the action of that their part, which is opposite the set of reasons, determining argument values.

3. The statistical kind of dependencies between hydrological variables is formed by crossed sets of the reasons, determining argument and function values, but not by the sets, one of which is completely a part of other.

4. It is possible to conclude from the preceding, that the regression scheme of evaluation of statistical dependencies in methodical terms does not satisfy the requirements of reduction problem solutions in hydrology.

5. The scheme of estimation along the dependency line, which is situated between regression of x on y and of y on x, satisfies the requirements of hydrological variables reduction to long-term values.

ADDRESSING THE ACTUAL ISSUES OF THE WATER OBJECTS PROTECTION IN THE GAS INDUSTRY

Akopova G., Popadjko N., Solovyeva N.
OOO "VNIIGAZ", Razvilka, Moscow region, Russia

Rational water use and reduction in polluted waste waters discharge into the water objects is one of the major trends of GAZPROM eco-policy.

Addressing the issues of monitoring, standardization and control over the water use by the gas industry enterprises is both actual from the ecological, social and economic aspects viewpoint - decrease the extra payments beyond the norms for discharges of polluted waste waters into the water objects, to the local relief and other waste collectors.

Development of the information-analytical water use industrial system will allow to summarize and take corresponding advantage of using during the work of all the tremendous bulk of legal, normative and literature data, all the accumulated information (being duly revised and complemented) on the structure, quantity and quality characteristics of the industrial water use system. Possessing sufficient amount of the valid information promotes creating of the software complexes for rendering practical assistance to the technical personnel of the ecological service of the industrial enterprises.

As an example of informative data blocks use can serve software complex currently under development for calculation of standards and norms for water use and water by-passing of the natural gas production, transportation, processing and storage enterprises.

Verification of the calculation norms as compared with specific industrial water use enabled to substantiate the planned water consumption volumes, fresh water flow rate etc. (as applied to the involved equipment, technology and facility management, water supply and sewerage).

Of actual importance is the problem of industrial discharge waters utilization making great contribution into the gas industry water ducting. As compared to the other branches of the fuel-energy complex the volume of waste waters in gas industry is not so significant-less than 70 mln cu m per annum, however the volume of solely condensation-reservoir waste waters constitutes almost 10% of the gas industry water by-passing. Waste waters ducts contain some specific pollutants caused by technology of major and auxiliary production, which circumstance hinders such waters cleaning and utilization. Efficient, valid and systematized information on the break-down of the industrial enterprises waste waters as well as the earlier created informative data blocks (on the break-down of waste waters, operating in the industry purification units, prospective biotechnologies and modern cleaning units, on construction and operation of the industrial waste waters ducts burial) serves as the basis for the gas industry enterprises environmental impact assessment.

Searching for solution of the problem on the waste waters cleaning of the major pollutants (methanol, glycols, oil products, bio-gene substances) follows the route of effective technologies development for waste waters cleaning without using expensive reagents and based on the specifics of the gas industry water ducting.

The methods of addressing the actual issues of the water objects protection in the gas industry include forming the ecologically substantiated water use system, implementation of prospective technologies for waste waters cleaning, upgrading of the waste waters purification units, control over the cleaning process and monitoring of the waste collectors.

ANNUAL RUNOFF OF RIVERS OF UPPER VOLGA BASIN AT LAST QUARTER OF XX CENTURY

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Climatic changes on Russia plain at last quarter of XX century can be explain in the following way. There are two periods against a background of global warming of lower air stratums: first - from the middle of 30's years till 40's years, second - from the middle of 70's years till the present time. Rate of growth of annual air temperature at second period (1976-1997) had exceeded all characteristics of previous periods with proportional duration from 1856 till 1976 years at Northern Hemisphere. Rapid temperature growth at Northern Hemisphere against a background of record high average temperature last century has happened in situation of changes lag of more inertial thermic-ice regime of Arctic [Drozdov O.V., 1992; Alexeev G.V. etc., 2000]. As a result meridian gradients of air temperature had changed and thermo-moisture exchange in ocean-land system had increased. The macro-circulating processes had modified too. Cyclonic processes and zonal air transfer had increased in Atlantic-European sector. As a result the annual runoff of rivers of Upper Volga basin had increased.

T-test of annual runoff of Volga basin rivers till and after 1976 has shown that period of high water 1978-1999 can't

be explained by stochastic nature of stationary series of runoff data for main part of Volga basin (forest region) and can be regarded as ordinary event of long-term runoff fluctuations for south part of Upper Volga basin (forest-steppe region).

Differential climatic changes response of annual runoff in forest and forest-steppe regions can be explained by difference of main factors of runoff formation [Pilev I.V., 1995]. Annual runoff in forest region reacts linearly to increasing of annual precipitation. Runoff response to climatic changes is more complicated in forest-steppe region: increasing of winter precipitation entails increasing of snowmelt water losses to soil moistening and follow-up increasing of evaporation losses in spring-summer period.

Annual runoff of main rivers (Oka and Volga up to their confluence) and summary runoff from Upper Volga basin in 1978-1999 years was above average on 10-11% and was not exceeded at previous 100 years (1877-1977) for periods with proportional duration. Nevertheless it should not be considered as evidence of inceptive irreversible changes of water resources. No less attractive interpretation can be used on basis of conception of runoff stationarity and cycle variation. Period of high water at 1978-1999 years had compensated for long-term low-flow period at 30's - 70's years of XX century. So, statistical characteristics of annual runoff for first and second part of observation period (1877-1999) had equalized: for period 1877-1938 (62 years) $Q = 2900$ m^3/s, C_v=0,20, $r_1 = 0{,}31$; for period 1939-1999 (61 years) $Q = 2860$ m^3/s, C_v=0,21, $r_1 = 0{,}34$.

ANTHROPOGENIC LOAD ON RIVER BASIN

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The problem of pollution of the small rivers of the Volga basin costs now is very sharp. The small rivers of basin of Volga make a hydrological basis of territory, forming as though capillary system. The number of the small rivers is estimated in four hundreds thousand, that makes about 99 % of common number of the rivers of basin and 95 % of its hydrological network. At such plenty their individual features appreciably lose the value. The small rivers should be considered as a specific hydro natural resource. The river drain is in essence formed by the small rivers, the large rivers play a role of a collector in the already generated river drain. The river Koloksha (4-th about) is left coast inflow Klyazma river. General length of the river makes 146 kms, water catchment area - 1430 kms. The basin consists of 7 largest inflows : Gza, Sega, Kuchka, Toma, Semiga, Yachroma, Kolochka. All these basins differ on morthometrick characteristics, on structure nature use and land tenure. Anthropogenic load in territory of basin carries versatile character. In work Anthropogenic load rendered by various sources on basin of the river Koloksha and on basins of inflows on the basis statistical data is investigated. Thus total the reset of polluting substances was given in units of toxic weight in view of factor relative toxic of impurity. The parameter of specific anthropogenous loading is used which paid off as total reset referred to complete volume of all superficial waters of basin, i.e. to the charge of water in a mouth river channel.

The parameter, accepted in work, of specific anthropogenic load allows to compare among themselves ecosistems with various morthometrick and tecknogenic parameters. We investigate Anthropogenic load on river basins after some last years. Is established, that various sites of basin of the river Koloksha were exposed to unequal anthropogenic load. The greatest anthropogenic load was carried out on basins of the rivers Koloksha r. Gza and Kuchka. The maximal anthropogenic load was fixed in 1996 owing to resets in these river channel of a plenty Cu^{2+}, Zn^{2+}, Cr^{3+} and petroleum. On specific anthropogenic load, basins of inflows - r. Gza and Kuchka cost on the first place. Apparently, nature uses of these basins use unsufficiently effective technologies water treatment, and the basins, in turn, have unsufficient regeneration ability. Therefore, for definition of optimum conditions nature using inside basin it is necessary to analyse, on the one hand, technologic processes, rendering negative influence on basin; and with another, regeneration of an opportunity of the given basin. This work also will be carried spent now.

APPLYING OF GIS-TECHNOLOGIES FOR CREATION OF THE DATABASE ABOUT TRANSFORMATION OF THE CHANNEL IN LOWER COURSE OF THE TERECK RIVER

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Within the framework of creation of the integrated database about a state of natural environment of the Caspian sea in boundaries of a maritime belt of Republic Dagestan and all-level GIS "Water resources of the Tereck river" for information support of management by water resources the operations on creation of the database about of long-term

transformation of the channel in lower course of the Tereck river under influencing of floods and fluctuation of level of the Caspian sea are executed.

The problem of study and prognosis of transformation of channels under affecting of the natural and technical factors is important both in the scientific plan and practice of designing and exploitation of river hydraulic structures, as well as in an ecological ratio. From veracity of the prognosis of transformation of channels depends not only reliability of hydraulic structures, but also ecological safety of habitability on inshore territories, as the high floods on the rivers with not regulated flow at insufficient discharge capacity of the channel, reformed by erosive processes, can cause submersion of large territories and bring considerable economical and social damage of economic activity on them, it take place in area of lower course of the Tereck river.

Results of full-scale investigations and the numerical modeling of transformation of natural river beds represent large scale arrays of data by the way of planning coordinates and altitude marks of points of a channel and shores on numerous cross-sections, the analysis which one and usage for project solutions are impossible without their visualization. On the basis of the analysis of GIS-shells from the point of view of their accessibility and possibilities for visualization of planning and altitude deformations of river beds, and also flooding boundaries of coastal territories at floods the software package ArcView GIS 3.1 is chosen, which one grants broad possibility for visualization and analysis of dimensioned data.

As a result of processing on a computer of materials of topographical shootings and hydrometric works which have been carried out by Institutes "Sevkavgiprovodhoz" and "Daggiprovodhoz" on mouth stretch of the Tereck river for the period 1965-1994 years, in the environment ArcView GIS 3.1 the graphic and attributive database about long-term transformation of a channel of the river on the 100-km stretch from the weir Kargalinskaja up to the Caspian sea is created. The graphic database contains the scalable vector electronic map of coastal territories of lower course of the Tereck river with a topographical basis of scale 1:200000, and also longitudinal section and combined cross-sections of a channel for 1965-1994 years on 70 line of mouth, which one by command "Hot communication" on an electronic map by click of the mouse on necessary line are visualized. The attributive database consists of 70 tables with coordinates and altitude marks of cross-sections of a channel in 70 line and marks of water-levels of 1% security.

The created database is opened for upgrading on the basis of topographic shootings as considered, so other stretch of the channel of middle and upper course of the Tereck river and already now at designing of anti-flood measures in area of lower course of the Tereck river can be used.

In the long term, at creation built-in in GIS of the module of hydraulic calculations the specified database for development of an intelligence system for the forecast and visualization of borders of flood zones of coastal territories and further transformation of a channel in area of lower course of the Tereck river at high waters of different security can become a basis.

ASSESSMENT OF REDOX-CONDITION AND SELF-PURIFICATION CAPACITY OF PRUT RIVER

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In the period of summer mean water the field research have been carried ont on Prut river (tributary of Danube) on its 180-km portion, which accept the highest anthropogenic loads. On this portion waste water from Yassy (Romania), Ungheni, Leuseni and Leova (Moldova) is discharged into Prut river, and the most strongly polluted tributaries inflow in it. From early May till the middle of August, samples for analyses were daily taken at eight permanent sampling sites on the river. Redox-state of water environment have been measured, summary contents in thiol compounds, kinetic parameters characterizing the chemical self-purification capacity with the involvement of free radicals.

It was shown experimentally that within the study period the redox-state of water masses of the river have been changed from normal oxidative to the reductive one. The clear limit was marked of unstable redox-condition establishing and its transition to the reductive one practically at the same time, with the slight shift, along the entire studies portion of river.

In the first half of the summer when the Prut water temperature was not higher than 18,5°C, the contents in H_2O_2 in it was observed in physiologic favourable amounts for hydrobionts (from $5{,}0\cdot10^{-6}$M to $5{,}0\cdot10^{-6}$M). Index of water masses inhibiting capacity with regard to ·OH-radicals ($\sum k_i\cdot[S_i]$) was varying from $7{,}5\cdot10^{5}s^{-1}$ to $1{,}0\cdot10^{4}s^{-1}$, hydroxyl radicals concentration was changing in average from $1{,}5\cdot10^{-17}$M to $9{,}1\cdot10^{-16}$M. This proves the existence of inner-water body processes balance, which is favourable for water systems.

Gradual increase in water temperature to 20°C and higher, which took place from the second half of May, was accompanied with the gradual decrease in it of hydrogen peroxide contents and that of $\sum k_i\cdot[S_i]$ index, increase in the reducing nature substances contents, which total amount was controlled with the help of sample "titration" with H_2O_2. Contents in thiol compounds, determined by the free [SH] group, was increased and by dynamics it followed the curve of water temperature growth. From 5 to 20 June the period of unstable redox condition of river water was observed, which was characterized with the minimal values of $\sum k_i\cdot[S_i]$ parameter,

maximal contents in OH-radicals and continuing increase in reducers amount. After 20 June till the end of study period, hydrogen peroxide was not registered in water, and water system within the entire studied part of the river was characterized with the reducing condition. During this period constant decrease in OH-radicals concentration proceeded, in average from $3,8 \cdot 10^{-16}$M to $1,0 \cdot 10^{-17}$M on the background of the increase in $\sum k_i \cdot [S_i]$ index from $3,0 \cdot 10^{5} s^{-1}$ to $1,2 \cdot 10^{6} s^{-1}$ and that of amounts of substances-reducers, titrated with hydrogen peroxide, and also of thiol compounds - typical representatives of peroxidase nature substrates, accordingly, from $5,0 \cdot 10^{-5}$M to $3,0 \cdot 10^{-6}$M and from $2,5 \cdot 10^{-8}$M to $4,5 \cdot 10^{-6}$M.

Within the whole study period, the curve of thiol compounds concentration growth have clearly followed the curve of temperature increase.

Thus, the research on Prut river have shown that in the period of summer mean water in year 2000, its redox condition was varying from the oxidation at the beginning of summer, to the reducing one after the second decade of June. With the increase of river water temperature, its chemical self-purification capacity with free radicals involvement was decreased: H_2O_2 was not registered in it, water system was passing to the reductive condition, the amount in substances-reducers was increased, concentration of hydroxyl-radicals reached its minimum. It was especially clearly evident in those sampling sites where Prut have accepted the polluted water from its right-side tributary Jijia.

CAUSES OF ENVIRONMENTAL RISKS OCCURRING AT HYDRO-RECLAMATION SYSTEMS

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Any system can be sustainable or unsustainable from ecological point of view. Sustainability is construed as maintaining of balanced condition, ability to oppose certain impacts. The notion of ecological sustainability can be interpreted as a subject ability to keep continuously ecological balance in the defined limits during certain span of time. Possibility of finding out permissible limits of the ecosystem balance violation requires their determination on the basis of objective scientific analysis at each particular entity, functioning under the influence of internal and external random factors. In the process of establishing of hydro-reclamation system (HRS) any errors and defects can be admitted, both in design and construction. All these defects whatever their causes might be, become evident in the process of HRS operation. All possible causes of HRS failure can be divided into two big groups: design/constructive and operational, this division is presented in the diagram.

When analyzing failures of hydro-reclamation systems in Leningrad oblast it can be mentioned that the failures are due to the following causes: design - 23.3 %, construction - 37.7%, operation - 39 %.

According to the presented scheme of HRS failures it can be stated that design/construction group causes 60% of instantaneous failures, and operation/wear group causes 40%. Thus, design/constructive reasons that causes instantaneous failures are the most significant out of all possible HRS failure reasons.

Analysis of the failure reasons demonstrates that it is necessary not only increase the existing systems reliability but to define reliability of the future systems at the stage of designing.

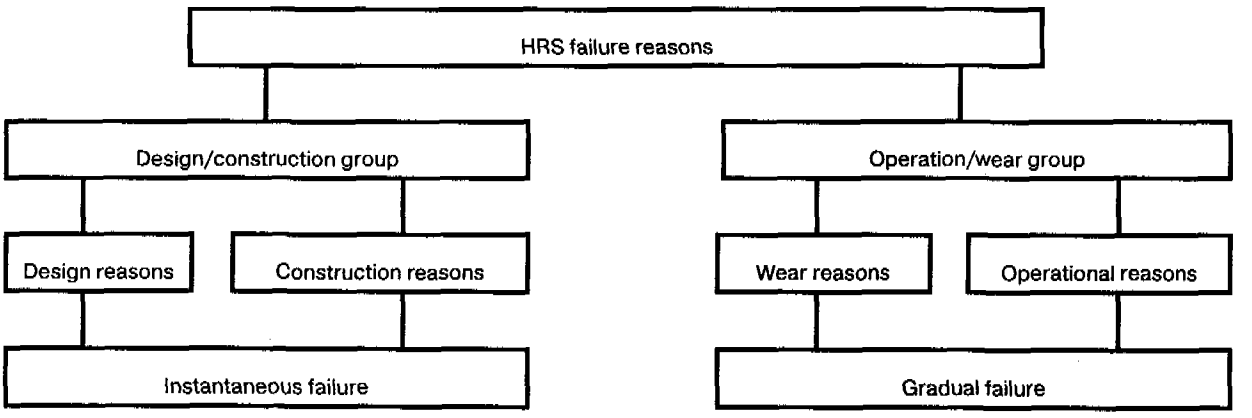

Fig.1. Classification of failure reasons.

CHANGE OF THE KUBAN RIVER FLOW IN ITS UPPER REACHES AND MIDDLE COURSE DUE TO DIVERSION OF RUNOFF

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The Kuban River basin locates at the northern slope of the Greater Caucasus in its western part. In the meantime Ullukam glacier is considered to be the Kuban river source. The glacier is positioned on the eastern slope of the Elbrus Mount at altitude of 3080 m. The Kuban River is 906 km long and watershed area is 57,900 km^2. The Kuban River has only left tributaries. The main are the Uchkulan, Teberda, Maly and Bolshoy Zelenchug, Laba and Belaya. The studied area encompasses part of the Kuban basin from the source to the Bolshoy Zelenchug river mouth. The stretch is 208 km long and watershed area is 11,000 km^2.

In terms of hydrography the given river reach includes: the Kuban River from the source to the source of the Nevinnomyssk canal, as well as important tributaries such as Uchkulan, Daut, Teberda, Maly (the Aksaut and Marukha rivers) and Bolshoy Zelenchug. Glaciers and snow are key alimentation sources. In total they amount to 62%. Stable winter low water period is recorded on all the rivers, as well as extensive spring-summer flooding. At that time 71% (khutor Degtyarevsky) of water flows through the lower part of the reach and 75-76% (the Teberda, Uchkulan, etc. rivers) through the upper part. Watery of the Kuban River and its tributaries is high. The average annual water discharge is 75.7 m^3/sec with layer of runoff 628 mm (till water intake of Bolshoy Stavropolsky canal, near village Kosta Khetagurova). Water discharges of the Aksaut, Marukha and Bolshoy Zelenchug rivers within the Zelenchug depression are 14.9, 8.04 and 28.1 m^3/sec and layer of runoff are 887, 843 and 1005 mm respectively.

Up till the middle of the 20th century at the studied reach wateruse was insignificant and mainly for householding and to a smaller extent irrigation. Steppe territories with insufficient water adjoin the Kuban basin and thus, in 1949 a Nevinnomyssky canal was built with water abstraction from the Kuban near the town of Nevinnomyssk. In 1966 a Bolshoy Stavropolsky canal with water intake near Ust-Dzheguta town was put into operation. They are both canals for diversion of runoff to other basins. Thus, they are used for irrevocable water abstraction from the Kuban River with further diversion to the Don and Kuma river basins. Canals carrying capacity is 75 and 180 m^3/sec respectively.

Diversion of runoff to other basins is the most important factor for wateruse in the studied area due to an insignificant use of water for municipal, industrial and agricultural purposes. It also poses a significant impact on hydrological regime of the Kuban River downstream the Ust-Dzheguta town. This impact is obvious almost till the Ust-Labinsk town, i.e. till inflow of the Laba River to the Kuban River because water abstraction by canals is significant. Water abstraction to the Bolshoy Stavropolsky canal for 1966-1975 was 0.78 km^3/year; and to the Nevinnomyssky canal for 1949-1975 it was 1.16 km^3/year (including the idle discharge back to the Kuban River). For 1990-1999 water abstraction to the Bolshoy Stavropolsky canal increased up to 1.51 km^3/year and to the Nevinnomyssky canal decreased up to 0.824 km^3 (including the idle discharge to the Kuban River). Some years water intakes varied significantly from 140 km^3 in 1993 to 2.27 km^3 in 1997 to Bolshoy Stavropolsky canal and from 0.653 km^3 in 1997 to 1.04 km^3 in 1991 to Nevinnomyssky canal.

Significant water intakes drastically decreased not only total Kuban flow in its middle course but also changed its inter-annual distribution. In a cold season monthly flow downstream water intakes decreased by 30-50% and in a warm period - by 70-90%. Such significant water intakes developed intensive water consumption at sites located downstream the canals, especially near towns Cherkessk, Armavir and Kropotkin. In summer only sanitary flow is recorded near this towns. Thus, in the nearest future it is required to redistribute runoff with reduction of water abstraction to canals and increase of water flow along the Kuban riverbed.

CHANGE OF WATER RESOURCES OF AGRICULTURAL LANDSCAPE UNDER INFLUENCE NATURAL AND ECONOMIC FACTORS

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Formation of water resources of any territory - the complex process dependent on natural and anthropogenous factors. For past century there were significant transformations both those, and others.

The greatest changes of a water regime are peculiar to the agricultural grounds. They are caused by a plowed land, forest belts, ponds etc. Thus negative consequences which can be aggravated with possible climatic changes are take place also.

Research of a water regime change is made for agricultural landscape, representing set natural and agricultural lands in a river basin of a forest-steppe zone. As elementary structural units we choose watersheds of ephemeral stream in river basin Chigla (Stone Steppe),

having natural borders and parameters of a drain in concentration point. Long regular supervision on watersheds of ephemeral stream allow to estimate transformations of water balance components on various elementary structural units and also to establish between them qualitative and quantitative relation.

We investigated space-time laws of parameters of territory hydroecological condition (water-physical characteristics of soils, ground water tables, water supply of aeration zone, a surface runoff, water use, structure of agriculture), and also climatic characteristics (air temperature, air humidity and deficiency of air humidity, rainfall, speed of a wind, overcast).

By results of construction and the analysis residual mass curves the periods (1893-1950, 1951-1998 and 1988-1998) for which average values of parameters are determined were selected. As a result of the analysis it is detected, that at rises in air temperature the quantity of rainfall for the annual and cold periods is increased. Last decade average values of air temperature and rainfall have increased in comparison with all period of supervision both in warm, and in a cold season. Especially appreciably it has had an effect in the cold period - the air temperature has increased on 1.5 °C, and quantity of rainfall - on 37 mm. It is necessary to note, that average values of both characteristics for 1988-1998 are higher its average values not only for all period of supervision, but also for the period of increase of air temperature and rainfall. It is possible to explain these changes both cyclic fluctuations of meteorological elements, and possible changes of a climate.

We execute the comparative analysis of dynamics of some a water regime parameters of Stone Steppe (rainfall infiltration, a surface runoff, ground water table, water supply of aeration zone) and meteorological elements for the period with 1950 on 1998 years. In result it is detected, that dynamics of meteorological elements fluctuations is unidirectional, that it is impossible to say about parameters of a water regime. So, up to the end of 80th years a surface runoff and water supply of aeration zone had the common tendency to downturn. However from the beginning of 90th years when there was a sharp recession of human impact, their increase is observed. Ground waters for the long-term period have strongly risen, that has resulted to soil degradation.

The analysis average values of annual, spring and low depth of runoff on watersheds of four ephemeral streams for long-term period is carried out. It is established, that a mid-annual depth of runoff, 29.8 mm which have made in last 10 years, has increased almost on 30 % in comparison with all previous period of supervision. The spring surface runoff thus has decreased on 20 %, and the low runoff has increased more than in 4 times. I.e. has taken place inside-annual redistribution of a runoff with significant amplification of its role in a cold season.

Thus, changes of a water regime are connected both to influence of economic activities, and with change of weather conditions. Thus last decade there was an coincidence of sharp recession of human impact and weather conditions.

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CHANGES IN WATER QUALITY OF A SMALL RIVER UNDER EFFECT OF ANTHROPOGENIC AND ZOOGENIC FACTORS

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Small rivers, as initial parts of larger systems, determine the originality of their aquatic biocenoses. Small rivers, respond quickly to changes of conges of conditions in the catchments area, anthropogenic effect, influence of hydrobionts.

The main portion of the Rybinsk reservoir alimentation falls on lateral water inflou the third part of which accounts for medium and small rivers. Hence the study of their effect on water quality and biota in the reservoir is the problem of actual importance. In 1999-2001 the investigation were carried out in a small river (its length about 20 km) of the Rybinsk reservoir basin to study changes in the water quality under effect of anthropogenic and zoogenic factors. During the period of observations the river was intensively populated with beavers. Up to the present 8 dams have been constructed by beavers and the river runoff is completely regulated. Besides in its middle course the river is subjected to a significant anthropogenic impact of the cheese dairy sewages. The beaver dam built upstream the cheese dairy decreases the river runoff thus enhancing the effect of wastewaters especially during the summer low-water period. Discharge of wastewaters increases the water mineralization up to 550-700 mg/l as compared to 450-550 mg/l in the upstream parts of the river depending on the season. Besides, concentrations of carbon dioxide and organic matter increased two and more folds. Biochemical oxygen consumption to (BOC_5) can increase 30-40 folds and reach 100 mg/l. The amount of suspended matter reaches 180 mg/l exceeding tens folds the background values. The largest beaver pond is formed by the dam constructed two kilometers downstream the cheese dairy. Its backwater reaches the zone of wastewaters discharge. As a matter of fact the pond is a water body with a slow water exchange and exerts a notable effect on water quality changes in the river. As a result of beaver's active living activity a large amount of organic substances enters the water with metabolism products. The concentration of carbon dioxide in pond is the highest (up to 70 mg/l) as compared to upstream and downstream parts of the river. Photosynthesis of algae and higher aquatic vegetation cannot compensate the oxygen consumption for beaver's respiration and biochemical oxidation of organic substances. Namely for this reason during the vegetation season the concentrations of dissolved oxygen in the pond water were minimal (1-3 mg/l) and the degree of saturation didn't exceed

30%. Besides, unloading of ground water lacking oxygen worsens the situation. On the other hand the decrease in current velocity in the pond accelerates deposition of suspended matter (concentration of suspended matter decreases three and more folds as compared to zone of wastewaters discharge) and organic substances being mainly in a suspended form and leads to a decrease of organic matter concentration in the water. Its content also decreases because of organic mater mineralizations as a result of microorganisms activity. In the part located between the beaver pond and the mouth the river grade is larger and so increases the current velocity. As a consequence the water saturation with the atmosphere oxygen occurs and reaches 70-100% (depending on a season).

Thus the beaver pond plays a positive role in the river self-purification reducing sufficient anthropogenic pollution. As a result in the river mouth concentrations of the main ions, dissolved oxygen, carbon dioxide, organic matter in water become compatible with those in the background upstream part of the river.

CLIMATE HUMIDITY AND THE LAKE LEVEL REGIME IN NORTHERN KAZAKHSTAN

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Atmospheric precipitation and summer air temperature are the major climatic factors, which influence on the lake level regime. The climate humidity is characterized by the coefficient defined as a ratio between the sums of precipitation for hydrological year and the average air temperatures during the summer months.

According to the meteorological observation data the graphs of humidity coefficients in deviations from their annual averages and the graphs of integral curves in deviations of humidity coefficients from their norms are drawn. The main century cycles of atmospheric precipitation variations of hydrological year, consisting of dry and damp phases, are shown.

The synchronism between fluctuations of the integral curve of humidity coefficient deviations and the integral curve of modulus coefficient deviations of the Chaglinka river annual run-off are marked. It allows to speak about the dependence of river run-off on climate humidity.

The analogy between the river valley watering and the catchment basin watering of the lakes in the region is drawn. The character of water level fluctuation graphs for Maibalyk, Imantau and Arykbalyk lakes has the same configuration as the integral curve of deviations of the modulus coefficients of the average annual water run-off volumes of the Chaglinka river.

On the basis of information about the lake levels for different years and using the graphs of integral curve of deviations of the modulus coefficients of the average annual volumes of the run-off of the Chaglinka river, the fluctuations of water level in Saumalkol, Bolshoi Koskol lakes of Schuchinsk and Borovoye Resort Zone - Zhemchyuzhinyv of Kazakhstan - are reconstructed.

The fluctuations of lake water levels, including the current ones, are the consequences of regional and, maybe, global climate changes. At present the century cycle of the lake water level rise is taking place, that is exposed by the perennial fluctuations within the century, which are different by intensity and depth.

Despite the changes of the climate towards the humidity increase, the lakes of the resort zone are catastrophically getting shallow, which is caused by non-regulated use of the surface water for water supply of Schuchinsk, Borovoye, Kotyrkol and numerous sanatoria, health centers, tourist centers and holiday-camps.

The long-term forecasting model of the lake regime is being considered, taking into account potential climate changes and water-economic human activity. The recommendations for water-economic regulation with the purpose of preservation of the unique resort zone lakes are being given.

COMPARATIVE ANALYSIS OF ANTHROPOGENIC IMPACT ON WATER RESOURCES OF RUSSIA AND USA

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The comparison of water use dynamic in Russia and USA shows that general processes in water management were similar, however in Russia they were violated by the modern crisis.

In the water use dynamic in USA it is possible to select two main periods:

- 1980 years - the continual increases in the water withdrawals in all sectors in 1,5- 2,5 times. This situation was connected mainly with the expansion of irrigation and increases in energy development.
- 1995 - the decrease of total withdrawals on 10%,

essentially in industry mainly due to the introduction of new water save technologies and change of strategy in water management. In irrigation the stabilization of water use was observed as a result of the improved technology, water price growing and reducing of farms activity. Public supply and rural domestic and livestock water use continued to increase with the population development.

From the middle 1950s the specific water use coefficient (per unit of production) had a firm trend to the reduction.

The trends observed during last years in the water use dynamic provide some basis for forecast estimations. Water withdrawals for public supply and domestic uses very likely will continue to increase as population increases, however reduction of per capita water use seems to be quite real. With the water price rise and increasing competition for water between users a stabilization or even certain decrease in irrigation water use is very likely to go on. Though, should be borne in mind that in agriculture except economic reasons the large role play natural, climatic conditions. In foreseeable future industrial water use and specific water use (per unit of production) most probably will continue to decrease in most sectors, although not so quickly as in the recent past.

In the water use dynamic in Russia we can select the following periods:

- 1960-1975-years - the intensive increase in all water use categories due to the economic grown;
- the stabilization of impact on the water resources as a result of slowing-down the economy growth rates and introduction of water save technologies, and agriculture in connection with natural reasons as well. Such situation in the water management of Russia on the genesis approximately corresponds with the second period in USA water use.

1990s - the decrease in water use as a result of social-economic crisis, at that industrial water use was decreased in 2-3 times more slowly, than fall of industrial production. Similar trends distinctive and for other areas of modern nature management. On the contrary in agriculture - rates of water use decrease in the majority of regions were higher than rates of fall of agricultural production. Obviously that except economic reasons, in accordance with reducing the irrigating areas on 25%, determined influence has rendered a favourable hydroclimatic situation, which promoted a drop in the needs for water of agricultural cultures.

Specific water use during the first period was rising, during the second - was falling, and in the last decade its sharp increase was observed.

Revealed tendencies and specifics of modern period of anthropogenic impact on water resources of Russia show that in the nearest perspective continue improvement of hydroecological and water management situation is not expected.

COMPLEX ECOLOGICAL ESTIMATION OF A VALLEY SYRDARYE ON THE BASIS GOAL FUNCTION

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Intensive economic activity, endogenetic and exogenetic processes fast and noticeably change a hydrographics web and influence a hydrochemical condition of a runoff, Syrdarye river. Universal irrigated of a measure have reduced that the natural runoff, in pool, especially in his average and lower parts is completely broken. The effective control of eco-hydrological and hydro-geological circumstances in locale and solution of transboundary problems requires a complex estimation anthropogenic load first of all for the most populated part of territory - valley Syrdarye river. The complex estimation was carried out on the basis of one of expert methods - construction the goal function.

In a mark estimation of eco-hydro-geological circumstances (*ЭГГО*) the square and degree of strength was taken into account, i.e. for this complex parameter the "interior" goal function was used: for squares of distribution strongly changed under influence anthropogenic environment processes and technogenic disturbance of natural environment the coefficient 10, for an average degree modification - 5, and for a weak degree and practically not changed - 1 was used. The water factor was taken into account also on a degree of contamination of the river (*ЗР*).

As the additional factors of action were used:

- Environmental radiation represented by squares distribution of natural radioactive contamination (*ПрР3*) and technogenic radioactive contamination (*ТехР3*), connected with deposits of radioactive raw material in terrigenous horizons cretaceous palaeogene age;
- Industrial, agrarian, town-planning contamination (*ПАГ3*);
- Land irrigation (*ОрМас*);
- Pastures (*Паст.*).

The action of land irrigation on a state of an environment is ambiguous. As positive influence it is possible to accept air humidity, presence a green mass promoting cleaning up of air, fulfilment stores of ground waters. Negative consequences are violation a soil cover, secondary salinization, wetland, contamination of ground

waters by excesses pesticides and fertilizers. For the registration the complex influence of land irrigation to summarized technogenic action on a locale geoecological situation in the goal function the contribution of this factor was estimated by coefficient 5 (half in comparison with other factors load).

In the goal function it should be taken into account factors hindering a negative modification of a geoecological situation. As such factor in our territory pastures now can appear which in conditions modern economic collapse test a sharp drop of anthropogenous load, restore the clearing role through substantial growth a green mass (testimony to that is the magnification of number wild vegetarian animals and even appearance two new aspects in locale). Therefore in the goal function this factor should have the large negative load (negative integer 10).

Goal function for the summarized registration of influence technogenic on a geoecological situation ($У_{эколог}$). Can look like this:

$$У_{эколог} = ЭПТО + ЗР + 10ПАГЗ + 10ПрРЗ + 10ТехРЗ + 5ОрМас - 10Пастг.$$

Quantitatively value of each factor was estimated on the basis of grid model territory. By results of grid model the following outputs are obtained:

The goal function gives precise and natural regional of summarized influence of the factors technogenic contamination.

The high level technogenic influence is necessary to a zone in immediate ploximity Chimkent.

Majority of a valley Syrdarye river has hitted to a zone enter technogenic influence.

The traditional gang of the factors technogenic contamination does not mirror influence cosmodroma, engaging the additional factors is necessary. Such factors can be action of the transport communications in area complex, buildings connected to civil work at preparation start platforms. But these informations are classified, and consequently could not be taken into account.

CONCENTRATIONS AND FORMS OF EXISTENCE OF HEAVY METALS IN THE WATER OF THE KUIBYSHEVSKOE RESERVOIR

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In the 1991-1992 in the dam pool of the Kuibyshevskoe Reservoir a set of experiments aimed at revealing the concentrations of heavy metals (HM) in water and forms of their existence was carried out. HM compounds (Cu, Zn, Pb, Cd, Co) were separated by fracturing into acid and base forms. In base group (I) organic and nonorganic colloid forms, HM complexes with organic substances of base nature, proteins, aminoacids are collecting. In acid group (II) HM complexes with natural high molecular organic substances - humic acids are prevailing. The main part of these compounds are not accessible for hydrobionts and don't represent a toxic danger for them. After fracturing neutral forms of HM remained in the water sample - free ions and neutral compounds with organic and nonorganic ligands. Ionic HM forms have the most high toxic degree for water organisms.

The concentration of HM was determined by atomic-absorbtion spectrometry methods.

Results of the study. The gross concentrations of dissolved HM forms of the in water Kuibyshevskoe Reservoir are within the limits typical for surface fresh water bodies. In seasonal aspect HM concentrations have not significant variations: Cu - 2,1-3,5 mcg/l, Pb - 0,8-1,5 mcg/l, Cd - 0,25-0,58 mcg/l, Co - 0,29-0,63 mcg/l. Only winter concentration of Zn (41,6-48,5 mcg/l) exceeds the values of other seasons (6,5-15,0 mcg/l) in several times.

Cu Show very high capability for forming complexes with organic substances of humic origin. In spring near 90% of Cu was fined in stuff of acid group. In winter this value attain 65%.

Zn Also manifest significant capability for complexation. Up to 65% of dissolved Zn in spring-summer period formed metal-organic compounds. But in winter, then the gross Zn concentration is highest, it's most part (64-90%) represented by the most toxic ionic forms.

Pb Complex compounds stuffs no more than 50% of summary dissolved Pb.

Cd, Co Principal part of these metals exist in water of Kuibyshevskoe Reservoir in non-complex state - up to 88% Cd (winter) and $\geq$70% Co and around the year.

Investigations on the Kuibyshevskoe Reservoir confirmed that only gross concentrations of HM in natural waters don't give a full picture of toxic danger of HM-pollution. Studies of the forms of HM existence are necessary for more precise estimation of ecological status of water body for prediction of its possible variation.

CONCEPTION OF BIOLOGICAL ESTIMATION OF WATER QUALITY: ECOTOXICOLOGICAL APPROACH

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Problem of qualitative exhaustion of water resources caused by pollution became extremely critical during the last several decades. It is known that guideline concentrations (GC) for water quality are not perfect and it does not fully

prevent water ecosystems degradation. Limitation of influence on water objects should account not only for exceeding of standard matters concentrations (according to experimentally obtained data) but also for transformation of the matters, their interaction with natural and anthropogenic factors, phenomenon of synergism and antagonism, i.e. combined effects on habitants of particular water objects.

There are two commonly admitted methods of biological estimation of water quality:

Biotesting, as a method, means establishment of concentrations of contaminating matters (effluents, contaminated waters), which results in the most significant and easily detected disturbances of water organisms under experiment (ex-situ). It is difficult to say to what degree it is competent to apply data obtained in the laboratory to natural conditions. Particular organisms used in the experiment have little in common with natural populations and communities.

Bioindication, as a method, means estimation of water quality by characteristics of state of indicator species communities in natural water objects (in situ). However quantitative methods of estimation of water quality are not widely adopted for hydrological analysis. Indexes and characteristics based on species structure of populations are often subjective. They depend on biotope homogeneity and seasons. Besides different species populations vary in degree of polyfunctionality. As a result it is preferable to use comparative estimations evaluated in classes, numbers and indexes. Estimations of this kind mediate between qualitative and quantitative characteristics and depend on professional skills of experts.

Recently ecological approach is getting commonly acknowledged in science community. "Ecosystem health" (in situ) is investigated with the help of this method. This approach combines methods of both ecology and toxicology. It is based on studying of conformity of anthropogenic changeability of biological systems, stability and adaptation mechanisms; definition of "standard and pathology", thresholds of irreversible changes in organisms or new states of communities. This problem can be solved by revealing of relations between integral characteristics of water quality and informative biological criteria. The former reflect dose of influence of contaminating matters on water objects. The latter reflect both short lasting and long lasting affects on different hierarchical levels of ecosystem- organisms, populations and communities.

There are no universal criteria for estimation of all types of influence, because each type of contamination has its own - "target-function". On the one hand characteristics of state of organisms (Physiological, clinical and pathology-morphological symptoms) are used to estimate short lasting affects. On the other hand characteristics of populations (change of growth rate, terms of ripening, life duration, fertility, etc.) and communities (changes of productivity, biodiversity, trophic structure, etc.) are used to estimate long lasting affects.

According to ecotoxicological approach investigations on assessment of water quality on the Far North, the Upper and the Lower Volga were carried out. It was found out that even when guideline concentrations (GC) of contaminating matters are not exceeded pathologies and dysfunctions occur in fishes. This is the evidence of necessity of reconsideration of threshold values under multifactoral contamination of water.

CONCEPTUAL BASIS OF THE DEVELOPMENT OF WATER MANAGEMENT SYSTEM IN THE REPUBLIC OF TAJIKISTAN

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Since establishment of international water relations between Central Asian republics there is an urgent need in Tajikistan to set government policy in a field of rational water use and conservation. In December 2001, the Government of Tajikistan approved the Rational Water Use and Conservation Concepts for the Republic of Tajikistan.

Major water consumers are irrigated agriculture (up to 84% of water diversion), household-drinking and agricultural water supply (8,5%), industry (4,5%), and fishery (3%). The main and now prior water user is hydropower engineering in Tajikistan. These major players of water management system influence national development strategy of Tajikistan.

Tajikistan faces complex, capital intensive, and long-term task of rehabilitation and improvement of the technical state of irrigation and collector-drainage systems since created irrigated agro-landscapes play an important economic, environmental and ecological role for 75% of population (4,6 million people). Based on inventory of capital stock, first priority, medium- and long-term measures on rehabilitation and further development of irrigation and drainage will be developed and implemented in Tajikistan. Rational water use, to be reached through the improvement of soil-landscape, reclamation, and water allowance zoning, the application of sound irrigation scheduling and advanced water saving technologies and the improvement reclamation state of lands, is of economic and environmental importance. Improvement of irrigation system efficiency and irrigation technique and technologies, as well as major and current land leveling and all-round reconstruction of irrigated lands will be implemented through long-term programs.

Effective legislation of Tajikistan sets the following investment sources:

- funds collected from water consumers;
- national budget;
- local budgets;
- land tax;

- foreign investments;
- other sources, not prohibited by the law (private sector, funds received from expropriation of lands for non-agricultural needs, tariff and tax regulation for raising effectiveness of irrigated agriculture, etc.)

Water management system, created in Tajikistan, is a good basis to achieve food security. To meet demands of both population and national economy for grain and cereals a targeted comprehensive program is being implemented to increase cereals production and reach yields of 1 million tons, including at least 40 centner of rice and wheat per 1 ha of irrigated lands, 50 centner/ha - maize, and 30 centner/ha - soybean. It is planned to increase cotton yields and its production up to 700 thousand tons. Appropriate tasks are established on other directions, such as cattle breeding, viticulture, potato production, etc.

Calculations show that next 10-15 years and in far future water consumption will depend on sustainable economic development, demographic situation, formation and implementation of living standards system, gradual improvement of livelihoods, and development of all economic sectors. However, food problem is getting increasingly critical and has to be solved through the increase of productivity on existing agricultural lands.

Currently, the main issue in the Aral Sea basin is interstate water allocation, including guaranteed water supply to the Aral Sea. Other problems, including environmental ones, are derived from the main problem, solution of which will depend on states and their joint efforts.

Foreign policy of Tajikistan in the field of water relations is aimed at: integrated water use; consideration of water as economic welfare and establishment of economic water use mechanism; support of regional efforts on joint water management; and, establishment and strengthening of conflict resolution mechanism. Reliable forecasting of water availability in sources and mutually acceptable compromises will help to solve emerging water use problems.

Optimization of water management system in Tajikistan is considered at institutional, technical, and economical levels. Technical problems of water supply to economic sectors and the environment should be solved by increasing available share of natural water resources and using them rationally with simultaneous implementation of water conservation measures. Institutional and economical measures should be implemented at national and international level. The following actions are planned in Tajikistan: gradual transition to system management approach within hydrographic, not administrative, boundaries; acceleration of extensive WUA establishment; application of water demand management in practice; provision of differentiating payments for water supply depending on specific conditions; development of various types of private, collective, and stock-holding water use on base of market water activities.

In view of water use conditions having formed during long years of joint living of CAR's peoples in single state system and now in context of new independent states, two scenarios of regional water resources use are being considered.

Keeping formed situation, when downstream countries keep using actively water resources for irrigation needs, thus causing sharp power crisis in upper watershed countries.

Water use for power needs, thus leading to water scarcity in lower reaches of river basins.

Both these options are extreme and cannot be acceptable for all the nations in the region. Therefore, their is an urgent need to optimize operating modes of hydrostructures with account of both national and regional interests. This can be solved only by establishing a mechanism of mutual services and compensations. Thus, in part of water use in Central Asian region the states should build their relationships on a base of tolerance for each other.

DECISION SUPPORT SYSTEMS FOR WATER RESOURCES MANAGEMENT AT THE REGIONAL AND FEDERAL LEVELS

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In 2000-2001 measures on introduction of a basic information/program complex of the decision support system for water resources management into regional divisions of the Russian Federation water service were taken. The launch complex of DSS was prepared composed as follows: information/reference sub-system for assessment of the conditions, use and current regimes of water bodies and water-economic systems; water-economic balances simulation system; information/program complex for calculation of the maximal permissible discharges of pollutants to surface water bodies; the "Limits, paid water use" system. The software was provided for basin water administrations, natural resources committees and other institutions of the Russian Federation constituent members, totally for 83 water agencies of the Ministry of Natural Resources in different regions of Russia. Experts of the regional divisions of the MNR water service were trained to work with information/technological software.

DSS of the Federal level is formed on the basis of adoption and development of basic information/technological software for solution of water management tasks at the regional level. It is an integrating sub-system that functions on the basis of the integrated information/technological network of the MNR water service being realized in the global Internet network framework. It is supposed to develop DSS in several steps. At the first step, in the processes of data exchange protocols creation and tasks solutions, it is planned to process and exchange the most essential water-related information.

Expansion of the information composition and the scope of the tasks being solved, practicing of the network data exchange technology, development of geo-information basis as a basic technology for work with spatial data are further directions of DSS of both Federal and regional levels.

Promising information technologies will be linked with network GIS technologies oriented to solution of users tasks, associated with automatic processing of distributed and remote information.

Key direction of high efficient technologies creation for water bodies monitoring system is further development of GIS technology network infrastructure oriented to automatic processing of distributed and remote information to secure access of distant users to the network resources, as well as creation of geo-information banks and use of novel efficient access technologies.

To implement the described technology it is imperative to develop regional blocks and develop appropriate sub-systems for the catchment/territory level with further summarizing of the information for the upper level.

The above activities aimed at creation of geo-information basis for existing decision support systems currently are being performed for the Don catchment.

DETECTION OF INTRARANK AND MUTUAL LINKS IN CYCLIC OSCILLATIONS OF THE FLOW ACCORDING SLIDING-SCALE YEAR GROUPS

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The need for hydrological series of water and water management component balance arises in prognostic estimation of artificial replenishment variability of water resources for Lake Sevan. The change is planned with the goal of the lake water level inereasing, ecological state and water quality improvement. Such analysis has been implemented by mathematical statistics methods.

The definition of correlation among ranks and intrarank links related to annual flow shifts for a year did not revcal any effective results. The search was proceeded in direction of correlative links with in sliding (shifted) on t years of m year size groups. An intrarank link is delected by means of correlograms construction.

Almost regular repetition of signs and extremal values of autocorrelation parameter can be easily seen from obtained correlogramss under certain combinations of m and t.

This fact indicates the existence of peculiar small intrasecular cycles of stream-flow in series under consideration. This conclusion is confirmed by results of spectrum analyses of the same series.

The analysis has shown the existence of nonstrict correlation links among components of balance for Lake Sevan, between active return of the lake and constituents of balance with in definite groups of years, which indicates as well the existence of corresponding intrasecular cycles.

DEVELOPMENT OF WATER MANAGEMENT OF UKRAINE

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The system of a water management in the national economic complex of Ukraine comes out as structure, which at one resources and protection, water-technology and economical activity is based on two-unified nature of water, as integral component of a part of environment, fundamentals of life and engine of processes in natural systems, and also renewable resource indispensable for function of all branches of economics.

Ukraine is considered as one of the European countries, which least ensured of water resources, (1 thousand m^3/per., while in Germany - 2,5; France - 3,5; Great Britain - 5 thousand m^3/per.).

In 2000 year from natural water objects is collected 18,3 mlrd. m^3 of water, that on 47% is less 1990 yr. For this period on 46% was reduced water consumption in industry and on 65% in agriculture (Figure). It is explained to considerable (on 53%) reduction of manufacturing costs of water in industrial sector, and also decreasing (on 67%) costs of water for irrigation. Along with considerable reduction of volumes of water usage the increase of losses of water is watched at transportation (in 2,7 times) and overflow disposal of polluted waters (in 1,2 times). The decrease general water consumption has resulted and to decrease of water lead, that promoted some improvement of ecological condition of the rivers. However deterioration of economical situation has entailed during 90 years suspension of building of series large and

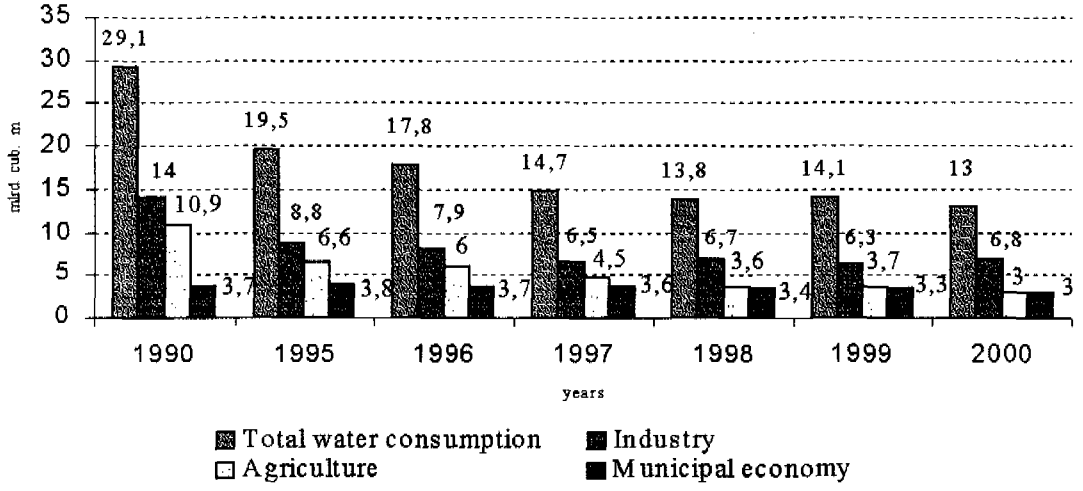

Fig. Dynamic of consumption of water in Ukraine, 1995-2000 years.

In according our forecasts is envisioned gradual increase of specific water usage in calculation on one inhabitant with 107 tj 170 l/day in 2005yr. and 220 l/day - in 2011 yr. General usage of water by the population and branches of economics in 2005 yr. will make 16,6-17,2 km^3, in 2011yr. - 17,6-19,1 km^3. The total amounts of gross industrial usage of water in 2011 yr. in comparison with 2000yr. will be increased on 30 %, that is will be increased by smaller paces, than volumes of industrial product. By 2005 yr. the increase of volumes of usage of surface waters compared with 1999 yr. is forecasted, and the subsequent years it is envisioned more intensive use of seawater, back, repeated and successive systems of water supply, and also more general usage of underground waters.

To take into account of social and economic conditions which were adding up in Ukraine, it is necessary stabilise and reduce water requirement by an intrusion modern little water capacity, waterless technologies and complete of learning to disengage powers of systems of diversified usage of water, to increase effecting of mechanisms of economical and legal regulation water management of activity, and also advance of the standards of costs of water with allowance of ecological limitations and being water resources potential.

DISTRIBUTION OF THE WATER CATCHMENT AREA OF MARY REPUBLIC RIVERS

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Today the condition of rivers and their cause much alarm they are exposed to the intensive anthropogenous influence. The problem of ecological improvement of a river and it is basin is not only one of the water economical problem, but it is a complex problem which include the whole natural technological complex of the territory of the basin. That is why to solve their problem we must take into account the statistics which characterizes availability, condition, the use of basin resources, measures of their re-establishment in the specific place and time.

The rivers basin is characterized by clear natural borders and represent a great number of relatively homogeneous, but individually different water catchment areas of various rivers tributaries. They represent the unity which was formed under the influence of the identical biotikal and abiotikal, external and internal factors of the environment.

In consequence of the work with the map of the scale 1:200 000 we got the data of the water catchment area of the rivers flowing along the territory of Mari El: Rutka (1833.9 km^2), Bolshaya Kokshaga (6539.8 km^2), Malaya Kokshaga (5052.5 km^2), Ilet (6571.4 km^2), Nemda (3772.2 km^2), Buy (893.2 km^2), Urzumka (1790.2 km^2). Examining the water catchment area like an indivisible natural territory, we picked out all the tributaries of the principal river and determined their water catchment area. So, we got the totality of the data of the water catchment areas. We set ourselves a target to distribute rivers and their tributaries in each indicated basin according to the data of the water catchment area. Using G.A.Stredzhessa's formula have determined a step of a grouping of values for each basin which in our case changed, depending on examined basin, from 3 up to 8 km^2.

According to the received information about 7 basins, we constructed wave dependence of the number of rivers on the

data of the water catchment area and determined the type of mathematical model with the help of biotechnical law.

We got the interval of the water catchment area, data for each basin which are characteristic for most of the rivers tributaries.

So, the distribution of the water catchment areas of the basin allow to pick out the parts of surface which require a special regime of using natural resources and what is more the number of these parts is changing in wide limits, if depends on the peculiarities of the structure of the river basins.

DYNAMICS OF MINERAL OIL POLLUTION OF THE AZOV SEA IN THE PERIOD OF TRANSITION TO NEW ECONOMIC CONDITIONS

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The monitoring of the Azov Sea ecosystem, including that of the accumulation of mineral oil products in the water column and the bottom sediments, has been conducted throughout the whole period of transition to the market-oriented economy (since the end of the 1980s to the present time). The results obtained allow us to judge about the regularities concerning the dynamics of oil pollution caused by quantitative and structural changes in the economy of the South region of Russia.

Even though the industrial and agricultural productions declined, the extraction of oil products and their shipping have increased considerably. In 1992 only 50 vessels passed through the Azov-Don canal, while in 2000 this figure went up 40 times. During the navigation period in 2000 more than four thousand ships passed along this canal (half of which were tankers with 1.3 mln. tons of crude oil on board), in 2001 there were five thousand vessels. Accordingly, the extent of loading and unloading of oil and mineral oil products in ports increased a great deal.

An increasingly harmful source of oil pollution is becoming illegal discharge of bilge waters which are often masked by dispersion agents of various kinds.

The contamination by oil products carried with atmospheric precipitation, primarily due to ever-increasing number of cars, has also grown. The amount of hydrocarbons discharged by automobiles in 2000 into atmosphere in the Rostov region only attained more than 79 th. tons.

The observations made in 1996-2001 have shown that the concentrations of mineral oil products falling down with atmospheric precipitation on the sea area ranged from tenth parts to dozens of mg/l. In some cases mineral oil concentrations in precipitation were an order of magnitude higher compared with those in the seawater.

The annual average concentration of mineral oil products changed in the Azov Sea water from 0.25-0.86 mg/l (5-17 MPC) in 1985-1988 to 0.07-0.10 mg/l (1.5-2 MPC) in 1999-2001.

Concentrations of mineral oil in the marine water exceeded maximum permissible concentrations both in the period of maximum pollution and in the last years, in 100% of all cases of observation over the period of 1985-1988 and in 80% of them in 1999-2001. This bears evidence of chronic pollution of the sea by oil and mineral oil products when even a concentration lower than one maximum permissible concentration causes toxic effects in fish and other hydrobionts (Patin, 1997).

The chronic character of oil pollution of the sea is supported by data showing high content of mineral oil products in sediments during all the period of observations (1985-2001). The average annual values changed from 0.6-1.2 mg/g in 1985-1992 to 0.6-0.8 mg/g in 1999-2001. The coefficient of accumulation of mineral oil in the upper 1-2 cm layer of bottom sediments makes up at present $n \cdot 10^{-4}$. 120-150 th. tons of mineral oils are present in the upper one-centimeter layer of bottom sediments, which is three times more compared with the water column of the sea.

As the production has begun to grow now one should expect that in the nearest future more mineral oil products will enter the sea with river and distributed runoff. It may cause changes much deeper than in the previous years and producing irreversible damage to the sea ecosystem.

DYNAMICS OF SECONDARY WATER POLLUTION WITH OIL PRODUCTS

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Under the condition of "concentrated environment" forming and with the presence of vegetable residua and decreasing of oxygen delivery into the waters of a water body, secondary water pollution by the oil products seems inevitable.

Secondary water pollution may occur as a result of:

- sediments roiling;
- oil products and products of their decomposition transfer to the surface and to the water strata from the basin bottom along with the bottom sediments fermentation gas;
- desorption in the form of oil hydrocarbon directed transfer from the bottom sediments into the water.

Experiments were held in order to study bottom sediments oil products desorption process. To do this bottom sediments were placed into the water capacity, which contained sorbed (occluded) oil products and vegetal residua.

Vegetal residua adding allow us to model certain conditions that characterize non-vegetative period, when vegetation dying off begins.

Creation of anaerobic conditions in the presence of low temperatures imitates ice appearing during winter time. In order to create anaerobic conditions capacity was hermetically sealed.

The research was held in three versions:

- First version - sediments were put to the bottom
- of a vessel, full of water. Vegetative residua were added. Afterwards the vessel was put in a cold place.
- Second version - sediments were put to the bottom of a vessel, screened by clay full of water. Vegetative residua were added. The vessel was put to the dark warm place.
- Third version - sediments were put to the bottom of a vessel, full of water. Vegetative residua were added. The vessel was put to the dark warm place.

The results of experiment are shown in fig.1

The experimental data analysis showed that oil products desorption process from sediments into the water under the anaerobic conditions and low temperatures is strained in time and practically is over already after 4 days (1st version).

Quick oil products concentration growth was observed in the water for the 2nd and 3rd version correspondingly in the process of oil products desorption under the temperature 18-20C 8 and 6 days after the experiment was started. This effect is stipulated by the carbons delivery to the water as a result of vegetation decomposition and dying off and oil products desorption from bottom sediments. In fact, active oil products yield from the sediments screened by clay starts 2 days later than the unscreened ones.

Bottom clay screening was held in order to study the possibilities of avoiding oil products yield from bottom sediments into water, since clay obtains high sorbtional characteristics in relationship to organic substances.

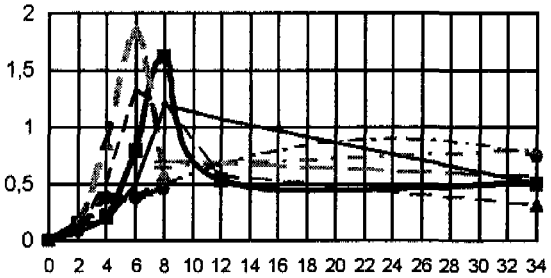

Fig. 1.

Oil products desorption from bottom sediments
Concentration, mg/lit
Time, Days
From bottom sediments at low temperatures
From bottom sediments, screened by clay at temperature 20C
From bottom sediments at temperature 20C

It has been find out that oil products desorption from bottom sediments into water both at low and high temperatures is described by third-power polynomial equation.

$C_t = a t^2 + b t + C_o$,

where C_t is oil products time concentration, mg/dm^3;

C_o is initial oil products concentration in the water, mg/dm^3;

t is time, day;

a, b are coefficients given in Tab. 1

Table 1. Coefficients of equation $C_t = a t^2 + b t + C_o$

Option	Co, mg/dm^3	a	b	Correlation coefficient
From bottom sediments under low temperatures	0,0027	- 0,0015	0,0737	- 0,98
From bottom sediments screened by clay under the temperature 20 °C	0,0468	0,0336	- 0,0745	- 0,99
From bottom sediments under temperature 20 °C	0,0141	0,0529	- 0,0063	- 0,999

The conducted experiments allow us to make certain conclusions:

1.Anaerobic process promotes secondary water pollution, stipulated by oil products delivery from bottom sediments.

2.The process of secondary water pollution by oil products is especially intensive under the higher temperatures with the presence of vegetation residua. This organic substance, consuming water oxygen, is easier to oxidize.

3. Clay screening of the bottom sediment containing oil products does not prevent oil product yield from bottom sediments into water under anaerobic conditions.

4. The carried research allowed us to get the dependence, describing oil products delivery dynamics from bottom sediments into water in the process of anaerobic conditions formation.

ECOLOGICAL ASPECTS OF THE POLLUTION BY PESTICIDES IN THE LOWER DON

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The river Don plays still a great role in natural reproduction of sturgeons and other valuable commercial fish species, but in the last decades the industrial reproduction has increasingly developed in this region. After the construction of Tsymlyansk hydrosystem more than 200 ha of spawning grounds were preserved in the lower part of the river, they are suitable for natural reproduction, which is necessary condition to sustain the genofond.

The technogenic impact inflicted on the Don ecosystem caused a large decrease in species diversity of the ichthyofauna and fish stocks in the Azov-Don basin as a whole (Volovik, 1994).

The agriculture with its many branches where a great variety of chemicals (200 names, to 2.6 th.tons per year) is used occupies a leading place in the economy of the region.

Within the framework of observations of the ecological situation in the lower Don basin the pesticide pollution has been estimated during the last two decades in routine surveys and when finding out reasons for fish deaths. Special attention has been paid to obtain reliable data on the content in water and bottom sediments of highly toxic, most stable and common organochlorine pesticides (OCP) capable of accumulating intensively in fish organisms.

During the last 15 years great changes have been observed in the pesticide pollution in the lower Don. At the end of 1980s - beginning of 1990s the annual average concentration of pesticides in water amounted to 3-7 MPC (maximum permissible concentrations). At some stations in that period the concentration of OCP reached 10-30 MPC. In the subsequent years the contamination of water decreased. By the end of 1990s it attained 0.5-0.7 MPC (5-7 ng/l).

In 2000-2001 annual concentrations of OCP in water averaged 4-5 ng/l (0.4-0.5 MPC). At the same time higher concentrations (10-20 ng/l) were also observed. In 2000 in the water of the Don, where the tributary Temernik flows in, the OCP concentrations exceeded MPC 13 times (130 ng/l).

In addition to usually observed OCP in the river, in 2000-2001 some new pesticides used in agriculture entered the water, they are trifluralin, diazinon, heptachlor, aldrin, dieldrin, propiconazole, α-cypermethrin, phosalone, fenvalerate, deltamethrin, parathion-methyl, etc. The part of these toxicants contributed from 10 to 90% of the total concentration.

In bottom sediments and in the water of the river Don the highest concentration of OCP (5-9 ng/g of dry weight) was observed at the end of 1980s - beginning of 1990s. In the following years the contamination of bottom sediments decreased and by the end of the century it amounted to 2-3 ng/g of dry weight. In 2000 the annual concentration of OCP increased to 5 ng/g but in 2001 it lowered again to 2 ng/g.

Similarly to the early 1990s period in 2000-2001 much higher concentrations of OCP (10-40 ng/g of dry weight) were again observed in bottom sediments at some river sites, which is due to illegal use of prohibited preparations or to the violation of storage rules etc. According to the official statistic only, about 1.2 th.tons of not suitable for application pesticides are kept in storehouses, among them 1.5t of DDT and 23.9t of hexachlorcyclohexane and its derivatives.

The entire ecosystem of the lower Don is now in conditions of chronic influence of organochlorine pesticides In recent years the agriculture has experienced a considerable revival, the amount of the pesticides used has grown which may be fraught with adverse consequences for the ichthyofauna and ultimately for the health of people living here.

ECOLOGICAL DANGER OF DEGRADING WATER PROTECTED ZONES DRINKING WATER SUPPLYING SOURCES

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Among the diverse complex use of the Ivankov reservoir, i.e. common and industrial water supply, fishing, shipping, hydroelectric power supply, recreation, the main one is the reproduction of clean drinking water for Moscow amounting to 70% of the total water supply of Moscow. The problems of water protective construction for the reservoir with the area of 41000 km are evident to be the most urgent ones.

The analysis of a long-term research enabled to make a conclusion that the state efforts on the water protection in 1980-s significantly improved some parameters of water quality in the Upper Volga basin, especially those oftechnogenic origin. (1) Having transferred to the market relationship in the economy in the early 90-s a sharp reduction of the controlled discharge of industrial and common sewage water occurred according to the state reporting 2TP-vodhoz. As a result of long-term research

databases of the main contamination sources and qualitative characteristics of the Ivankov reservoir were made making it possible to reveal the following trends:

- The class of non-controlled contamination sources widened and its power is increasing on many parameters. Surface washing from the areas of cities, industrial sites, rural areas of the whole basin is being considered;
- The class of controlled sources (state reporting 2 TP-vodhoz) is transferring to the class of non-controlled ones;
- The quality of the water in the reservoir did not improve. Some trends in the modifications in the qualitative condition of the main drinking water supplying sources is transferring to the division of "ecological and irreversible".

New dangerous sources of the reservoir degrading appear in the first position together with the strengthening of traffic effect, poor quality of municipal service in the towns and settlements, poor condition of roads, the lack of drainage system with the purification of the most contaminated sewage. One of those sources being the most urgent one is the construction boom directly on the coast of the Ivankov reservoir breaking all the norms and regulations. Water protecting zone of the Ivankov reservoir is now defined to be 500 m and the protection line is to be 100 m.

The main destination of the water protection zone is to keep the special mode of economic and other kinds of activity to prevent water reservoirs from contamination, pollution, silting and exhausting and to preserve the habitat of animals and vegetation.

Special long-term investigations and observations held in the coastal zone and water surface of the reservoir allowed the following assessments:

- To define the intensiveness and the density of the area being constructed;
- To calculate modules of surface washing out of different plots and to compare it with the background index;
- To define the plots of the reservoir being the most effected by the delivered contaminants.

At the present time a number of new ecological problems connected with the intensive non-controlled construction in the coastal zone can formulated as follows:

1. The density of the construction does not comply with the Construction Regulations "SniP (SP 2.1.4.031-95) for the sources of drinking and industrial water supply of Moscow". The Regulations fix the density of the population being 20 people per 1 hectare. The investigations indicated that within the period from May till October the density of the population in the water- protecting zone is 10-15 times higher than allowed. Transport overloading refers to the same aspect, as 80% of the owners of the plots of land in the protected zone live in neighboring regions. Trucks and lorries are intensively used for the construction purposes as well.

2. The lack of the joint drainage system with the purification resulted in the common discharge of sewage directly to the reservoir.

3. Sharp increase of small fleet, the use of expensive motorboats caused the construction of a great number of boating stations, moorages and slipways. A number of unauthorized individual canals-ports appeared resulting in the coastal destruction and increase of shoals number.

4. A catastrophic wood cut is carried on in the coastal area. Sand pits appear on the places of wood cut.

5. A total degrading of channel network due to the wood cut and the use of stone bed as a construction material. The result of the aforesaid is intensive silting of shoals and destruction of spawning-grounds.

6. Unauthorized common wastes dump organizing.

7. A deficit of free space in the coastal zone resulted in the unauthorized land location for unorganized rest.

8. All cottage plots of land in the area of 500 m have the square of 1500 m, that allows agricultural works with fertilizers application. Greenhouses are constructed directly at the water cut.

9. In the vegetation period qualitative parameters worsen in the plots of the

reservoir with high recreation load. Surface washing out of the reservoir coastal zone become especially apparent.

Uncompleted list of the arisen problems connected with the ecological degrading of the Ivankov reservoir water protecting zone enables to formulate some trends of forecast character as follows:

- Construction dynamics indicates the beginning of a new stage of construction campaign;
- Further worsening of the reservoir ecological state should be expected in all the aspects of the reservoir qualitative state assessment (hydrochemical, hydrobiological, microbiological levels).
- Reduction of the woods area will reduce ground waters supply to the reservoir in the low water period;
- Social and economic problems of the regional character are becoming urgent together with the ecological problems.

At the present time the Ivankov reservoir being the main drinking water supplying source for Moscow requires the following to be done:

- Urgent revision of Construction Regulations SniP requirements for drinking water supplying sources, strengthening of the regiment of the water protection zone use with economic damage assesment.
- Giving the Ivankov reservoir special legal status to comply with the new regiment requirements.
- Widening of scientific research attracting state nature protecting bodies.

The development of "the project for the water protection zone development to improve technical and sanitary state of the Ivankov reservoir" taking into account the present state of things.

ECOLOGICAL PROBLEMS OF WATER RESOURCER USAGE OF SOIL IRRIGATION IN THE VOLGA AREA

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Interaction between the society and natural environment caused negative effects. That is why it is vitally important to from successive equilibrum natural use

While choasing the calculated supply of dischare of small rivers of the Volga area for irrigable meadows it is necessary to take into account the type of meadows and composition of farm crops.

The amount of irrigation of must be planned higher than the average of many - year discharge to provide water regulating for many jast not to make water resources during years of high flooding to apply them during of low flooding, lint to make fodder resources from additional irrigated areas provided during years of high flooding to use them during years of low flooding.

The authors offered a new method of accounting the influence of irrigation rate for cases of manyyear and seasonal regulating of water - flow of small rivers. The principle of harveshing of optimal volume of farm produce in spite of flooding is tairon as a basis of this method.

The account of the influenu of variability of irrigation rates has a great practical importance forrational and economical application of water resomces. In this case more rationally is applied calenlated water capacity of reservoir and the power of irrigation system can be increased by 30...40%.

With the aim of rational application and convervation of water resources in steppe and wooded steppe zones of the Volga area the authors offer a new method of complex meliorations of water discharge of freshwater and salt lakes, the point of which is in a total changing of the rate of soil - ground layer airation and transfering a part of surface flow into the underground.

ECOLOGICAL RISK ESTIMATION IN THE PROCESS OF OIL AND GAS FIELDS DEVELOPMENT ON THE RUSSIAN FEDERATION CONTINENTAL SHELF

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The Arctic and the Far Eastern seas hydrocarbon recourses development having value of hundreds of billions conventional fuel is one of the major tasks and serves as the basis for the economic and the Russian common weal stable development.

At all stages of oil and gas field development the water environment is exposed to the major pollution which affects ecological situation in the continental shelf fields development region.

Nowadays the most critical task is to estimate a degree of the environmental risk at hydrocarbon raw material fields development and exploitation on the continental shelf of RF.

CERP developed the methodical recommendation "Oil-and-gas bearing provinces territory zoning by a degree of the environmental risk in the process of fields development taking into account the territory status" in 2000 by demand of the Ministry of Natural Resources of the Russian Federation (MNR RF).

The main purpose of the research - exposure of the main kinds and sources of environmental impact and development of the methodical recommendation for the sea waters zoning by a degree of the environmental risk taking into account the specially treated natural territory status at the basic stages of the oil and gas fields development on the continental shelf of Russia. In the basis of the developed methodical recommendation of oil-and-gas bearing provinces territory zoning by a degree of the environmental risk in the process of the Arctic and the Far Eastern seas shelf fields development are the preliminary complexity estimation of existing natural conditions and determination of the environmental risk level.

This work covers the following:

- the Arctic and the Far Eastern shelf of the RF natural-climatic conditions were analyzed;
- the technologies and the work types which are used in the basic stages of hydrocarbon raw material fields development on the continental shelf were described;
- the specially treated natural territories characteristics were examined;
- impacts types and negative consequences on the environmental components (surface and underground waters, bottom sediments, atmosphere, depths, flora and fauna and near-shore zone soils) were listed;
- the oil and gas fields development emergency conditions on the shelf were presented;
- vulnerability degree parameters for different components of the environment at the fixed technogenic impact were revealed;
- the principles of oil-and-gas bearing provinces territory zoning by a degree of the environmental risk taking into account the specially treated natural territory status were determined;
- the mapping method of environmental risk degree was developed for the first time.

It is recommended to use the environmental risk degree mapping method developed by the authors for drawing up of norms and methodical recommendations for the purpose of the normative documents drafts development (in particular, on oil-and-gas bearing provinces territory zoning by a degree of the environmental risk) at exploration of oil and gas fields on

the Arctic and the Far Eastern seas continental shelf.

The recommendations developed by CERP aimed at prevention of considerable number of side actions threatening the environment at hydrocarbon raw material fields development on the RF continental shelf.

The proposed methodical recommendation is directed to environmental organizations, oil and gas companies, insurance companies, licensing bodies, controlling units.

ECOLOGICALY SAFE TIMBER FLOATING. WATER BODIES REHABILITATION. PROTECTION

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Timber floating is used widely on all rivers in "the taiga zone". Wood transport by the water way is the most economic in comparison with the other means. Poor development of the road network in the Russian northern regions makes timber floating to be the only possible way for wood transport from the distant areas to woodprocessing centres. However in the process of timber floating series of ecological problems appear. Two main problems are step forward. The first problem is destruction of riverbeds and river banks in the process of timber floating and the second problem is the clogging of rivers. The first problem is determined by the timber floating technology and has relatively small environmental consequences. The special techniques were envisaged to minimise negative impact of river melioration on the biota (first of all on the fish resources). Negative impact of snag determines by two factors:

- change of water chemical composition;
- creation of mechanical obstacles.

Mechanical blockage of riverbed by snag is dangerous because of accumulated in river mouth and in the shallow water snag masses are putting obstacles in the way of spawning of valuable fish species. It cause for sudden reduction of fish population. To solve the emerging problems a number of administrative decisions was undertaken. Prohibition of drift floating was the main of these decisions. Besides, attempts of snagging have been carried out at the expense of budgetary funds and from funds of timber-floater. Since 1997 the similar work has been stopped because of lack of financing. The process of snagging was carried out partly in the streams where timber floating was continued.

For the water bodies rehabilitation it is necessary to pass the documents providing normative-legal foundations of this activity. Drafts of these documents were worked.

The action program on the water bodies environmental rehabilitation was developed to form effective tactics for the water bodies rehabilitation. The program envisages realisation of several actions during 5 years period without taking out of the water bodies from the economic rotation. The following tasks must be settled:

- improvement of water bodies usage control for the purpose of timber floating;
- strengthening of inspection measures for companies which carry out timber floating;
- development of methodical approaches for ecological risk estimation in the process of usage of the water bodies for timber floating;
- implementation of environmentally safe technologies for salvage, processing, utilisation of snags;
- development environmentally safe technological schemes for timber floating in the northern rivers.

For the purpose of organisation of effective protection of the water ecosystems at timber floating it is necessary to implement the following:

- complex environmental regulation;
- licensing and inspection of such kind of activity;
- introduction of modern technological timber floating methods.

It is necessary for the environmental regulation to determine the basic technical specifications which guarantee environmental safety of timber floating. Licensing must include the complex of nature-conservative measures providing stability of environmental balance in a water ecosystem. Control of timber floating must include the following:

- systematic inspections of environmental state of a river basin on the all way of timber floating;
- timber-floaters must keep to the requirements of water use.

Implementation of new technologies in timber floating must increase not only economic effectiveness of timber floating but also to provide higher level of environmental safety.

ECOTECH DATA BANK FOR WATER RESOURCES USE, RESTORATION AND PROTECTION AS AN INTERACTIVE TOOL FOR SOLUTIONOF WATER/ENVIRONMENTAL TASKS

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Conceptual basis of water use and water protection as it is presented in the RF Water Code orients water users to minimization of the damage to natural water bodies. Mechanism of the minimization principle realization on the basis of operative introduction of advanced water protective technologies and technical means can be efficient only

provided that there are information base of analog data, systematized in a universal way and acceptable foe information accumulation, its fast search, analysis, summarizing and forming of information/advising systems.

Data bank for water resources use, restoration and protection technologies and technical means (EcoTech) is a system of flexible (able to be replenished, updated and summarized) data bases on polluted water treatment/secondary treatment methods, pollutants transformation in water media, selection of economically grounded technological solution of a water-protective measure from the analog series.

EcoTech software complex is based on an integrity of a pollutants catalog according to the system applied in the form # 2-тп (водхооз) reporting with a swept systematized catalog of natural and waste waters treatment technologies and technical means that permits to present water protective technologies as block-diagrams. Basic block-diagrams of water treatment plants (WTP) facilitate rising of the enterprise water/economic and water protective operation ecological status from exoecological (using water resources) to endoecological (saving and restoring water resources) ones.

A guide and methodical recommendations for EcoTech users that secure its interactive use have been developed.

EcoTech software permits to form automatically the higher level information/advising systems on the base of initial information (fig. 1), the former after statistic processing are used for solution of various tasks.

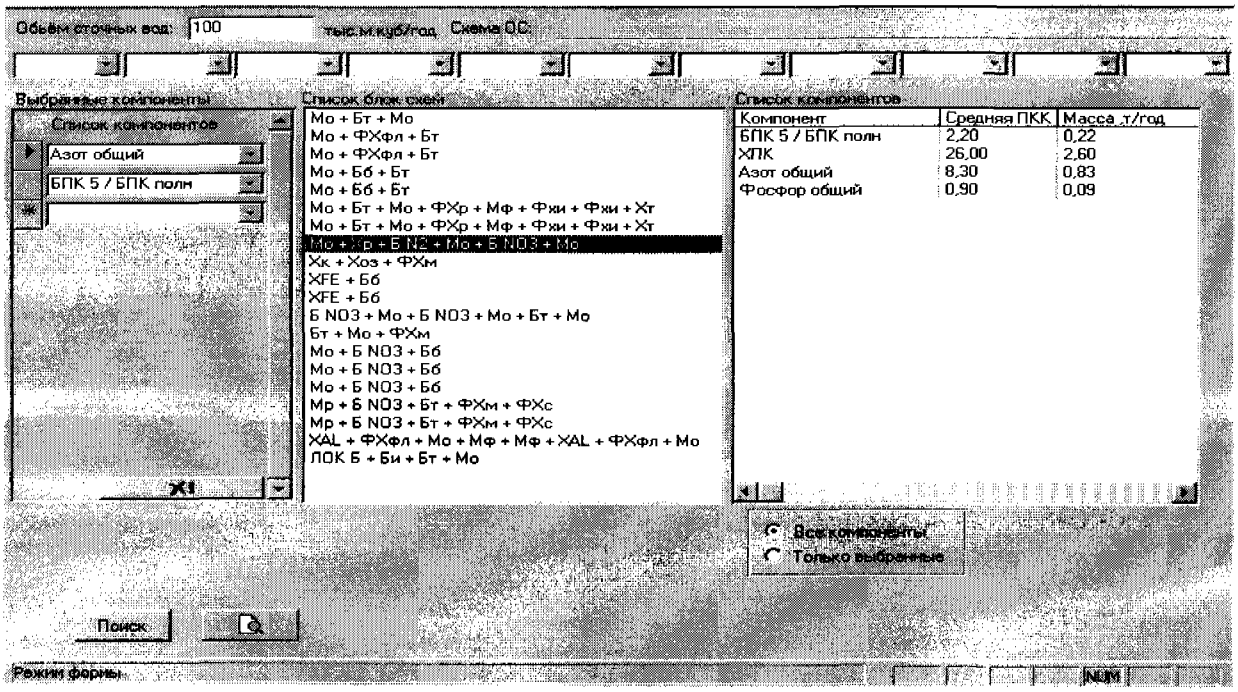

Fig. 1. Data base "WTP-PKK" block-diagram" by the BOD5/BODtotal criterion

For example, when setting norms for effluents the data on the waste water quantity are input to the information chart first line. The block-diagram of actually existing waste water treatment plants is input to the information chart second line. The zone of interest is identified in the components list."Search" is being effected. Data on advanced water-protective technologies stored in EcoTech appear in the block-diagram list. When expanding the zone of search with the "All components" mark the list of components shows data on all ingredients mentioned for the block-diagram being considered (marked with a black stripe), their maximal final concentrations (MFC), as well as spills with the given quantity of waste waters. Reverse tasks can be solved as well: options of waste water necessary treatment can be assessed by maximal permissible discharge of a specific ingredient.

As a result of development and updating with information on results of water -protective technologies introduction, EcoTech data bank becomes a source of analog for rationally organized enterprises water-economic systems, the warning complex *against* water resources degradation (transformation section), and a system of measures of their restoration.

EcoTech information can be used for:

- development of basin schemes of integrated water management;
- substantiation of ways and stages for water resources quality target indicators attaining;
- audit, certification, ecological/economic examination of enterprises water activities, water use licensing;
- development of recommendations and projects on step by step or integrated reconstruction of waste water treatment plants;
- setting norms for discharges for water users depending on the level of the used water-protective technology;
- development of recommendations for model designing;
- formation of ecological outlook.

ECOTOXICOLOGICAL STATE OF NATURAL WATERS IN DAGHESTAN

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It was practically total lack of data on biological value of natural waters in Daghestan that determined necessity of doing this work. In the course of our research we have carried out biological testing both of water environment and components of water ecosystems of different water bodies in Daghestan, main attention being paid to those water bodies that are exposed to the most intensive anthropogenic impact. First of all, it concerns watercourses and reservoirs in the area of the Terek river mouth, which have undergone an unexampled ecological pressing during and after the so-called "Chechen events". Suffice it to say that for the past seven years (1994-2000) about 120 thousand tons of oil products has come to the Terek from the Chechen territory.

Biotesting on algae. Tables 1 and 2 show results of our research carried out with the use of the laboratory culture *Scenedesmus quadricauda*.

Table 1. Inhibition of the *Scenedesmus quadricauda* culture rate of growth in water and in extracts from the Terek soils (characteristics of the Sulak river water and soils were taken as control data)

Table1.

Object, season		Gross output, percentage of control										
		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Water:	spring	108	100	105	95	95	85	70	95	85	80	72
	summer	97	125	97	100	90	93	85	90	95	50	82
	autumn	110	95	102	95	95	90	67	93	80	45	75
Soil:	spring	100	95	90	97	90	92	60	75	64	60	67
	summer	105	97	101	95	92	90	78	70	75	35	70
	autumn	97	100	97	105	90	95	60	64	80	40	73

Table 2. Inhibition of the net product (percentage of control) of the laboratory culture Scenedesmus quadricauda in samples of water and extracts from soils in 2000.

Sampling point	Water			Extracts from soils			Soil characteristics
	7.04	20.06	14.10	7.04	20.06	14.10	
The Terek river	70±3	82±4	85±4	83±3	72±4	75±2	Sand
Kizlyar-Caspian Sea Canal	93±3	100±4	95±3	108±6	94±4	95±2	Sand
K-8 Canal	93±5	95±3	95±5	91±4	88±4	90±2	Uliginous
Bryansk (coastal waters)	-	100±2	-	-	105±5	-	Uliginous
K-6 Canal	73±2	105±2	95±5	91±4	94±3	90±4	Uliginous
Arakum reservoirs	85±5	95±4	103±5	75±5	75±2	73±4	Uliginous
Low-Terek reservoirs	73±2	95±5	93±4	85±2	75±2	63±7	Uliginous
The Sulak river	100±3	103±3	96±3	93±2	94±3	105±5	Sand
The Samur river*	95±4	87±2	100±2	88±3	75±4	85±4	Sand

Note: *-samples were taken on 25 April, 3 July and 30 September

Before 1993, the water and extracts from the Terek ground soils did not inhibit the growth of phytoplankton but rather stimulated it. From 1994, regular decrease in the primary output was to be observed, and in 1999, individual samples showed total mortality of plankton. In 2000, toxicity of the Terek water slightly came down - figures of gross output were down 20-30%, while extracts from ground soils showed a climb of 30-40 % in comparison with the control group.

Results of the one-year monitoring surveys (Table 2) allow to conclude that in all seasons water of the Terek River

remains the most toxic, the Sulak water being the least toxic. The similar picture is observed in toxicity of ground soil extracts. Greater extent of toxicity in soil extracts from reservoirs in comparison with the soil extracts from the Terek, canals and headers can evidently be explained by passing of contaminants from water into ground sediments due to lessening in flowage of water bodies. Besides, toxicity of ground soils is very largely determined by their physical-chemical characteristics and granulometric composition.

Biotesting on organisms of animal plankton. The Terek water has always demonstrated its natural toxicity to animal plankton. However, in 1990-93, mortality of Daphnias did not exceed 5-10 % of basic amount of individuals, while beginning from 1994 toxicity of water started to rise steeply to achieve its peak in1999 when Daphnias were observed to perish in the very first hours of contact and by the end of 24 hours 100 % of individuals were dead (Table 3). Their behaviour was characterised by clearly expressed deviations - at first they continued to move, then their activity slumped, they sank to the bottom of the vessel and died after convulsive contraction of extremities.

The same picture of toxicosis is caused by aromatic hydrocarbons. In 2000, 60% of individuals died in samples of summer and autumn surveys that testifies to the high toxicity of the Terek water.

Table 3. Vitality of Daphnias (mortality percentage of basic amount) in the Terek water (numerator) and in aqueous extracts from soils (denominator).

Season	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Spring	5/10	0/5	0/5	5/5	20/20	20/15	40/20	30/20	55/30	40/30	30/45
Summer	0/5	5/5	0/10	10/5	25/20	25/10	60/25	50/30	65/30	100/40	60/30
Autumn	5/5	0/5	5/5	5/5	30/15	20/25	60/30	55/30	60/30	100/55	60/30

Toxicity of the aqueous extracts from soils has also been growing since 1994. Beginning from 1997, this parameter of vitality has steadfastly remained at the level of 30-50 % that points to steady and chronic contamination of the Terek ground soils.

Of all streams examined in the Terek mouth area in 2000, water samples from the main riverbed appeared to be the most toxic for Daphnias. In this respect reaction of animal plankton organisms to the toxic impact of environment bear similarities to the reaction of phytoplankton. From the other hand, toxic impact of soil extracts from the Nizhne-Terek reservoirs exerted on the animal plankton is more striking than their impact on the phytoplankton.

We have not found any considerable difference between toxicity of aqueous extracts from bottom sediments of over-flow canals and the Terek River: their toxicity is mainly determined by granulometric composition.

Our research revealed an extremely unfavourable ecological situation that has formed in the natural water of Daghestan. First, this concerns the Terek mouth area and Caspian coastal waters. Not only high level of anthropogenic burden on the water bodies of Daghestan threatens with ecological dangers, but the tendency of its growing from year to year constitutes even more grave danger.

EFFECT OF WATER ENVIRONMENTAL FACTORS ON CHANGES IN ECOLOGY OF CASPIAN SEVRYUGA SPAWNING RUN, EXAMPLE FOR RIVER URAL

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Caspian sevruga provided from a quarter up to half of world sturgeons fishing yield. Some centuries in Caspian Sea existed as trade fishing in rivers so sea trade fishing, the latter irrational from positions of fish productivity. From middle of the sixtieth years of the expired century and till disintegration of the uniform state USSR (the Soviet Union) in year 1991 the sea sturgeons trade fishing was stopped and transferred in the rivers in the period of sturgeons spawning migration. In the basic area of fishing, Northern Caspian (NC), there are rivers Volga and Ural. If sevruga share, caught in Ural, is n to yield in NC, so in Volga (1- n).

Below we consider dependence of relative fishing sizes in % in each of the rivers for the period 1966-1990 years (for the subsequent period the statistical data on fishing yield become not representative) from the ecological factors determined by a water mode. The sevryugas shares in both rivers for the period discussed changed about 2,5 times (in Ural from 30 till 75 %). It is not possible to explain such big changes by fluctuation in spawning stocks in rivers.

As a result, the negative relation of sevryuga yield, fished in Ural, from a level of the Caspian sea is precisely traced. The separate years of the period forms three sets of points at different state of a sea level, in each of which the dependence of fishing yield and sea level is negative.

At a minimum of the sea level for the discussed period - about marks a minus 28,95- 28,8 m on Baku footstock - the years 1976-1978 formed one group of points, characteristic of maximal sevryuga yield in Ural, (till 75 % of yield in NC).

At more high of a sea level about marks minus 28,6- 28,2 m the sevryuga yield in Ural is lowered (42-71 %), the second set of

points (years 1966-1975, 1979-1980) is grouped, which can be described as

$y = 70 x - 179,6$, ($n = 12$, $r = 0,83$). (1)

Here at parameter y - percent of sevryuga, fished in Ural, to her total yield in NC, parameter x - sea level on Baku footstock (in the equation instead of negative values the sea level is expressed in conditional positive values - for a mark of a level a minus 27 m conditional size makes 2 m, for a minus 28 m is accepted for 3 m, and for a minus 29 m for 4 m).

And at last - at the further rise of a sea level - by mark about a minus 28,1-27,5 m - the character of relation changed, also it is submitted by the third set of points - per years 1981-1990 with more water flow. The fishing yield in Ural thus is more lower - in interval 73-30 % from sevryuga yield in NC. The equation for these points looks like

$y = 60,95 x - 120$, ($n = 10$, $r = 0,95$). (2)

By changes in the equations (1) and (2) of a mark from minus for sea level (parameter x) to condicional plus marks the relation seems positive, in situ, on the contrary, it is negative.

As the most real explanation of such dynamics of a sevryuga spawning run in Ural at a different sea level may by the influence of a well known shallow threshold, dividing the NC on western and eastern half (Biological productivity of the Caspian Sea, in Russian, Moscow, Nauka, 1974). At a sea level by mark minus 27,5 m the section of a threshold makes about 65 % of the maximal size of its in a year 1929 (at a mark of a sea level about minus 26 m), at minus 28 m the section is reduced up to 55 %, at minus 28,5 m makes 45 %, and at a mark minus 29 m- about 35 % of the maximal size in year 1929.

It is interesting to discuss the influence of rivers flow capacities on dynamics of a sevryuga run in Ural. With annual water flow of Ural the dependence of sevruga run in Ural is poorly negative. So is with the april monhly urals water flow. As long as the annual water flows of Volga and Ural varies unidirectional, it is more really possible to explain falling of a sevryuga run a in Ural at increase of its flow only by increase of an attracting for fish run role of the Volga flow by growth of its volume - the april flow of Volga is in many times higher than Urals one.

The comparison sevryuga yield in Ural with april flow of Volga conduct to conclusion, that the Volga water flow in volume less then 21 km^3 on intensity of sevryuga run in Ural does not influenced. However at futher increase of april water flow of Volga more then 2 km^3 (with a maximum in year 1966 till 47 km^3) a negative relation yield - flow is shown: (in years 1966, 1970, 1979, 1981, 1983, 1986, 1988), which can be expressed as

$y = 97,2 - 1,2 x$, ($n = 7$, $r = -0,82$),

where at y - percent of sevryuga crop in Ural from its fishing yield in NC, and x - flow of Volga in April, km^3.

All told above allows to believe, that in environmental condition in period discussed a level of the Caspian sea and a water capacities of Volga in April were able to render serious influence on hereditary spawning migration and redistribution of Caspian sevryuga stocks between the rivers. It is expedient to consider the NC together with low parts of Volga, Ural, Terek as unitary ecological object (the biom) with following from here strategy for fisheries resources exploatation.

EFFECT OF SEASONALITY ON THE CONTENT OF THE NATURAL ORGANIC MATTERS IN SUPERFICIAL WATER SOURCE

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As a rule natural organic compounds in superficial water source are presented as humus substances. Humus substances could be of marsh, plankton or soil origin. Ways of migration of humus substances to a water source are different and depend on their origin. Extraction of natural organic compounds during potable water preparation is a basic technological process, that is why forecasting of natural organic compounds content is important for exact planning of water purification, reagent expenditure, optimization of purifying technology etc.

The content of natural organic compounds based on the index of oxidation in river Ufa (the main source of potable water of the city) during 1994-2000 was analyzed. This index is one of the basic indices of quantitative estimation of the content of the natural organic compounds in water.

To find out the influence of seasonality on changes of humus substances concentrations seasonal decomposition method of time series was used. Trend values were obtained by using moving average method. Average trend value ranges 2.58 ± 0.38 mgO/L. Seasonal effects estimation was based on seasonal indices (SI). SI were calculated as the next: the ratio of the theoretical means of oxidation to trend values expressed as percentage were found. Then the arithmetic middling of this ratios for each month was calculated (S_i) and the sum of all obtained values for all the period was found. Conditionally the sum of all values corresponds to the number of months multiplied by 100%. For each i-month the value of SI estimates as:

$SI_i = 1200 / \Sigma S_i \times S_i$

The character of changes of SI represents regularity of changes of actual oxidation indices through the year. So, the beginning of the flood (March) is characterized with sharp increase of SI values, the flood peak falls on May and then quick decrease takes place till July. The period from July to March shows smooth decrease of SI values and oxidation correspondingly till the beginning of the next flood (Fig.1).

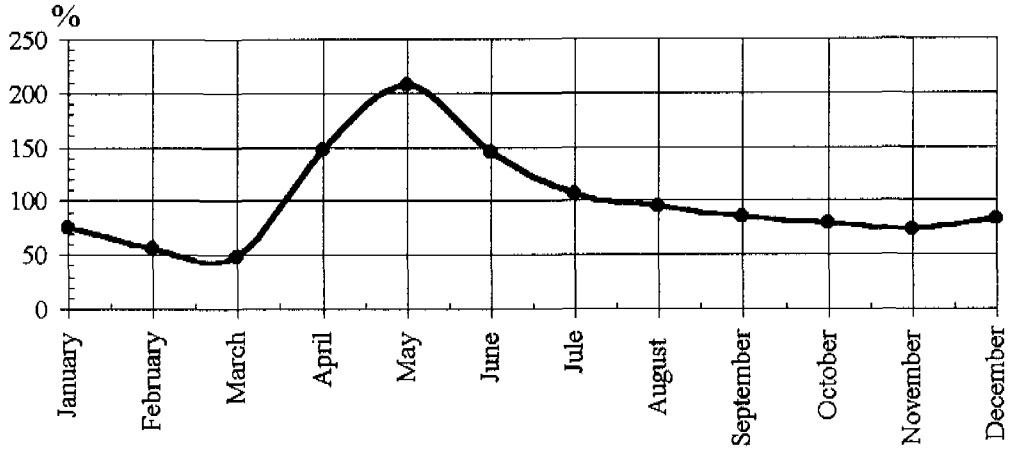

Fig.1. Calculated seasonal indices (SI) value for r. Ufa.

The oxidation values through the year could be obtained by using SI values and average trend value:

X_{calc} =tr×SI/100

X_{calc} - calculated oxidation value, mgO/L;

tr - average trend value, 2.58 mgO/L;

SI_i - seasonal indices value for i-month in percentages.

Obtained in this way values are averaged oxidation values of river water (Fig.2).

In spite of general line of changes of oxidation indices each year has it's own peculiarities. To estimate the stability of calculated SI values the effect of individual values on total result was checked. SI without one-year data of the period under review were calculated by turns. It was found that SI of January, February, March, July, October and November are stable and are in accordance with each other; influence of different years is insignificant, the deviations of SI in calculated values are less than 6%. The result shows that in these months the oxidation values for the river correspond to each other from year to year.

SI values of August and September are stable enough except 1994. The oxidation values of the river of this period were very high due to increased precipitation.

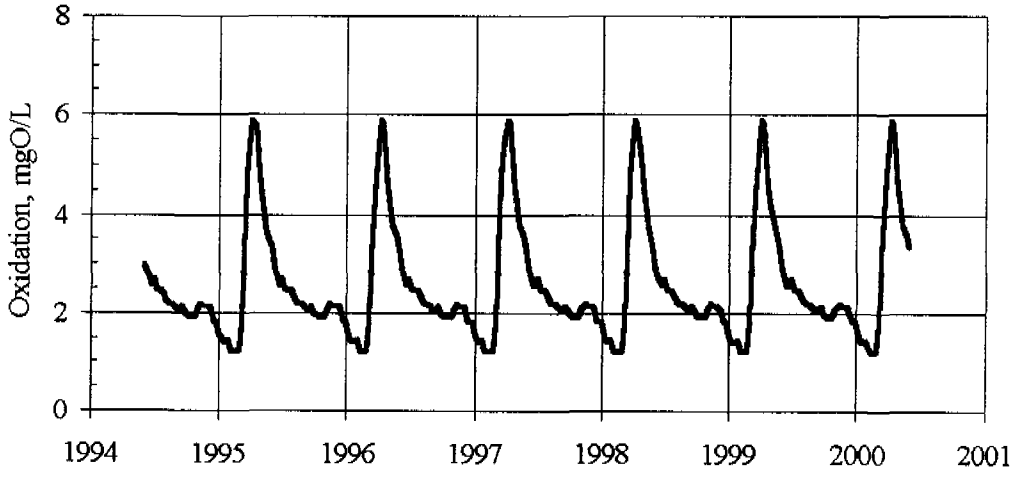

Fig.2. Plot of calculated oxidation values of r. Ufa.

The parameter spread is a bit higher for December and is 7.8%. That is due to increased concentration of humus substances in river on December of 1998, 1999 and 2000 in comparison with analogous period of preceding years. High content of organic compounds in the river could be explained by increased evacuation of water from the Pavlovka's storage pool.

The most essential differences of SI belong to flood period April-June; differences of individual years are up to 19.2%.

As the result the obtained SI values allow forecasting of the natural organic compounds content in the river water exactly enough. Some lack of coincidence between calculated and actual values are the result of averaging the calculated oxidation value and this difference could be considered a random process.

EFFECTS OF BOTTOM SEDIMENTS ON WATER QUALITY

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Forecast of metals content change in surface waters subjected to anthropogenic impact is, on the one hand, a necessary link in organization of water streams and reservoirs protection, with taking into consideration all processes occurring in aquatic ecosystems, on the other hand, such a forecast is insufficiently elaborated methodically. For instance, prediction lacks such a component as secondary pollution of waters with metals supplied from bottom sediments.

This paper contains results of an experiment on determination of metals (Ni, Co) compounds supply to water from bottom sediments of water bodies-recipients of metallurgy/mining waste waters containing sulfide minerals, as well as kinetic parameters of the self-purification from metal ions in the system without bottom sediments.

In order to conduct a laboratory experiment, bottom sediments were taken from the Sorya river (a receiver of waste waters and surface runoff from the territories of the Krasnouralsk Copper-melting Plant - up to 8 % polluted with metal sulfides). Table 2 gives chemical composition of the bottom sediments pore water and the water body water. The experiment was conducted both in aerobic and anaerobic (that is possible in winter) conditions.

Table 1.

Chemical composition of water	Co, mg/dm^3	Ni, mg/dm^3
Bottom sediments pore water	1.7	0.87
The Sorya river	0.1	0.04

Intensive outcome of sulfates from bottom sediments was observed in the course of the experiment in aerobic conditions, this is explained by transition of metal sulfides into dissolved sulfate form, this causes decrease of pH in water of the stream. Dependence of hydrogen ions supply (r ion/м^2) to the solution by bottom sediments on the time of contact with bottom sediments (ϕ, hour) at T=18-20°C:

$[H^+]=0.0583*10^{-3}\cdot\phi$, (1)

Specific supply of metal ions from bottom sediments with different values of pH is given in table 2.

Table 2. Influence of pH value on ingredients supply by bottom sediments.

pH	SO42-, mg/cm^2*day	Co, mkg/m^2*day	Ni, mkg/m^2*day
7.3	0.219	43.96	28.54
6.2	0.287	55.73	-
4.9	0.408	119.43	71.66

When the experiment was conducted in anaerobic conditions no metal supply from bottom sediments was observed, this is natural for reduction medium.

In winter time anaerobic conditions are quite often when metals present in the solution are transferred into insoluble sulfides and the metals outcome from bottom sediments is not actually observed.

Processes of metals transition from bottom sediments to water and pH value decrease can occur at a river range with bottom sediments polluted with sulfides, under the influence of microflora and physical/chemical processes. The pH value decrease is determined by hydrogen ions (2) concentration at the initial range $[H^+]_1$ and by the hydrogen ions supply $[\Delta H^+]$ due to secondary pollution, with taking into consideration bottom sediments area (S), water volume at the range under consideration (V) and the velocity of hydrogen supply to the solution determined by the formula (1):

$$[H^+]_2 = [H^+]_1 + [\Delta H^+] \quad (2)$$

$$[\Delta H^+] = \frac{S \cdot [H^+]}{V} \quad (3)$$

Be the value $[H^+]_2$ one can determine the water pH value:

$pH = -lg[H^+]_2$ (3)

An experiment on research of surface waters self-purification from metal ions in the absence of bottom sediments has been conducted. Metal concentration in water changes are described by the following equation:

$$C = C_0 \cdot \tau^{-b} \quad (4)$$

where C_0 is-the ingredients concentration at the initial range, mg/dm^3;

C is the ingredients concentration at the range being determined, mg/dm^3;

ϕ is time, days.

-b are the coefficients values for C_o = 0.2991,

Ni = 0.1341.

Metals concentration in water bodies changes due to pollutants supply from bottom sediments can be determined by equation (4):

$C_2=C_1+\Delta C$ (4)

where C_1 is the ingredient concentration at the initial range, mg/dm^3;

C_2 is the ingredient concentration at the range being determined, mg/dm^3;

ΔC is the ingredient concentration increase at the range being determined, mg/dm^3

$$\Delta C = \frac{c \cdot S \cdot \tau}{V}, \qquad (5)$$

where c is the ingredients output from bottom sediments (table 2), mkg/m^2*days;

S is the bottom sediments area, m^2;

ϕ is time, days.

V is water volume, dm^3.

The obtained experimental data have been verified at tributaries of the Tura river and can be used in forecasting of water streams and reservoirs, receivers of copper-melting and mining waste waters, water quality.

EVALUATION OF CHANGES IN THE ION COMPOSITION OF THE TEREK RIVER

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The table gives experimental data of V.V.Tsirkunov, received in the course of studying hydrochemical regime of the Terek River main ions at the river station in the village of Stepnoye, and results of our research drawn within the period of 1936-2000. Before considering these data, we think it necessary to note that studying hydrochemical regime of rivers under anthropogenic influence by arithmetical mean concentrations shows only main tendencies in its transformation because random sampling without taking into account peculiarities of hydrochemical regime of the river makes final results uncertain.

Assessment of changes in the ion composition can be carried out with the use of ion concentration absolute values. At the same time this approach is hardly to be considered fruitful due to fluctuations of water-content during observation periods and its instability caused by natural and man-made factors, the latter manifested in ever-diminishing discharge rate resulting from increase in offtake. With the object of getting comparable values we have used relative changes in the ion concentration, $R= (C_i-C_i)100/C_i$. Calculation data are shown in Fig. 1.

Experimental data show that the greatest rise is observed in the ions of Mg^{2+}, (Na^++Ka^+), SO_4^{2-} and Ca^{2+}. Such increase in content of calcium, magnesium, sodium and potassium may be connected with anthropogenic changes in the landscape of the basin, for example, with the extent of its being ploughed up. So, calcium and magnesium come into water as a result of rock and soils lixiviation, but calcium precipitates in the form of $CaCO_3$, while magnesium which is similar to calcium in what concerns regularities of migration is strongly adsorbed by negatively charged colloids of soils and loams.

Table 1. Changes in the chemical composition of the Terek water in 1936-2000

Ions	Period of time, years	Number of tests	Arithmetic middling, mg/l	$(C_i-C_i)100/C_i$
Ca^{2+}	1936-1950	40	74.7	0
	1951-1964	10	72.6	-2.8
	1965-1975	25	74.0	-0.9
	1976-1980	10	72.0	-3.6
	1993-2000*	55	97.7	+30.8
Mg^{2+}	1936-1950	40	14.7	0
	1951-1964	10	15.9	+8.2
	1965-1975	25	16.9	+15.0
	1976-1980	10	18.9	+28.6
	1993-2000*	55	31.3	+112.9
$Na^+ + K^+$	1936-1950	40	22.8	0
	1951-1964	10	21.2	-7.0
	1965-1975	25	30.1	+32.0
	1976-1980	10	32.0	+40.4
	1993-2000*	55	38.8	+70.2
HCO_3^-	1936-1950	40	204	0
	1951-1964	10	180	-11.8
	1965-1975	25	178	-12.7
	1976-1980	10	178	-12.7
	1993-2000	55	125.5	-38.5

Ions	Period of time, years	Number of tests	Arithmetic middling, mg/l	$(C_i-C_1)100/C_1$
SO_4^{2-}	1936-1950	40	92	0
	1951-1964	10	109	+18.5
	1965-1975	25	117	+27.2
	1976-1980	10	149	+62.0
	1993-2000*	55	143.7	+56.2
Cl^-	1936-1950	40	20.9	0
	1951-1964	10	19.7	-5.7
	1965-1975	25	30.5	+45.9
	1976-1980	10	36.7	+75.6
	1993-2000*	55	26.4	+26.3
α_i	1936-1950	40	433	0
	1951-1964	10	448	+3.5
	1965-1975	25	449	+3.7
	1976-1980	10	521	+12.5
	1993-2000*	55	455	+7.4

Note: * - our data, the rest- data by V.V.Tsirkunov

Of all main ions only hydrocarbonates show fall in concentration. A similar fact is also observed on other rivers suffering from considerable anthropogenic influence - the Don, Syr-Darya, Danube, etc. Reasons of decrease in absolute concentrations of HCO_3-ions stay obscure. Lewis and Grant explain this phenomenon by the surplus intake of hydrogen ions with atmospheric precipitation $HCO_3^- + H^+ = H_2O+CO_2$.

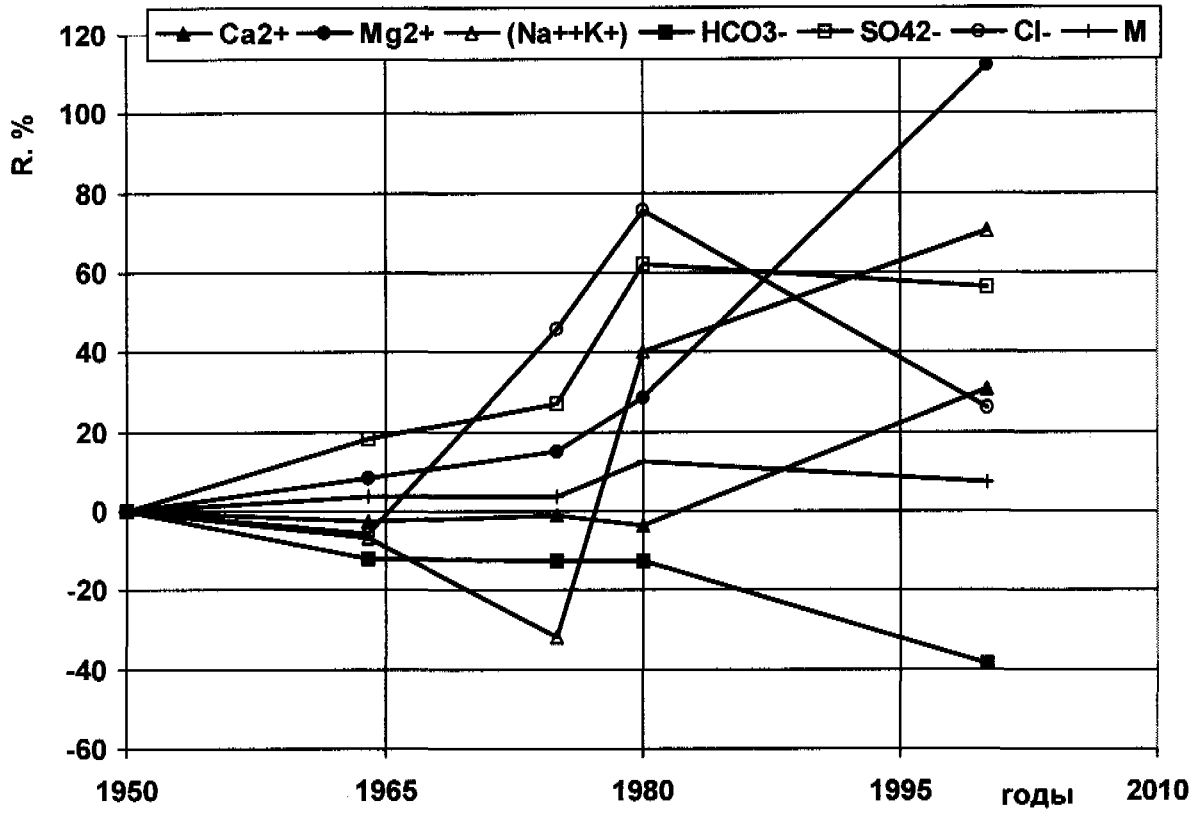

Fig.1. Relative changes in the ion concentration of the Terek water in the course of time.

However, such phenomenon cannot have a regional distribution because from 1936 to 2000 the Terek pH value did not diminish, on the contrary, it rose a little.

In the period under investigation, mineralization of the Terek increased by approximately 10 %. The main reason of such "insignificant" changes in the $\sum i$ is decrease in concentration of the prevailing in weight hydrocarbonate ion.

So, since 1940-s, hydrochemical regime of the Terek has undergone considerable changes. These changes are manifested by increase in the content of Mg^{2+} ions to 100 %, $(Na^+ + K^+)$ ions to 70 %, SO_4^{2-} - to 60 %, Ca^{2+} - to 30 %, Cl^- - to 70 % and by decrease in the content of HCO_3^- to 35 %. It must

be noted that some of these figures need additional examination because unambiguous, free of bursts, regularities in changes of concentration in the course of time are not found in all the ions. Besides, chemical composition of natural water is usually expressed as concentration of different elements or ions. Nevertheless, in a compound aqueous medium, ions tend to combine into various complexes. Presence of such associates shows considerable difference between analytic concentrations and activity of the given ion. In many cases, when studying, for example, bioaccumulation and toxicity of elements, it is more difficult to define the level of the element's activity in natural water than to fix its concentration.

Results achieved in the course of this work should be taken into account when searching reasons of salinization of croplands irrigated by the Terek water.

EVALUATION OF WATER BODIES WATER RESOURCES POTENTIAL: CONCEPT, METHODS AND PROSPECTS

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Natural resources and their territorial combinations have the value, definition and account of which is becoming a mandatory and essential component of the social/economic and political decisions making process. The absence of natural resources cost evaluation in account of national wealth leads to strategic and tactical errors in planning of he regions social/ecological/economic development. Reconsideration of the water resources potential (WRP) value in the overall economic potential of the country and the territory in the aspect of contemporary social, ecological and economic problems of Russia became a prerequisite for the development of the WRP economic evaluation methodology. At the previous stage of studies the concept of full economic value of water bodies was considered the most acceptable and meeting the current requirements concept of the WRP economic evaluation. This concept plays the central role in WRP evaluation, as it permits to evaluate different kinds of benefits connected not only with use but with preservation of the "water body" system, its resources and services, including those that can not be expressed in money form, in the system of market preferences.

In the presented methodology version evaluation criteria for each element of WRP were developed and a classification by social/ecological/economic importance of individual resources categories for the reproduction process was developed. This methodology is characterized by integrated approach to WRP as a system of inter-related elements. The following potentials of lower order are identified as the WRP elements:

- water supply potential;
- assimilation potential;
- hydro power potential;
- hydrobiological potential;
- anthropological-ecological potential;
- territorial potential.

Each of these potentials is characterized by a certain value and qualitative state.

At the first stage of economic evaluation the river catchment zoning is performed. Identification of water-economic territorial units of various type and rank, their spatial identification in terms of water bodies resources distribution permit to differentiate the WRP economic evaluation indicators in territorial respect. It is proposed to consider the catchment territories within the RF constituent members boundaries as initial unit in order to perform the WRP economic evaluation, this will permit practically determine the water bodies WRP nowadays.

At the next stage WRP individual elements are classified by groups and categories with taking into account social/ecological/economic importance, resource and possibility of its use; the key evaluation category is chosen, too. The following potential groups are isolated: instantaneous stationary reserves and replenishing resources. Then resources categories are isolated within the groups: total bulk reserves, potential reserves, and operation reserves.

Further the integral water potential is economically evaluated. Depending on the WRP group various methods are used for evaluation: to assess the single moment instantaneous group conventionally-survey method or method of declared preferences method is used; for assessment of replenishing resources group rent evaluation methods are used, this permits to demonstrate more convincingly value and prominence of the water resources potential itself, as well as efficiency of its use as a full-right factor of economic activities and to determine its place in aggregated national wealth.

In evaluation of the resources groups special attention should be paid to account of the time factor and conversion of the annual evaluation indicators to comparable form.

The methodology permits to obtain economically substantiated indicators of surface water bodies water resources potential cost. The proposed methods are applicable within the boundaries of integral economic space of Russia, and they correspond to the contemporary world level of research in this field (state of art).

Economic evaluation of water resource potential permits to create an information base for formation and realization of efficient mechanisms for water use processes management both at the macro-economic level and at the level of regional economic processes.

EVALUATION OF WATER RESOURCES FOR BASIN WATER MANAGEMENT COMPLEX

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Evaluation of water resources is necessary for effective management of quantitative and qualitative parameters of surface water and groundwater in the process of their joint utilization for the needs of basin water management complex.

The main criteria in estimating the magnitude of operating resources is non-disturbed (nature protectoral, ecological) run-off, that must be preserved in the river-bed in order to provide the optimum functioning of the river ecosystem.

The non-disturbed (ecological) run-off quantity is being established on the basis of river flow interaction phenomenon with the different elements of basin ecosystem and internal-reservoir process.

One of the determining factors while solving questions connected with the basin water management water supply is the nature and the direction of the surface and ground water correlation.

The portion of ground water (P%)in annual run-off is calculated with the help of this equation:

$P=a*F^b$, (1)

Where F is catchment area in monitoring range, km^2;

a, b are regression equation coefficients.

The general water resources considering basin surface water and groundwater correlation in order to provide water-supply of the water management complex needs to be calculated this way:

- with P<10%, W (gen)=W(surf)+W(gr) (2)
- with P>10% (for middle rivers) W (gen)=W(sur)(1-P/100)+W(gr) (3)
- with P<10% (for big general rivers) W(gen)=W(sur) (4)
- where W gen are general water resources ;
- W sur are surface water resources;
- W gr are ground water resources.

In the presence of large lakes in the basin water resources are estimated as a sum of hundred year long renewed resources brought to the water exchange period:

- W lk=Wren+ Wanc.st/T (5)
- Where Wlk are major lake's water resources;
- W ren are average many year renewed resources equal to the water inflow into the lake ;
- W anc st. are lake water resources hundred year long stocks
- T - lake's water exchange duration.

The proposed methods enables to evaluate river basin water resources in dependence of the given task with different exactness.

The more complete characteristics of surface and ground water could be obtained by conduction combined hydrological and hydro-geological research.

FORECAST OF WATER USE IN THE VOLGA RIVER BASIN UP TO 2010

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The assessment of water resources use and transportation by economy branches and population, as modern, as perspective, is of great importance for the development and realization of water resources management model of river basin, together with the evaluation of available water resources. First of all obtaining of reliable time series of water consumption parameters and analysis of natural-economic conditions, determining their values, is necessary.

Two approaches are traditionally used for the assessment of economy and population requirements to water resources (amount and quality): normative and extrapolation of the revealed tendencies in the dynamics of water consumption parameters. The normative approach is based on perspective assessment of constitution and structure of economic complex and production volumes in the main sectors of economy, as well as the number of population (urban and agricultural). The second approach is based on the analysis of regularities of variations of water resources use parameters in different branches of economy and by population in retrospective, revealing of the characteristic tendencies in their dynamics. The extrapolation of revealed tendencies is the base of assessment of perspective water consumption.

During the last 30 years (1970-2000) it is possible to reveal the following tendencies in water consumption for population and economy needs: its sharp growth during the first 5 years (from 29 to 37 km^3), relative stabilization in 1975-1991 on the level of 36-37 km^3 and significant decrease during the years of economic crisis (to 27 km^3 in 2000).

Volume of fresh water use had decreased from 31-33 km^3 in 80-th to 21.5 km^3 in 2000. The structure of water use had essentially changed, which was represented first of all in sharp increase of social component of water use. Domestic and drinking water consumption part had grown from 13 % in 1970 to 28 % in 2000, and agricultural water consumption part correspondingly from 1,5 to 3,5 %. Specific weight of water consumption on industrial needs in

all branches of economy had decreased from 78 % to 53 %. Volume of water use for irrigation had decreased from 4.5 km^3 in the beginning of 90-th to 1.7 km^3. The tendencies of sewage waters volumes variations were analogous to the tendencies of total water consumption variations, as for the whole basin, as for individual branches. Despite the decrease of amount of polluted sewage waters during the last years (from 11 to 8.4 km^3), their specific weight them in total water consumption had slightly grown.

The main preconditions of normative method are the forecast of the number of population and scenario of the development of economy branches. In 1996 demographers carried out the forecast of the population number of Russia till 2010 according to three scenario of its development. The last years have shown, that the demographic process was developed closer to pessimistic scenario. According to our assessments 55 mil. person will live in the Volga River basin in 2010 (in comparison with 60 mil. person in 1995), and 43.5 mil. will live in cities. Taking into account developing process of reduction of specific water consumption for domestic and drinking needs (during the last years this parameter in the Volga River basin has decreased by 50 l/day person), volume of water use on these purposes by 2010 will make up 5.0 km^3. Value of specific water consumption from agricultural water-supply systems, estimated per one agricultural inhabitant, had decreased during 90-th in 2.3 times. Taking into account the forecasts of development of cattle-breeding and the number of agricultural population for 2010, volume of water use on agricultural needs (without the irrigation) in the Volga River basin according to our evaluations will make up 0.8-0.9 km^3.

According to the forecasts of Economic Branch of RAS industrial production growth in 2010 in comparison with 2000 can make up 80-85 %, and according to the forecast of Ministry of Economy ~ 50%. Taking into account the tendencies of specific water consumption decrease per 1 rbl. of industrial production and forecasted rates of industrial production growth, submitted in these scenario, volume of water use on industrial needs in the Volga River basin by 2010 can make up 16.7 and 15 km^3 correspondingly.

The area of irrigated lands in the basin during 90-th years had been decreased from 2.1 to 1.4 mil. Ha, and the area of really irrigated lands - from 1.7 to 0.7 mil. Ha. According to the forecasts of reclamation development the main attention will be paid on the reconstruction and restoration of acting irrigation systems, the introduction of new irrigated lands into exploitation will be very insignificant. Proceeding from these preconditions volume of water use for irrigation needs is evaluated by 2010 nearly 1.5 km^3. Volume of water use for the other needs (mainly for the purposes of ponds fish-breeding) according to our assessments can make up 1.2-1.5 km^3. Thus, in conformity with the submitted scenario of socio-economic development by 2010, evaluated volume of water use for all needs in the Volga River basin is expected near 24-26 km^3, water consumption from sources - 29-32 km^3, and volume of water transportation - 19-20.5 km^3.

The estimations, based on application of statistical forecasting methods (autoregression model, model of sliding mean and complex model), resulted in the evaluations of water use volumes close to the normative method.

FRESH WATERS RESOURCES OF RUSSIA'S FAR EAST (STATE, USAGE, PROBLEMS)

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The Fresh Water Systems of Far East Region in the borders of land watersheds and island territories of the Pacific (Bering, Okhotsk and Japan Seas) and the Arctic Oceans Basins (Laptev, East-Siberian and Chukotka Seas), their states, using and problems are considered.

The report contents is submitted bellow.

Summary average of several years' Fresh Water Resources of the territory consist of 1811.5 km^3/year. Most of the quantity are related to the Laptev Sea Basin (616 km^3/year) and Okhotsk Sea (546.4 km^3/year). Least meaning are related to Japan Sea (51 km^3/year). Analogues order one can see and in territories distribution of potential working stores of ground waters. The maximum (34.9 km^3/y) is in Okhotsk Sea Basin and the minimum (4.5 km^3/y) - in Japan Sea Basin. The whole Region's Ground Water Resources are assessed in quantity of 70-80 km^3.

Some other picture one can see in distribution of specific water providing. The quantity of Fresh Water for square unit (1 km^2) and for a man maximum is for Bering Sea Basin - 562.1 thousand m^3/y. For the rest of basins it amounts 246-361.9 ths m^3/y or 291 ths m^3/y in average for the subregion. Minimum of water providing for a man is in the Japan Sea Basin, consisting 25.5 ths m^3/y.

The main kind of river feeding in the central and the north parts of the Region is thawed water (melted snow), consisting 50-60% of year flow. In south part of the Region the rain waters feeding prevails (50-80%). The share of ground water feeding is changed in main in the range of 5-15% (min is at the North and max at the South)

Potential hydro resources in the Region are assessed as 1152 billion kWth. The Laptev Sea (Yakut ASSR) and Okhotsk Sea (Amur River) water systems possess of the most of hydro power resources - 638 and 313 billion kWth respectively. Effective economical hydro resources consist in average for the Region 31% of potential ones.

The volume of waste discharge in fresh waters consists 1793 mln. m^3/y. The most volume of the waste discharge is marked in the Okhotsk Sea - 1088.3 mln.m^3/y and the least in the Bering and Chukotka Seas - 14.4 mln. m^3.

70-80% of water taken from fresh water sources is subjected to be discharged. 58% of waste waters in average are polluted more than standards let, reaching in the Japan

Sea Basin 78%. Region's treatment plants capacity consist 0.8 km^3/y. In sea basins waste waters potentially can be purified from polluting substances to standard level. Yet at the present time only 5-6% of waste water are purified because of unsatisfactory technical state of treatment plants, non correspondence treatment technology to water quality characteristics and organization character reasons, which lead to pollution of coastal sea areas (inlets, bays).

The analyses of modern concentration of pollutants in river waters has shown that less than 5% of concentration is forming in result of pollutants discharge with waste waters icluding all ingredients. That means the main part of pollutants flow in a river systems through its irregular discharge due to anthropogenic activity. But the most influence on pollutions content in river waters has its uncontrolled discharge at transboundary parts of rivers (Amur, Ussuri, Razdolnaja, Tumannaja rivers).

Problems of water objects anthropogenic pollution are one of the main social and economic Region problems.

The most economic damage to the Region of all natural calamities cause floods reasons of which are high summer-autumn waters at the south and snow or snow with rain high waters, ice jams and obstructions at the north. Here we can see a negative influence of river-bed flow directed to washing away of river banks. In this case sanitary state of water objects and surface water sources of drinking water supply quality are worsening. In some regions this process has a range of natural calamity. Recurrence of floods in the region is practically annual, that is why the social and economic meaning has also the protection problems of popularity from harmful influence of waters. Unfortunately, the existing at present the standard-methodical base of objects designing of anti flood protection is not sufficiently based and demands to be redone.

Practically for all the Region's Seas the essential year and inter year irregularity of river flow is characteristic. In regions with big anthropogenic water pollution this leads to essential potable water deficit and water supply problems.

The necessary item of water resources management is water ecology monitoring. At present time an information of the Russian Federation (RF) of state of water resources is distributed through different departments with bad coordination in exactness and quality. Interchange of information between departments is rather difficult. Full value observation net and data banks of hydrological, hydrochemical and hydrobiological and other states of water objects are absent. There is no the cadastre of non controlled pollution of waters. That is why a big significance has the problem of development and realization system of full value monitoring of Region's water objects including a monitoring of hydrotechnical constructions safety state.

The specific peculiarity of south part of the Region is the border between Russia and Chinese People's Republic, which length along the Amur River and its tributaries Argun, Ussuri and Sungach, aquatory of the lake Khanka, rivers Razldolnaja and Tumannaja consists about 70-80%. Population quantity, industrial and agricultural production of CPR in the Amur River basin is 20 times more than ones of Russia. Due to our approximate assessments the CPR's share in sewage and pollutions discharge in the Amur river (Okhotsk Sea basin), rivers Razdolnaja and Tumannaja (Japan Sea basin) consists about 70-80%.

In the situation it is necessary the coordination of efforts of RF and CPR on planning and realization of measures directed to decreasing of the anthropogenic load and mutual change of information of water objects state.

So, as was said above, the fresh water system of Far Eastern Region possesses by huge potential of water resources. At the same time the sharp unevenness of year and inter year flow, frequent floods, considerable anthropogenic loads to water discharge landscapes lead to pollution and degradation of water systems which define the scale of statement environment problems on the regional level such as:

- restoration of degrading water objects
- qualitative drinking water deficit
- territories protection from harmful water influence
- neutralization of negative sequences of transboard foreign counties influences to water objects
- organization of full value monitoring of water systems
- improving of a standard and methodical base of water economic problems solving.

GEOCHEMICAL CONDITION OF THE SMALL RIVERS - THE TOM INFLOWS

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During the twentieth century as a result of developing the industrial and agrarian complexes there was a considerable change of a chemical and microbiological structure of river water in many world regions. Degradating the river water quality and increasing the geologic run-off are exist. Specially strongly anthropogenous factor has an effect for the small rivers, that causes necessity of detail studying the geochemical water condition. The undercurrent Tom inflows are research objects.

Researches of these rivers were conducted in different time with the purpose of hydrogeochemical prospecting the mineral deposits and estimating the water quality. In result the data about the chemical element content in some water objects were obtained. However, the common conception of ecological and geochemical condition of the small rivers of this region, the regularities and features of the chemical composition change of water masses in process of nearing them to the main river till now not existed. The data of the complex ecological and geochemical researches and monitoring activities held in 1993-2001 by State unitary company Territorial center "Tomskgeomonitoring", Tomsk polytechnic university and other companies is initial information.

Summarizing and analysing the available data about chemical composition of river waters in catchment basins of the considered small rivers has allowed to establish following:

1) river waters are fresh with average (200-500 mg/l) or heightened mineralization (specially, in low water level period), neutral, alkalescent and alkaline (in summer and autumn), usually hydrocarbonate calcium;

2) inflows of the small rivers, as a whole, have more higher contents of the dissolved salts in comparison with main water current of river system, because the underground waters in process of bed flow movement are transformed as a result of interaction with dissolved gases, base depositions and organic matter (presumptively, one of the transformation mechanism - deleting the low-soluble carbonates from the solution;

3) in case of obvious anthropogenous pollution the geochemical water type changes - it becomes hydrocarbonate calcium-sodium or even sodium; the similar tendency is marked for other water objects in Tom basin, subjected to strong anthropogenous pollution;

4) considerable increasing the sulphates, chlorides and natrium concentration in the river water is not connected with concentrated issues of sewages, and with surface and underground transfer of these components from household dumps and industrial wastes;

5) except for absolute and relative (in comparison with ions Ca^{2+} and HCO_3^-) increasing the concentrations of Na^+, Cl^-, SO_4^{2-}, the anthropogenous pollution is characterized by increment of organic content and, accordingly, river water oxidizability;

6) microelement concentrations, as a whole, are insignificant and poorly correlated with organic contents on permanganate oxidizability value;

7) for the Ushayka water and its inflows, in comparison with the other small rivers, closer correlation are marked, that is explained by joint incoming the macro- and microelements in river water from anthropogenous sources; such correlation makes possible definiting the metal and biogenic substances issues by computational way (using the regress relations), that will cause to considerable reduction of prices of measuring activities of the monitoring companies.

GEOECOLOGICAL DESCRIPTION OF THE AMUR DOWNSTREAM LAKES

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The estimation of sedimentation velocity in lakes is given. 4 main types of lake geosystems are marked out. They are determined by two gradation of water exchange intensity and by two main morphogenetic types of lake's bed.

By the kind of trace metals' distribution in bottom sediments (BS) the lakes of the Amur Lowlands can be divided into 2 principal groups. From medical-geochemical point of view the revealed element dispersion background can provoke some endemic diseases and syndromes for both people and animals.

The abundance of autotroph organisms in BS and their significant role in processes on the water-bottom boundary are revealed. The organic matter (OM) is released from mortified aquatic vegetation to introduce in biotic circulation in overgrown shoals, and partly to be brought away with floodwaters. The analysis of microbe communities' structure in OM, their activity and total OM contents is given. The "OM burial" effect is observed in several lakes. The correlation between OM contents and phenole contamination is revealed. The water ecological row is composed according to easily accessible OM enrichment degree. The human-made contamination is marked in 2 lakes nearby cities.

The water masses of lakes by degree of phytoplankton development in the Amur low-water period can be attributed to various trophic categories depending on genesis. The lake waters descended the Amur, are conferred by trophic status on V and VI classes of quality.

The lake waters are qualified as hydrocarbonate ones of calcium group. pH is in main within the limits of 6,70-7,30; mineralization varies from 13 up to 150-200 mg/dm^3: the smaller values are peculiar to lakes with rather large watershed square.

Most pure, but hardly depleted by the dissolved matter (DM), waters characterize the mountain and marsh lakes. The low concentration DOM is peculiar for the former, high DOM level and iron - for marsh lakes with hardly swamped watershed.

The lowest concentrations of main and biogenic ions are observed in spring-summer period to be caused by thawed and rain waters income as well as aquatic vegetation development. The researched waters are enriched with oxygen (supersaturated on shoals and depleted in near-bottom stratum through warm period). By DM contents floodplain lakes are divided into two groups. The 1-st group includes the lakes with water mineralization within the limits of 30-40 in summer and till 80-90 mg/dm^3 in ice-period. The 2nd group lake water mineralization is a little bit higher - 50-60 in summer and till 150-200 mg/dm^3 in winter.

The taxonomic structure of aquatic-riparian vascular plants is represented. The regularities of distribution and ecological features of some species as well the specific features riparian-aquatic and aquatic flora are considered, and endemic and relic flora elements are characterized.

Annual production valued per lake square unit for the most widespread species - Nimphoides peltatum - to be the largest in the most grown lakes with low internal water exchange intensity. The specific (per plant cover square unit) plants primary production value is significant and hardly varies.

In spring-summer period, many regional fine-mesh fish species spawn and fatten in the lakes. The lake tributaries, where pacific salmons go to spawn, are put to the highest fishery category. Fish-productivity in lakes estimated by primary production forms 30-90 kg/ha per y.

GEOGRAPHIC ASPECTS OF DIFFUSE RUNOFF FORMATION ON AGRICULTURAL LANDS

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Agrarian activities in river basins is associated with a complex of negative processes, i.e. transformation of matter and energy flows, deterioration of the catchment runoff-regulating ability and natural waters chemical composition.

A trend to mitigation of the organized runoff from agricultural farms has been observed in Russia over the past years. However, a considerable portion of pollutants is supplied to water bodies with unorganized runoff from agricultural catchments, not with waste waters.

The Tobol River catchment (the Ob River basin) was used as a study case in research of geographic aspects of pollutants flows formation; this catchment is characterized by considerable extension both in latitudinal and meridian directions, this causes diversion of natural/climatic and economic conditions.

Total area of agricultural land in the Tobol catchment is more than 13 million hectares. In the structure plough land is predominant (69 %), the rest of the territory is occupied by pasture (26 %) and hay meadows (5%). The portion of pasture decreases from the steppe zone to the forest/steppe and forest zones, while the portion of hay meadows increases.

The researches have shown that in the periods of spring high water and rain high water it is agricultural land that supplies the main volume of nutrients to the Tobol catchment waters. In particular it relates to the lands located within the steppe and the forest/steppe zones. But even in the forest zone where agricultural development extent is insignificant, supply of nutrient from agricultural lands contributes much to nutrient pollution of water bodies.

In the sub-zones of northern and middle taiga characterized by high forest content and low plough land content as a rule no intensive ingredients discharge is observed, in spite of the pronounced wash-through character of soils. Liquid and solid runoff modules decrease occur from the forest zone to the forest/steppe zone, and, consequently, decrease of specific discharge of nutrients (per 1 hectare of agricultural lands) also occurs. However, the population density and the degree of economic development of the catchments dramatically increase in the same direction. Therefore the specific nutrient load (per 1 km^2 of the catchment territory) increases.

The researches have shown that currently the plough land extent of a number of catchments exceeds the maximal permissible ecological limits, this leads to intensification of erosion processes. Thus, in the Tobol catchment the considerable part of agricultural lands is exposed to water erosion that increases from the north to the south, this being associated with decreasing forest content of the catchments and increasing plough land content. Intensity of erosion processes increases in the conditions of irrigation. In the summer time the main volume of suspended matter is supplied to the Tobol from irrigated lands.

As a result of the researches performed a series of map patterns was composed, they permit to assess the degree of the catchment development and the value of nutrient load on water bodies, when taking into consideration natural characteristics and economic conditions. Besides, a plan of water protective measures for the Tobol agricultural catchments have been elaborated and a cost estimation of investments necessary for this plan implementation has been made.

Thus, due to the fact that leaching of pollutants depends to the considerable extent on specific features of natural/climatic and economic conditions, it seems expedient to take into more consideration geographic aspects of diffuse runoff formation when setting norms of economic activities and taking managerial decisions aimed at prevention (or decrease) of water bodies pollution.

GIS TECHNOLOGIES IN AGRICULTURA AND LAND RECLAMATION

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The growth of cost of technical resources necessary for the creation and operation of irrigation systems determines actuality of the problem of improving quality of their operation.

Appearance in 80 ties of PC has greatly increased the number of designers and users of programs enabling us to solve these problems.

In design and maintenance organisations, there began to appear new targets, requiring visualization of systems objects of also processes taking place in them.

GIS development leads to the wide use of PC in these fields.

Geo-informative technologies make it possible to use a precise digital maps and plans to visualise data and simplify their analysis increasing effectivity of taken decisions, as at the stage of designing so at the stage of operating reclamation systems.

In this connection the choice of the main lines of development of geo-informative technologies and mechanisms of their realization becomes especially important.

The analysis of GIS application by design and local agricultural and especially reclamative organization shows its low level.

In addition to the above mentioned the main problem hindering GIS application in agriculture and land reclamation are:

- the difficulty in developing the instrument of interaction of the user with the mathematical model of the designed object in the Limits of GIS possibilities;
- it can be explained by the fact that the majority of purposes of CAD are not deterministic that is they have no unambiguous algorithm of working initial data into the final results;
- inadequate base of standard-legal economic problems;
- inadequate information on modern software and hard ware support;.
- inadequate canals of experience exchange.

Nevertheless it is possible to speak about the progress in development of GIS technologies in the branch. So, the programme of research and scientific work of Ministry of Agriculture of Russian Federation for 2001 includes investigating and introducing GIS of taking decisions in the field of agricultural water supply). In 2001 began first-order development of the indicated GIS -technology.

In this programme a conception of geo-informative support of managerial decisions in land reclamation and agricultural water supply has been elaborated. This programme contains the main principles and stages of creation of a system geo-informative support of taking decisions on the base of development of GIS technologies.

Realisation of these targets has been realised by VNIIGiM developing a computer system of control and evaluation of technical condition of irrigation systems.

It includes a geoinformative system, a management system of the data base as well as standard and special programs providing the system of operational monitoring.

According to the results of the optimization problem the following information is given:permissible variants of repair plan, the list of operational objects to include into the plan of repair, capital investment required for realisation of the plan of repair.

Experimental functioning of Moscow region of Yakhroma flood land of experimental monitoring system is based on geo-informational technology shows the perceptivity of such approach to the planning repair-operational work to control and evaluation of technical state of the irrigation system.

GLOBAL WATER RESOURCES AND WATER USE

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Long-term studies on the assessment of water resources and water use on the Earth have been recently completed at the State Hydrological Institute. Unlike well-known publications on the world water resources prepared by M.I.Lvovich, A.Baumgartner and I.Reichel as well as by the State Hydrological Institute (in 1974), the present studies have been based on numerous methodological approaches which provided an estimation of water resources dynamics on the continents, from continental slopes, in natural - economic regions , selected countries and in river basins for a single long-term period since 1921.

The use of new methodological approaches and data from more than 10000 stations of streamflow measurements provide a rather reliable assessment of annually renewed water resources on the Earth in the volume of 42780 cu.km (without Antarctica). Among the continents of the Earth, the maximum water resources are formed in Asia (13500 cu.km), the minimum water resources are formed in Australia (352 cu.km). The largest renewable water resources occur in six largest countries (Brazil, Russia, Canada, USA, Chine and India). More than 40% of the world annual river runoff are formed in these countries.

Besides the assessment of annual water resources for all regions, the values of streamflow distribution during a year have been estimated; long-term annual runoff variations and dynamics of specific water availability for the population inhabiting all the regions and continents of the Earth have been analyzed. Mean annual water availability for the world population decreased by 1.7 times during the last 25 years all over the world. This is mainly explained by the population number increase by about 2 billion.

The dynamics of water use during the XXth century and for the future before 2010 and 2025 has been determined for all natural-economic regions and continents; trends towards water use have been estimated for the countries with different climates and levels of socio-economic development. The present global water use equals 3790 cu.km/year; water consumption equals 2280 cu.km/year; great variations in water use are observed all over regions and continents.

Two scenarios of fresh water use in the world have been applied for the assessment of the future water use in each region, i.e. the so-called Conventional Scenario (CS) and Sustainable Development Scenario (SDC). In accordance with the CS it is suggested that water use would be developed in the world according to the model of the past decades; the SDC is based on a wide future use of effective and improved technologies in irrigation and industries with the account of basic factors determining the specific features of each region.

According to CS, the total water withdrawal in the world before 2025 would increase to 5235 cu.m/year; the water consumption would increase to 2764 cu.km/year. Moreover, before 2025 it is possible to expect the water use increase by 15 to 35% in the developed countries and in the countries with limited water resources; in regions with developing countries and abundant water resources the increase of water use may be by 100-200%. The analysis shows that in case of such water use development a critical situation with water resources would be observed

in many countries before 2025; about 40% of the global population would live in the conditions of a catastrophically high load on water resources.

According to the computations based on the SDC, the world water use would be practically stable by 2025; moreover, the industrial water use would be lower by 10%; agricultural water use would be practically the same; and municipal water use would be by 25% higher (due to developing countries). Concurrently, in Europe, North America and in Australia it is possible to expect a lower water use by 22%, 24% and 5% respectively, if compared with that in 1995. On the other continents water use would be higher: in Africa - by 33%, in South America - by 21%, in Asia - by 12%. Still greater differentiation in the water use dynamics is expected in natural-economic regions of the world where it mainly depends on the socio-economic development of the countries included in the region.

Development of water use according to the SDC may greatly decrease the load on water resources on the global scale. According to the computations, the population number in the areas with catastrophically high loads on water resources may be about 4 times lower, if compared with the situation according to the CS.

The cardinal problem of the future water supply in the world may be solved only in case if effective projects on the improvement of the technologies of freshwater use are developed in combination with the appropriate measures on the increase of the available water resources.

HEAVY METAL CONTENT IN SEA BOTTOM SEDIMENTS WITHIN THE COASTAL AREA OF THE GEORGIAN SECTOR OF THE BLACK SEA

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The Black Sea can be considered as an intercontinental sea, subjected to the negative antropogene impact.

Sea bottom sediments are the last component in circulation of heavy metals in the nature, and are acting as indicators of water pollution and self purification of water environment. When the level of their accumulation is high the sediments can turn into the source of secondary pollution of the sea basin.

We have studied bottom sediments within the shallow part of the Georgian sector of the Black Sea shelf. Rivers flowing into the Black Sea drain several types of geological and landscape formations originating from the Greater and the Lower Caucasus, respectively the sediments deposited in the coastal strip contain marking elements of each of the mentioned units.

In the South part of the shelf, from the river mouth of Chorokhi River up to Batumi city the heightened content of copper, zinc and molybdenum originating from sulphide ores is observed. Sulphide minerals come from copper-pyrites deposits of the South Georgia and Turkey, located within Chorokhi river watershed.

Small rivers in the limits of the section from Bartskhana to Supsa introduce sediments rich in chromium, vanadium, manganese and iron formed by leaching of volcanogene ores of the main rocks, withered red soil crust and red soils of the West Georgia developed on the basis of the latter.

Sediments of Kolkheti lowland are notable for high manganese content. Manganese accumulates in the process of draining of the peat bogs. Besides, sediments of Rioni river are fortified with manganese originating from Chiatura manganese deposit and from residues of concentration enterprise.

The main pollutants of the sea environment within the region are municipal solid waste and effluents. For instance, in bottom sediments collected in the water area of Poti heightened content of zinc is detected which is the main indicator of "municipal" pollution.

Bottom sediments of water area in the limits of Batumi and Poti cities are under the technogene load. In comparison with the sediments of adjacent open areas of the sea shelf heightened concentration of copper, lead and zinc is observed here.

On the basis of obtained data plotted are the maps picturing distribution of copper, zinc, iron, lead, manganese, chromium, vanadium and molybdenum in bottom sediments of the coastal shelf of the Black Sea.

HEAVY METALS DISTRIBUTION RESEARCH IN THE BOTTOM SEDIMENTS IN THE UPPER VOLGA REGION

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Research on the heavy metals (HM) contents, in upper layers of bottom sediments (BS) of water object allows revealing the negative ecological influence of a various kind anthropogenous and technogenous factors.

Total contents of Cu, Zn, Cd, Pb, Mn, Fe and mobile forms Cr, and also organic matter (OM) (losses after calcination) in the samples were determined in the upper (25 sm.) layer of BS in different stretches of the lake Seliger.

To estimate the technogenous pressing according HM pollution of BS with the account of granulometric structure, a special study of BS in southwest part of Seliger was realized in 2000 together with Kostjakov's SSE RSRIG&M (Moscow) and the Heidelberg University (Germany). Contents of Pb, Zn and Cd were analyzed in BS fraction less than 20 microns in size and BS pollution was estimated by classes of geoacummulation (I_{geo}-classes).

The maximal values of Pb (at the level of "average pollution" according I_{geo}-class), Cu and Cr contents were observed for the period of researches in the upper layers of BS in a zone of influence Ostashkov city sewage and in the BS in the area of river harbour of Ostashkov. High concentration of Cd and Zn are revealed in the Lake Seremo and in the central part of the Selizharovo stretch. High content of Mn is observed in the BS selected in the deep-water zones of the reaches. The analyze of HM and OM content has allowed to reveal formation of geochemical association of Cu, Pb, Cd, Zn, Cr with Fe and OM in the upper BS layer, and Mn is allocated in separate association.

The TM content in the underlying soils of the Seliger lake system is dispersed relative to the clarke of sedimentary soil. Studying stratified BS has allowed revealing some laws in the HM accumulation in the lake sediments during the long geological period. Cd, Zn and Pb are accumulated in BS more actively then in underlying soils (clays) (in 14.5 times, in 3.0 times and 1.9 times correspondingly). In respect to the clarke of sedimentary soils the Cd and Zn are accumulated more actively in 4.3 times and 2.6 times correspondingly. The close correlation between accumulation of OM and Cd and the return correlation between accumulation of OM and Mn is established. Mn dispersion relative to the underlying soil is observed in the BS the central parts of eutrophic lakes. The Cu accumulation is not high. The increase of Pb content in the upper layer BS (0 - 1 m) is connected with technogenous impact.

Sites with various character of accumulation and the level of HM pollution are established according to research of distribution HM in the BS of the Upper Volga Region. It is the part of Upper Volga Lakes with the high content of OM and increased HM content while absence of technogenous pressing and the site of the Volga river which is situated lower than Beyshlot and characterized by the higher total HM content in the BS in the places of technogenous pressing (Selizharovo, Rzhev, Zubtsovo, Staritsa, Tver cities). The level of pollution estimated according I_{geo}-classes as "average pollution" according the content of Pb is found in Tver city in T'maka river. In other cities BS pollution by Zn, Pb and Cd is revealed as "moderately pollution".

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HYDRAULICITY OF THE YEAR BY THE RIVER FLOW AND ECONOMIC ACTIVITY

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The hydraulicity of the year, especially extreme, in many respects determines the character and scales of economic activity. On the other hand, economic activity - important factor in formation of the rate of streamflow. The special attention in interaction between hydraulicity of the years and economic activity deserve wet and dry years. Among the first are the years of less than 25% probability, among the second - the years of more than 75% probability.

In Forest, Steppe-forest and Steppe zones of Russian plain the contribution of dry years in formation of an average long-term runoff makes accordingly 15-25, 10-20, 5-10%. For wet years this participation is defined on the average by sizes: 30-40, 35-55, 55-70 %.

By the specificity of influence on the rate of streamflow in conditions of the most part of Russia the anthropogenous factors are expedient for grouping as follows:

- influencing the conditions of the flow formation on catchments and most brightly shown during a high water (basically land treatment and agricultural afforestation measures);
- transforming the water regime in the channel network and changing general rate of streamflow both during a high water, and in the warm period of the year (hydraulic engineering structures);
- influencing the size of the annual runoff due to the use of water resources mainly in the warm period of year (mainly, various branches of water economy).

At increase relative (in %) reduction of a flow under the influence of land treatment measures with the hydraulicity reduction the greatest changes in the volume of runoff are observed in the average and wet years. In the most dry and wet years their effect is close to zero. In dry years due to the fact that the overland flow practically is absent, and in wet years - because of extremely adverse conditions of infiltration and evaporation.

With increase of hydraulicity the requirement for water of various branches of water economy is usually reduced in connection with the simultaneous decrease of dryness.

The given regularity also works by comparison of a flow of the large rivers - Volga, Dnieper, Don with needs for water in territories, adjacent to mouth sections. But the relation is not clearly defined, especially not in the most extreme years. Thus irrigation rate at Elton station on the average long-term aspect only in 1,09 times is higher, than in wet years of less than 25 % probability by the Volga runoff (at Volgograd) and in 1,25 times is less, than in dry years of more than 75% probability. Within the years of less than 10 % probability by the Volga flow the irrigation rate is less than average long-term values in 1,37 times, and within the years of more than 90 % probability is higher than average values in 1,31 times.

Practically distinctions in water consumption between extreme years are even lower because of restrictions in water use in the most dry years especially in irrigated agriculture.

The distinctions in additional losses on evaporation by reservoirs between dry and wet years are even less expressed due to reduction of the area of water with decrease of the year hydraulicity.

The examples how to tare into account the influence of extreme hydraulicity of the year by the river flow on economic activity by hydraulic engineering construction and water economy are well known. The indirect and remote consequences of interference between the year hydraulicity and economic activity are much worse investigated. Thus low water level on the Volga in the1970th and then beginning of a phase of raised moisture and raised flow have played the certain role in socio economic events in our country.

HYDROCHEMICAL MODE OF THE IVANKOVSKOYE RESERVOIR AND THE PECULIARITIES OF ITS FORMING

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Contaminants are brought directly to the surface waters with the drained water discharge by industrial, municipal and agricultural sources and with the flat washing from the water collecting area. The number of contaminants brought with the flat washing depends on the degree and the character of the economic development of the area, its landscape and structural peculiarities and on the coastal areas state and characteristics.

The peculiarities of the contaminants migration in the ecosystem "reservoir - water collecting area" are determined by the protective properties of elements being the parts of the system (soil, vegetation, GW, bottom sediments, hydrobionts and surface waters themselves). Depending on the condition of the coastal and water complexes brought contaminants can be absorbed, transformed and utilized by natural components to different extent and with different intensiveness.

The Ivankovskoye reservoir is the largest source of drinking water supply for Moscow. For this very reason its hydrochemical mode causes special interest of the experts. Detailed research of the reservoir hydrochemical mode were started in 1950-s by Rybinskaya HMO on two ranges (Kalinin and Dubna) and were continued in 1964 on four ranges Kalinin, Bezborodovo, Konakovo, Dubna). Nowadays the monitoring of the Ivankovskoye reservoir water quality is carried on by the departments of Rosgidromet, Commiteees of natural resources, various scientific, educational and industrial establishments, in particular, by Ivankovskaya SRS of Water Problems Institute of RAS.

The greatest contribution to the salt content of the Ivankovskoye reservoir water is made by the Up[per Volga and Tvertsa. According to the data for many years, the amount of mineral salts in the water of the Volga in the part upper the reservoir increases from spring to winter from 200 to 330 mg/l, and in the reservoir in it increases to 500 mg/l. The type of water is hydrocarbonate-sodium.

The content of the main ions in the reservoir water is defined by natural conditions and varies reasonably according to the changes of the river Volga nutrition conditions within the year cycle.

Delivery of contaminants from point and diffusive contamination sources results both in the absolute increase of some ions content (sodium, sulfates) and to the modification of co-relation of one- and bivalent cations.

The most important factors of forming chemical content of the reservoir water within winter period are lowering of water level, ice cover, absence of surface drain and the increase of underground water delivery to the reservoir.

A high degree of water coloring is characteristic for the reservoir and its tributaries. Within the recent years water coloring degree does not go lower than70° Pt-Co scale even in winter, and in the second part of high flood and during summer highest level it reaches100-140° Pt-Co scale due to the delivery of highly colored waters from the water collecting area and accumulating organic matters in the reservoir itself.

According to the peculiarities of forming surface drain, permanganate oxidation (PO) both in the tributaries and in the reservoir itself reaches high parameters. The highest values of PO are mainly observed in spring when melted water bring various soluble organic matters away from the surface and from the soil. High content of PO in summer period is connected with the development and dying off of water vegetation and phytoplankton. The lowest oxidation is observed in winter, it is connected with the increasing contribution of GW to the Volga and its tributaries nutrition and with the still life in the reservoir. In summer the content of organic matter in all stretches increases due to the internal reservoir processes. Average values of PO in summer and autumn periods are a bit higher than in spring. No sharp differences in the PO content from the upper part to the dam are observed. In Shoshinskiy stretch the PO values are generally higher than in Volzhskiy and Ivankovskiy stretches. It is about 22-23 mg O/l.

The value of BPK_5 in Volzhskiy and Ivankovskiy stretches in the main cases is lower than LAC for the reservoirs used for economic needs and drinking water supply (5 mg O_2/l) and varies within a year from 2 to 4 mg O_2/l. During the period of mass maturing of phytoplankton its values in those stretches

increase to 4-5 mg O_2/l, and in Shoshinskiy stretch those values always exceed LAC.

The content of copper in the water of the Volga and the Ivankovskoye reservoir is rather constant within the whole year and is 5 mkg/l average. Copper is mainly delivered due to its washing out of soils. A small additional amount of copper is brought with the towns drain waters. Copper concentrations in the reservoir are much lower than LAC for the reservoirs used for economic needs and drinking water supply, but LAC for the reservoirs used for fishing needs are significantly exceeded especially in the layers close to the bottom.

Zinc content in the water reaches the highest value during the winter low level of water amounting to 30-60 mkg/l average in different years. In other seasons zinc content reduces to 20-32 mkg/l. Natural delivery of zinc to the reservoir is rather significant. Average zinc content in the reservoir water does not exceed LAC for the reservoirs used for economic needs and drinking water supply, but significantly exceeds LAC for the reservoirs used for fishing needs.

Within the recent five years the main contamination ingredients exceeding the allowed sanitary norms were as follows: the average copper content level and the average oil products content level exceeded the allowed sanitary norms in 4-5 times, the level of common iron content exceeded those norms in 1.5 times. Cases of contamination with zinc, manganese and phenols (up to 2-3 LAC) were observed.

According to the data of summer hydrochemical testing of the Ivankovskoye reservoir, hydrometeorological factors were proved to influence greatly forming of the reservoir hydrochemical mode within this period. Different meteorological conditions in summer periods define different character of internal reservoir processes at the actually equal volumes of delivery to the reservoir, as a result of that separate hydrochemical parameters will be different. A slight difference of values is observed for mineral phosphorous, nitrate and mineral nitrogen.

From the beginning of the reservoir existence up to the present moment a deterioration of a number of parameters of water chemical composition is observed, especially in winter.

In the authors' opinion, the most urgent problem of hydrochemical mode forming is to define seasonal and long-term dynamics of heavy metals concentration and of the directions and intensiveness of their migration, sorption and desorption processes.

HYDROCHEMICAL STUDIES OF SURFACE WATERS OF THE EAST-EUROPEAN TUNDRA

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Hydrochemical studies of large lake systems of the Bolshezemelskaya tundra - Vashutkiny, Padimeyskie and Kharbeyskie lakes - were conducted for the first time in 1960 - 1969 as a part of complex researches aimed at revealing prospects of fishery development. Under conditions of active natural resources development, tundra surface waters are involved in economic circulation. But they are not always able to manage with man-caused effluents, coming from mines and oil-and-gas prospecting drilling-rings because of insufficient volumes of pure water necessary for pollutant neutralization. In the result transformation of the water chemical composition towards its saturation with pollutants is observed. In this connection from 1988 till 1997 water bodies and watercourses of the Vorkuta river basin were under study. Their main contamination sources are plants of coal industry. During the last years special attention have been given to study water chemical composition of water bodies and watercourses confined to oil and gas fields in the basins of the Varknebkhiyahka, Labahkanyahka, More-Yu and Kolva rivers, downstream of the Pechora river and coastal part of the tundra. From the obtained data it can be concluded that the origin of lakes underlies the formation of the natural water composition of the lakes of the Bolshezemelskaya tundra. In this connection they are subdivided into glacial (lakes Vashutkiny, Kharbeyskie, Padimeyskie, Naul lakes and others), lagoon (Lake Bolshoy Taravey) and thermokarst (Lake Mal. Izyaty). Characteristic indices of the water of glacial lakes were low-alkaline reaction of medium (pH=7.5-8.2), favourable oxygen saturation of water and low content of carbon dioxide. Water mineralization is low (from 43 up to 100 mg/dm^3), with rare exceptions (Lake Vanyukty). The ionic composition of water varied from hydrocarbonate-calcium to sulfate-sodium. Waters of the glacial lakes were depleted in organic and biogenic matters. But in a number of lakes ammonium nitrogen content was 3-6 times higher than maximal permissible level of fisheries. Water of the lagoon lakes had high water mineralization (up to 3 600 mg/dm^3) and chloride-sodium composition. They were enriched with organic matters: biological oxygen consumption for 5 days was up to 12.3, chemical oxygen consumption - up to 105mg/dm^3. Ammonium concentration did not exceed 1.84mg/dm^3. The largest lake group was thermokarst lakes. They differed among themselves in all chemical indices: mineralisation - from 7.86 up to 92.3 mg/dm^3, reaction of water medium (pH) - from 5.3 up to 9.0. In rare cases there was observed oxygen deficit (up to 54%), caused by considerable organic contamination or biochemical oxidation of died plankton. Mineral phosphorus concentration in them was low. But iron and organic matter concentration varied within wide limits. It increased in water bodies and watercourses with swamped water catchments. The highest mineralisation (up to 180 mg/dm^3) was observed in watercourses in water supply of which ground waters of a thawing out active layer of permafrost must take part.

Under the influence of coal-mining industry in surface waters of the Vorkuta river basin there was observed incensement of mineralisation (up to 960 mg/dm^3) due to augmentation of proportion of sulphate ions and natrium ions. The increased copper content was registered. The main components of contamination of tundra lakes influenced by oil and gas fields are toxic organic matters which exceeded maximal permissible levels of fisheries: in oil products - 4-14 times, phenols - 7-27, synthetic surface-active materials - 3-7. In the ionic composition sulphate, chloride, natrium, iron content considerably increased. Among microelements manganese (23.5-219 mg/dm^3) and copper (4.0-32.1mg/dm^3) exceeded maximal permissible level.

IDENTIFYING THE HYDROLOGICAL REGIME FACTORS ALONG AN ARTERIAL GAS PIPELINE ROUTE

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The following applied studies were conducted for hydrological support of gas pipeline projects, including the pipeline "Yamal - Europe" at the section from Smolensk to the Polish border:

- Development of the hydrological regionalization methodology with the use of mathematical approaches of cluster analysis and numerical taxonomy;
- Calculation of the maximal river discharges and water stages for spring floods;
- Analysis of the data on soil physical properties and soil frost depth.

Major part of the hydrological support of arterial pipeline project is evaluating the parameters of spring and rainfall-originated floods on those small rivers traversed by pipeline that warrants decreasing hazard of local inundation. The low flow data are necessary to evaluation of the water supply and waste water releases admissible for the Gas Pumping Plants (GPP).

Basic soil properties conditioned construction and maintenance of pipelines are: soil density, saturated, capillary and field water capacities, water yield and filtration coefficients and the soil frost depth as well. Changes in these resulting from technogeneous impact can lead to a disturbance of overland and ground water flows. Consequently the ecosystem status can change as well as deformations can appear in soils that is very hazardous for pipeline.

Spring flood peaks were calculated using the empirical equation, reduction type, as recommended by Construction Rules, and by the regionally accepted method. Input data have been gathered from reference publications and obtained in preliminary investigations. Regional empirical relationships have been received between flood flow characteristics and physiographic features of the river drainage basins (see Figure below).

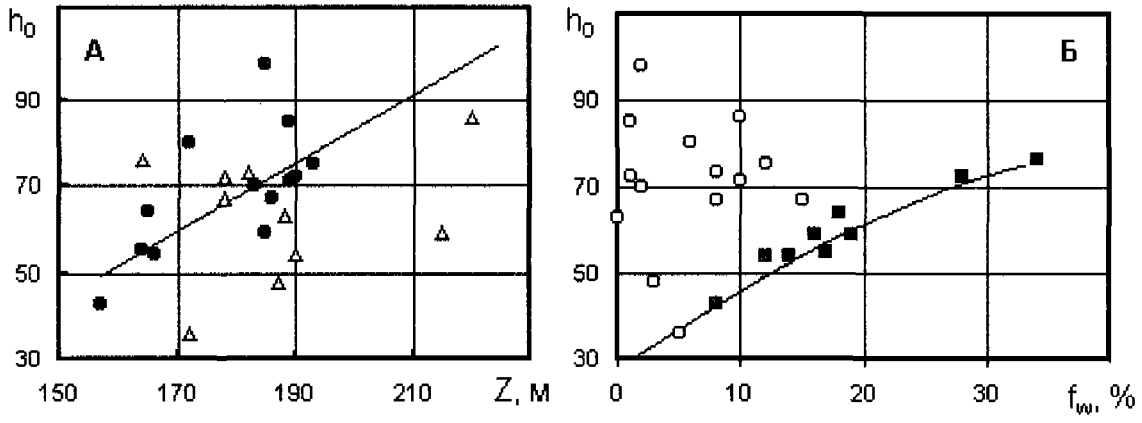

Fig.1. Examples of regional correlation of the spring runoff depth.
A) with mean elevation of watersheds,
B) with wetland fraction (the Polesje region is depicted)

For estimating the parameters of adopted equations, the observation data at the analogue (model) watersheds have been used. The latter have been defined resulting from cluster analysis of the watershed attributes and runoff parameters. The procedure was used of numerical classification which consists of an a-priori assignment of the class number, selecting the "cores" of each class by minimal Euclidean metric within the class, and consequent transfer the "boundary" objects (watersheds) from one class to another until those metrics within and outside the class would become equal. Resulting from such cluster analysis the regions have objectively been defined, as well as the analogue basins with their attributes for each of the regions.

For evaluating the low flow on small rivers, the analogues have been used selected based upon similarity in geo-hydrological conditions of the aquifers. The parameters of adopted equation for low flow specific discharges have been identified at the GPP's areas.

With the use of the soil maps available as well as the materials of preliminary investigations, the analysis has been done upon distribution of the genetic and textural soil types along the pipeline route. Based on previous experimental research results, the main soil water properties have been gathered, first of all the soil water capacities and water yield coefficients. At that the empirical relationships were used between soil textural types and permeability classes. The FAO/UNESCO soil classification and the resilience criteria of soils to a human impact are also used. Resulting from the analyses, those section of the pipeline route have been identified where special field investigations have to be implemented before construction.

IMPROVED RESERVOIR MANAGEMENT FOR INCREASED WATER SECURITY AND DRINKING WATER QUALITY IN WATER DEFICIENT REGIONS

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In the past, reservoir control was usually focused only on achieving a water quantity optimum. Increased population and industrial development In water deficient regions, increased population and industrial development has degraded water quality, reducing the quantity of useable water. In water deficient regions, most water that might be used is stored in reservoirs, and the processes that affect water quality in a reservoir have a significant impact on available water resources. Use of surface water becomes an additional importance due to over expoitation of groundwater resources and toxic pollutants.

Water quality and quantity optimization, the control of water quantity and quality in reservoirs to achieve more usable drinking water requires a detailed knowledge of pollution sources, their spatial and temporal variations and their interactions. A core element in water quality and quantity optimization is the combined use of river and reservoir models. Monitoring of water quality will not provide sufficient information to derive management strategies in those regions.

To predict the effect of controlling the inflow water quality on the total water quality of the Sidi Salem reservoir (the largest reservoir in Tunisia) and downstream, the reservoir model Lac was applied in the GTZ-project GE.O.R.E. Results of the model studies for the Sidi Salem reservoir show that it is best as a management strategy to consider a threshold combination of both salinity and inflow discharge. This enables the storage of some events with an important contribution to water volume and to reject those events that greatly affect salinity. The prohibition of inflows less than certain thresholds will protect the reservoir water stored during flood events that gave a significantly higher quality for drinking and irrigation supply.

The procject IWMT (Co-funded by EU-INTAS and German-DFG) focuses on the Tuyamuyn reservoir complex, which provides drinking water and irrigation water for the lower Amu-Darya region (in the territories of Uzbekistan and Turkmenistan). The Tuyamuyn reservoir complex comprises four large dams with a total storage volume of 7.8 kmi.

The planned optimization of water quality and quantity is based on the use of the seasonal variations of the AmuDarya river in both flow and pollution concentrations. The most challenging task for the project is to consider the requirements for irrigation supply. The amount of stored water in the Kaparas will be sufficient to provide the drinking water supply or to provide water for irrigation of lands, but it is not sufficient to meet both needs.

In summary, water quality and quantity optimization provides startegies to reduce pollution and plays a key role in achieving an enhanced water security in water crisis regions.

IMPROVEMENT OF CHEMICAL METHODS FOR CONTROL OF WATER BLOOM IN STAGNANT BASINS

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Water bloom is the common phenomenon during the warm season; most frequently it takes place in stagnant basins. The bloom is accompanied with mass propagation of some plankton microogranisms, suspended in the water. Thus, 1 cm^3 of water can contain up to 300 thousand of filamentous protococcal algae.

It is known that cities and large industrial centers is supplied with water from storage pools connected with distributing networks. The mass propagation of algae in these reservoirs frequently becomes the cause of filter clogging and, occasionally, complete interruption of water flow. According to published data, the dyeing-away of mature plankton organisms in decantation ponds of water distributing system results, in its turn, in deterioration of organoleptic values of water.

The water bloom causes damage to fish industry as the algae clog the meshes, making the fishing difficult. The facts were recorded when algae clogged the brachial system of young and even grown fishes, leading to their death.

It was widely recognized that most optimal way to control the water bloom is its prevention. Among the large variety of suggested methods (mechanical, physical, biological, chemical) the chemical methods are most available and much used (especially in small ponds). Among the latter the treatment of basins with copper sulfate, $CuSO_4 \cdot 5H_2O$, are more widely employed.

The extensive studies, performed by the specialists of Research Institute of Water Supply and Engineering Hydrogeology (NIIVodGeo), has demonstrated that in the case of cyanobacteria, which are the most frequent stimulants of water bloom, the toxic dose of copper sulfate varies in 0.3 - 0.8 mg/l range. The experiments on some species of fish (fry, carp, pike, loach, crucian) have shown that their toxic doses exceed those for phytoplankton, the most sensitive to copper sulfate is the fry and most resistant is the crucian.

More stringent requirements of national standards for drinking water and fish farming ponds, introduced recently, necessitate the significant reduction of copper sulfate doses, added to water. We have found that target level can be reached by combination of copper and silver ions (TLV of the latter is 0.05 mg/l at 0.001 - 0.005 mg/l doses). In this case the concentration of copper ions can be in 0.05 - 0.1 mg/l range.

It is advisable to use two flow-through electrolyte cells for generation of silver ions (one with silver consumable anode and other with copper one), which can be mounted in the motor-boats and powered by batteries. The silver and copper ions, formed in electrolysis process, are blended with outboard water due to propeller rotation. 230 g of silver metal, by 0.003 g/m^3 doses, is the adequate quantity for treatment of the pond with 5 hectares in area and 1.5 meters in depth. The energy consumption, necessary to transform silver metal into ionic state, equals to about 60 A-hr. The algicide treatment of water pool with above indicated size will require about 3.7 kg of copper metal, transformed into copper ions, consumed by 0.05 g/m^3 doses. Transformation of copper metal to ionic state in this case will require 3,400 A-hr.

INDEPENDENT ESTIMATION OF HYDROLOGICAL CONDITIONS ON THE BASIS OF THE ANALYSIS GEOMEASURE OF A DELTA ILY RIVER

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As the formation of types landscapes in arid conditions is defined first of all by water factor, there is a possibility an independent estimation of hydrological conditions by regional the factors of formation geomeasure a delta lly river, which are obtained on the basis of interpretation outcomes of the component analysis of their physic-geographical performances.

As the initial parameters the numerical values hydrological, hydro-geological, soil, power, humidity, dynamic characteristics of landscapes - character speakers (*Динамич.*) were selected, absolute marks of a water level in the river (*АбОтмВоРек*), discharge lotic (*РасхПроток*), volume of a runoff (*ОбСток*), suspended load (*ВзвНанос*), turbidity of water (*Мутность*), chemical structure of ground waters (*ХимГВ*), level of ground waters (*УГВ*), salt content of ground waters (*МинГВ*), precipitation (Осадки), annual average temperature (*Темпер*), solar radiation (*СолРад*), annual average atmospheric pressure (*АтмДав*), annual average absolute humidity of air (*ВлажВозАб*), annual average relative humidity of air (*ВлажВозОтн*), gumus content (*Гумус*), water content in ground (*Влагозап*), salt-affected soils (*СольПочв*), degree of a coating landscape by vegetation (*Покрытие*), degree of a stability a geomeasure (*КоэфУстой*). The bioefficiency (*Урожай*) started as an effect variable from the enumerated performances. According to classification Shukareva-Slavyanova in input datas the numerical performance of chemical structure of ground waters was estimated by number of the class water mirroring a degree metamorpholising ground waters; dynamiced was estimated by a mark dial, in which to static landscapes 1 number, dynamical - 0, transient states - 0,5 was appropriated.

As a result of data processing 98 % of a common variance of a system from 33 plants was selected 12 principal component (ГК) circumscribing, the entry an aspect of first three of them below represented:

ГК 1 (40%): + [*СолРад, Темпер, КоэфУстой, АбОтмВоРек, Динамич., Осадки, ВзвНанос, УГВ, Мутность, ОбСток, МинГВ*], - [*ВлажВозАб, Влагозап, АтмДав, СольПочв, Гумус, Покрытие, Урожай, ХимГВ*]

ГК 2 (16%): + [*РасхПроток, ОбСток, Мутность, Урожай, МинГВ, ВзвНанос, Гумус, Влагозап, АбОтмВоРек*], - [*ВлажВозОт, Осадки, Динамич*]

ГК 3 (13%): + [*Осадки, РасхПроток, МинГВ, ОбСток, УГВ, Динамич., Влаж ВозОт, АтмДав, ХимГВ, ВлажВозАб, Покрытие*], -

[*Урожай, КоэфУстой*]

The first principal component mirrors growth hydrological runoff, which wave has not coincided while with hydro-geological. From the point of view of productivity, its maximum values have on maximum modulo negative values of this component. The combination of indications in the second principal component can be treated as the factor of a geographical runoff. The third principal component is addition by first and second - here with identical is familiar of loads the indications describing hydrological runoff and a geographical runoff, were united. The check interpretation of components has proved to be true in traditional geographical exposition geomeasure.

So, component analysis geomeasure of a modern delta Ily river first three principal components explaining almost 70 % of a summarized variance of a system geomeasure a modern delta Ily river, characterized by 20 indications has selected as the carrying on factors formation:

- The factor hydrological runoff (1 principal component, 40% of a variance);
- The factor of a geographical runoff, (2 principal components, 16%);
- The factor hydrometeorological runoff (more than 13%).

Having returned a prevailing role to surface waters. Coming back to the equation (2), the variance of productivity geomeasure of a modern delta Ily river possible to mark, that. Or now is defined more than on 48% (1 and 3 of a component) water factor and on 24% by the factor of a geographical runoff.

Areas of maximum influence of an only hydrological condition mapping on positive values of the first principal component.

INFLUENCE OF DISPERSED SOURCES OF CONTAMINATION ON FORMATION OF WATER RESOURCES QUALITY OF THE VERKHNIAYA VOLGA BASIN

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Industrial, municipal and domestic waste water is the main source of water objects contamination in the Verkhniaya Volga Basin, a part of waste water delivered to the water object by centralized ways is subjected to state control. In recent years the considerable reduction of technogenic impurities (some base metals,detergents and others) is observed in that part of waste water as a result of the industrial production recession. Certain improvement of water quality is observed in such rivers as the Oka (down from Riazan), middle course of the Kliazma, the Belaya and ors.

But the research of some scientific institutions (IVP RAN, GNTS RF NII VODGEO and ors.) show that the situation with some contaminants does not improve. They are oil products, phenols, suspensions, some organic compounds and ors. As the study of the available observation data shows they arrive by unorganized ways and are not subjected to appropriate control. The main sources of such impurities are surface waste water of industrial sites, populated localities and residential areas as well as runoffs created as a result of the development and operation of mineral deposits. Agricultural lands and objects, industrial sites and developed territories, mineral deposits, residential areas, inland water transport and atmospheric precipitation are also sources of unorganized supply of pollutants.

The water objects of the Verkhniaya Volga Basin are classified as the 3rd class of the pollution level - *moderately polluted*. All reservoirs situated in the Verkhniaya Volga Basin are classified as *moderately polluted* and *polluted* and contaminated predominantly with phenols, oil products and copper. The strongest pollution of surface water with oil products is observed on the Volga down from the city of Yaroslavl, with ammonia nitrogen and nitrite nitrogen - in the basins of the Oka, the Upa, the Moskva and the Kliazma.

The approximate annual unorganized discharge of waste water into the Volga Basin is 5 km3. In most cases waste water is discharged into the water objects without treatment and brings over 100 thou tons of oil products and over 2.5 mill. t. of suspended Approximate substances. About 20 % of the total quantity of nitrogen introduced into the soils and about 5 % of phosphorus are discharged from agricultural lands into surface and underground water objects. A large quantity of pollutants come from livestock and poultry farms.

To improve the quality of surface waters of the Verkhniaya Volga Basin it's necessary to take some measures, among them the following main ones: improvement of situation with the waste water treatment and the reduction of their discharge into surface water objects; rational use of water resources; creation of water protection zones; development of antierosion measures; improvement of agricultural runoffs and industrial waste water water disposal; equipment of livestock and poultry enterprises; collection and treatment of residential areas waste water and transport waste water; establishment of a control system over unorganized waste water and ors.

For the successful solution of the problems of the improvement of rational water use it's necessary to carry out stage-by-stage some specific practical measures on the federal and regional levels.

INFLUENCE OF OXYGEN REGIME ON NITRIFICATION AND DENITRIFICATION PROCESSES

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At present the actual concentrations of nitrogen compounds in the treated sewages discharged into fishery basins at the territory of Russia are 5-20 times greater than maximum permissible limits.

The problem of nitrogen compounds removal at the stage of afterpurification can not be solved by chemical and physicochemical methods owing to their low efficiency, an increase in the treated water salt content and technical difficulties connected with the treatment of large wastewater volumes.

The biological method of removal of biogenic elements in the course of nitrification and denitrification based on the bacterial oxidation of ammonium nitrogen to nitrites and nitrates, and the restoration of nitrogen oxydized forms to gaseous state is the most perspective one.

In practice these processes are realized both in the apparatus with free-floating microorganisms and in the apparatus with microflora immobilized on different loading materials. Besides, these processes can be carried out both in separate units and in the joint ones according to the cyclic scheme developed by FGUP *NII VODGEO* and widely used in domestic and foreign practice.

The design of the structures and their control demand a detailed and in-depth study of the process mechanism, kinetic and technological dependences.

A large volume of the experimental research conducted with pure substances and industrial wastewater of different compositions shows that the key factor influencing the kinetics of nitrification and denitrification is an oxygen regime. The kinetic dependences of the both processes were received in the range from 0.3 to 8.0 mg/L of the concentration changes of oxygen dissolved in the sludge mixture. The process of nitrification is slowed down at oxygen concentration below 1.0 mg/L. The increase of the dissolved oxygen concentration up to 4 mg/L accelerates the nitrification by 2.5 - 3.0 times (at the ammonium nitrogen concentration - 1 mg/L) comparing with the process speed at the oxygen concentration - 1 mg/L. The joint influence of ammonium oxygen and oxygen on the nitrification speed is described by the kinetic equation of bisubstrata reaction at the speed slowed down by the substrata (ammonium nitrogen):

$$V_{нитр} = \frac{V_{\max}[NH_4][O_2]}{[NH_4][O_2] + Km[O_2] + Ko[NH_4] + \frac{[NH_4]^2[O_2]^2}{\alpha(Km[O_2] + Ko[NH_4])}}$$

The determined constants of this equation permit to use it for the calculation of the nitrification speed at different concentrations of ammonium nitrogen and dissolved oxygen both for the free-floating sludge and immobilized microflora.

The optimal concentration of oxygen for nitrification is 0.3 - 0.8 mg/L. The intensification of concentration of oxygen dissolved in the medium over 1.2 mg/L leads to the reduction of the nitrification speed by 2 - 4 times at concentrations of the oxydized nitrogen forms within the limits of Maximum Permissible Concentrations for fishery basins.

An increase of the dissolved oxygen concentration influences the nitrification speed according to the regularities of noncompetitive inhibition. The joint influence of the substrata (BOD, nitrates and nitrites) and oxygen on the speed of denitrification process by the kinetic equation of bisubstrata reaction for noncompetitive inhibition:

$$V_{денитр} = V_{\max}\left(\frac{Kio}{Kio + [O_2]}\right) \frac{[БПК][NO_3 + NO_2]}{[БПК][NO_2 + NO_3] + [БПК]K_{NO3} + [NO_2 + NO_3]Km}$$

It has permitted to develop a special computer program for the scheme optimization, prediction of its use for other types of sewage. The basis for this program are the equation of fermentative kinetics and the equation of material balance (removal of nitrogen with activated sludge and reduction of BOD at the expense of assimilation processes) allowing to divide the process into stages and to make a technological calculation by stages, to calculate the required relation between nitrification and denitrification zones at the maintenance of balance between the transformed forms of nitrogen compounds and the oxidation of organic substance at each stage of treatment.

INFORMATION/TECHNOLOGICAL COOPERATION IN THE SPHERE OF JOINT USE AND PROTECTION OF TRANSBOUNDARY WATER BODIES

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The Severskiy Donets River is the greatest tributary of the Don and a transboundary water body, its catchment is located within the territories of two states, Russia and Ukraine. Regulation of inter-state water relations in the catchment is performed in accordance with the "Agreement between Governments of Russia and Ukraine on Joint Use and Protection of Transboundary Water Bodies" signed in Kiev on October 19, 1992.

The information/technological basis of the "Agreement" is an information/advising managerial decisions support system (DSS) created by the two countries joint efforts for the Severskiy Donets catchment. The following blocks have been developed for each party to secure situational analysis of the catchment conditions within the structure of local DSSs: Block of information/reference support assignments and water sector conditions analysis, Block of operative (current) planning assignments, Block of water policy analysis and availability of water resources for all players in the catchment assessment, Block of taken decisions assessment.

Implementation of the coordination of mutually acceptable decisions in the conditions of true management process in the catchment will permit to transfer from "local" DSSs to introduction of the integrated decision support system for the whole water sector of the Severskiy Donets catchment.

The VIII meeting of Representatives of the Russian Government and the Ukrainian Cabinet of Ministers held in Azov (Russia) November 12-14, 2001 was devoted to fulfillment of provisions of the Russian-Ukrainian Agreement on Joint Use and Protection of Transboundary Water Bodies and approved the results of the first stage of activities on establishment of interstate information system for water sector in the Severskiy Donets catchment aimed at the implementation of integrated water policy by the both countries water services. Joint co-operation in the process of realization of the above decisions and the results obtained actually prepared the basis for starting of implementation in water sector of the Agreement on Information Co-operation in the Sphere of Ecology and Environmental Protection of the CIS Countries, signed in Moscow, September 11, 1998.

The key issue of the new stage of the joint Russian-Ukrainian co-operation should be establishment and development of the interstate information system (IIS) in water sector on the basis of existing communications and structures possessing water-related information. It is feasible to select the Severskiy Donets catchment as a subject of such a pilot project as there rich positive experience was accumulated in terms of joint work of scientific and water management institutions of both countries and information base for successful implementation of such a project was established. In this connection in the nearest future a Program to define the structure, approaches, stages and supporting mechanisms for establishment and functioning of such an international information system will be prepared, agreed and realized.

LAKE BAIKAL POLLUTION BY PERSISTENT ORGANIC POLLUTANTS

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Because of Lake Baikal recognition as a World Heritage Site pollution monitoring of the Lake and catchment area rivers by dangerous ecotoxicants, including persistent organic pollutants (POP), become urgent.

Organochlorine pesticides (OCP) (p,p'-DDT, p,p'-DDE, p,p'-DDD, o,p'-DDT, o,p'-DDE, o,p'-DDD, α-HCH, β-HCH, δ-HCH, ε-HCH, γ-HCH, dieldrine, endrine, hexachlorobenzene, polyaromatic hydrocarbons (PAH) (phenanthrene, anthracene, fluoranthene, pyrene, benz(a)pyrene and polychlorinated biphenyls (PCB) (PCB 28, PCB 52, PCB 138, PCB 153, PCB 180) were identified and quantitively determined in bottom sediments of the lake Baikal tributaries (rivers Selenga, Uda, Khaim, Turka, Bargusin and Bolshaya Rechka) by method of gas chromatography. HP 6890 gas chromatographs with electron-capture detector with mycrocell (BINM SB RAS) and mass-selective detector (UFZ, Leipzig, Germany) were used.

It was found that concentrations of hexachlorobenzene (HCB) in bottom sediments of Lake Baikal tributaries are comparable with those in bottom sediments of the Lake and Arctic seas.

The high values of ratio DDT to its major breakdown product DDE (DDT/DDE) (4,2-7,2) in bottom sediments of Lake Baikal tributaries indicate modern DDT inputs. On our view, the major source of DDT input into ecosystems of Lake Baikal basin is air transport from countries still producing and using DDT.

The pesticide HCH was detected in bottom sediments of all rivers. The HCH concentrations were one order higher than those in bottom sediments of Lake Baikal. In our research the isomer compositions of the samples are similar

to the technical HCH mixture prepared by photochemical chlorination. Therefore, it is possible to guess, that HCH presence is caused by its agriculture usage in the past and sources of HCH input are local.

PAH were found in bottom sediments of all examined tributaries. It is known that organic fuel burning, motor transport and ferrous metallurgy, aluminum and refinery plants are PAH sources. Examination of individual PAH composition in sample mixtures allows to suppose that air transport from industrial centers of Irkutsk and Krasnoyarsk areas and local sources put predominant contribution to Lake Baikal pollution by PAH.

Among PCB six indicator compounds were detected. Examination of individual PCB homologues reveals PCB mixture in river bottom sediments to be similar to russian technical product "Sovol". In our view, PCB origin is also of local nature because of in sediments much chlorinated PCB were detected. For global transport it is more typicaly lightly chlorinated PCB.

On the base of the experimental data about POPs presence in bottom sediments of Lake Baikal tributaries it is possible to conclude that POPs in Lake Baikal ecosystems have three folowing sources:

- local sources (HCH, PAH, PCB);
- transboundary transport from neighboring countries (DDT);
- global transport (HCB).

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LAKE CONSERVATION AND MANAGEMENT IN MONGOLIA

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This paper reviews briefly hydrological and ecological conditions of lakes and their conservation and management measures taking place in Mongolia.

We live in a changing world, and the effects of changes are of interest to everybody. Nature conservation and proper management of water resources are becoming major concern of the country. The physical geographical peculiarities create a specific lake ecological condition localized within the country. The lakes located in high mountain regions contain a cold water of small mineralization rate, supersaturated with oxygen. Here, main limiting factor of the growth of aquatic plants and overall lake population is the shortage of nutrients and coolness of water. In transition from high mountainous region to forest, forest steppe, dry steppe zones, it can be observed that nutrient concentration of lakes increases due to increase in heat energy. It leads to increase in biodiversity in lakes. In the Gobi desert region, the biodiversity reduces due to excess of heat energy supply leading to high evaporation rate, leading to metamorphosis of Lake Water constituents. The limiting factor of biological functions in lakes becomes the oxygen deficit, metamorphosing chemical concentration process in the Gobi. Such specific ecological condition of lakes requires own optimal conservation measures and proper lake resource management.

LONG-TERM WINTER OXYGEN MODE AMUR

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The dissolved oxygen is one of the main water quality parameters. At its deficiency (< 4,0 mg/dm^3) fish kill takes place, quality of water is reduced sharply. Deterioration of the Amur water quality in 1996-2002 has required consideration of its winter oxygen mode in long-term aspect.

The highest content of the dissolved oxygen (10-12 mg/dm^3) in the Amur water is marked in the beginning of winter, and the lowest one, because of its expenditure on oxidation of the dissolved organic matter, - at the end of winter in a mouth of the Amur (in March, 1998 up to 2, mg/dm^3).

In a long-term winter oxygen mode of the Amur, some stages connected to alteration of water mode and economic activity, are selected.

In 1949-1963, on the data of the Far East Hydrometeorological Service, the content of oxygen in the Amur water at Khabarovsk (with the lowest water stages - 194-310 cm) was within the limits of 5,13-10,8 mg/dm^3, and at Komsomolsk-on-Amur - 4,13-9,26 mg/dm^3.

The deficiency of oxygen has appeared in the Amur water at Khabarovsk (with the lowest stages -255-323 cm) in 1968-1971, 1975 and 1977. While in water of the Amur and Zeya river at Blagoveshchensk its content these years varied from 4,0 up to 11,1 mg/dm^3, in the Amur water at Khabarovsk - from 1,83 up to 3,68 mg/dm^3. Downstream to Komsomolsk-on-Amur, besides deficiency of oxygen, it were marked fish

death as well. Such deterioration of oxygen mode of the Amur, obviously, was connected not so much to natural water capacity decrease, as with income in its waters of a plenty of pollutants from the Sungari basin. The Sungari runoff in February, 1968 was 73,6 % of the Amur average runoff.

The increase of water capacity of the Amur because of Zeyskoye reservoir beginning of work, has improved an oxygen mode of the Middle and Down Amur. The contents of oxygen in the Amur water at Khabarovsk in 1980-1988 changed from 4,4 to 6,19 mg/dm^3, and at Komsomolsk-on-Amur - from 5,07 up to 7,08 mg/dm^3. The deficiency of oxygen was marked only in the most downstream of the Amur, as well as, and per former years, in floodplain lakes and fish winter holes.

The recession of the Russian industry and agriculture has not improved the oxygen mode of the Amur. In winter low water period 1997-1998 in its water the occurrence of a "chemical" smell was marked, the average content of oxygen at Khabarovsk was 4,9 mg/dm^3, at Komsomolsk-on-Amur - 4,48 mg/dm^3, and at Nikolayevsk-on-Amur - 3,4 mg/dm^3, i.e. gradually to the Amur mouth was reduced.

The research on state boundary sites of the Amur in winter low water period 2000-2002 has shown, that while upstream to the Sungari mouth the oxygen content was not lowered below 9 mg/dm^3, the downstream - on far water it was gradually reduced along ice period from 8,4 down to 3,2 mg/dm^3, i.e. twice. It testifies that the major source causing the decrease of oxygen concentration in the Amur water seems the economic activity increase in the Sungari basin in the last years.

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MAKING OF THE TYPES OF TERRITORIAL FORMATIONS OF THE ECOLOGO-HYDROLOGICAL SYSTEM OF THE SMALL RIVERS

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The ecologo-hydrological system of the small rivers (EHS SR) shapes representation about dependence of a state of the small rivers of Republic Tatarstan (RT) from plurality of natural processes of formation of a sink and anthropogenous processes in territory and immediately in the river (that is influence drainage-basin on aqueous objects).

The negative changes incipient under influence of anthropogenous activity, result in infringement of structure and functioning EHS SR, that conducts to diminution of ability of self-weeding, self-regulation and self-reproduction, therefore arise: natural-ecological and socio economic changes frequently resulting in to unsolvable ecological problems.

Features of the natural factors of formation of the rivers, their dimensional differences, distinction in a degree pollution, bound with features of economic use of the small rivers (fence, dump of waste of water etc.) and activity in basins, define accessories of the river to this or that type EHS SR. The effect - formation of particular types of territorial formations EHS SR.

The excretion of territorial types EHS SR gets by that major value and reliability, than more complete knowledge of local features of an aqueous facilities is necessary in its basis and than those natural requirements and socio-economic factors are more full investigated, on which these features depend.

The created model EHS SR is based on system of diagnostic indexs (or tests of an estimation), aggregated in two block: natural and anthropogenous (consisting from: of industrial, agricultural and social subblocks).

For the estimation of state EHS SR and the degrees of economic activity (or calculation of an ecological situation) are necessary legible and reliable tests, which combinations could serve the objective basis for excretion of types of territorial formations EHS SR. The process of a select and estimate of indexes is represented to one of the most important moments of examinations. Formally any estimate represents one of views of classification. For their carrying out the attributes of particular properties of objects are selected, the tests them point and correlation are telescoped. For a select of tests previously it is necessary generelizated the existing factors of formation and anthropogenous action in the shape of search of these diagnostic (determining) attributes, which will be obtained on the basis of the analysis of a state of natural medium in requirements of anthropogenous action. The tests, or diagnostic indexes are precipitate out with the help of a method of expert estimations.

Having analysed all specified indexs EHS SR, and carried out point of indexes in each separate block, nine types of territorial formations EHS SR are in aggregate allocated.

The carried out analysis EHS SR and excretion of the special types of territorial formations allowing to reveal the most important territorial distinctions and to approach to an explanation of the reasons of such distinctions, is apart important in the solution of the problems of forecasting of quality and quantity of water and serves before of state of ecological management and economic activity, on which determined nature protection measures, directional on improvement of a state of the small rivers substantially depend.

MICROBIOLOGIC SELF-PURIFICATION OF MARINE WATER FROM PETROLEUM RESIDUE

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Intensive investigation and marine fields development of hydrocarbonaceous raw material results to that petroleum and its derivatives become one of the most wide-spread pollutants in marine waters. In complex process of marine water self-purification from oil contamination micro-organisms play the leading part, due to diversity of their enzymatic systems and fast acclimatization to varying conditions of habitat.

Objectives of our studies included determination of micro-organisms role in breaking down of petroleum residue in waters of the North Caspian Sea that is specially actual in conditions of prospects of oil extracting extension on the marine shelf.

Monitoring studies of water in the North Caspian Sea area were conducted in spring 2001 at 107 stations. Sample selection for hydrochemical and microbiologic studies was made from subsurface and benthal horizons, thus detecting the quantity of saprophytic heterotrophic and oil acidifying microorganisms. To study reductive-oxidative conditions in marine waters under analysis and processes directness and intensity carried out by bacterial indigenous biocenosis, there was determined the content of Oxygen dissolved in water, potentially oxidative capacity (POC) in relation to petroleum hydrocarbons and loss of Oxygen on biochemical oxidation of dissolved organic matter (DOM) by index of florula respiration function.

The dominance of all groups of bacteria was detected in subsurface horizon of waters in comparison with benthal one.

Maximal number of saprophytes is registered on the stations sections flanking to the coastland of the rivers Volga and Terek where offset currents have effect.

The slight dominance of oil acidifying bacteria above saprophytic is marked on all horizons of stations.

It is necessary to note that intensity of microbiologic processes concerning organic compounds, petroleum hydrocarbons differed in heterogeneity. POC indices and respiration function in subsurface horizons of all the stations were higher than in benthal layers that is connected with decrease of Oxygen content with depth. The tendency of oxidative capacity increase with magnification of number of oil acidifying florula is detected.

If to suppose, that 1 mg of Oxygen acidifies 0,5 to 1,4 mg of petroleum (ZoBell, Prokop, 1966) then in the North Caspian sea area under analysis, probably, 0,1-0,4 mg up to 0,3 - 0,9 mg of petroleum residue may be disintegrated in 1 liter of water a day.

Thus, the results of the given study have shown, that in waters of the North Caspian Sea there run intensive processes of natural self-purification from petroleum and its derivatives, which restrict to a certain extent negative effect of oil contamination in conditions of the shelf increasing exploitation.

MICROBIOLOGICAL ESTIMATION OF THE SUNGARY RIVER IMPACT ON THE AMUR RIVER WATER QUALITY

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Sharp deterioration of water quality and change of organoleptic properties of fish catched in the Amur River in winter season is one of the actual ecological problems of the Khabarovsky krai. Essential pollution of the Amur River is at the expense of industrial and housekeeping wastes entering from the Chinese side and having low degree of purification or without it at all. According to different information the Chinese population of the Sungary River basin is ranged between 70 and 100 million whereas the population of the whole Russian Priamurje is about 5 million. The official data on kinds and pollution scope entering from the Chinese side are absent. In the period of freeze-up the entrance of polluted compounds into the Amur River is the most dangerous due to low activity of water microbial communities and decrease in the river self-purification.

In the 2000-2001 period of freeze-up (December - March) there was carried out the research of a structure of heterotrophic microbocenoses of the Amur River waters sampled at ranges situated higher (the Nagibovo village) and lower the Sungary estuary (the Leninskoye and Nizhne-Spasskoye villages).

The total number of heterotrophic bacterium-plankton in water of the river site studied has varied from 650 CFU/ml in January at a distance of 150 m from the left bank, near Nagibovo, up to 600 000 CFU/ml in March near the navigating channel, at the range of Leninskoye. At several stations between the left bank and navigating channel near Nagibovo the essential difference in number of ecologic-trophic groups of water microorganisms has not been found during the research period. Near Leninskoye the number of water microorganisms-destructors has increased when we were moving off from the (Russian) left bank. In December the total number of heterotrophic bacterium-plankton in water sampled in the middle of the river has increased 12, in January - 230, in February - 44 and in March - 600 times as compared with those of sampled near the left bank and is the

evidence of increasing soluble organic substances entering to the Amur River with the Sungary River waters in the course of ice thawing. The significant increase of phenol-resistant microorganisms near Leninskoye (100 times) has been observed in January when we moved off towards the right bank and this is the evidence of phenol compounds entrance into the Amur River. Lower, along the stream (Nizhne - Spasskoye), a tendency of the microorganisms' number increase has been sustained but less expressed than that of near the Leninskoye village (for various groups 1,7 - 6 times) when we moved off from the left bank towards the right.

The quality of the Amur water during the 2000 - 2001 freeze-up is classified as III - V classes. The Amur water higher the Sungary estuary (Nagibovo) and near Leninskoye is ranked as "moderately polluted". The Amur water quality at sites being under the impact of the Sungary River becomes worth and may be characterized as IV-"polluted" and V-"strong polluted" classes. The significant deterioration of water quality is observed in March during ice thawing at all sites examined. At the same time water quality near Leninskoye and Nizhne-spasskoye is characterized as "strong polluted".

MICROFOCUS PROCESSES -INDICATORS OF DESTABILIZED ENVIRONMENT

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Studying of dynamic processes in the biosphere, its actual changes and the lows of development of natural systems is one of the central tasks in modern ecology. Technical revolution in XX century resulted ecological destabilization of the environment. This new phase of biosphere is characterized by abnormal quick changes in structural organizations of natural ecosystems and intersystem interactions (Zaletaev, 1998). It results in emergence of the new phenomena in reactions of biocoenotic and landscape covers on external impacts and one can find the new unknown trends in development of environment. Under conditions of destabilized environment and quick changes in it the microfocus processes are widely spread. Studying of these processes is very perspective because they reveal the reasons and mechanisms of going tendencies in local area and possible perspective of its regionalization, on one hand, and basing on its indicatory role we can manage the state of environment and possibility to prevent the undesirable of aggressive processes and phenomena on the early stage of their development.

The microfocus process development is studied basing on changes in species composition and structure of vegetation together with changes in the soil moisture, ground water depth, quantity of salts in root zone of the soil and together with other phenomena, that limit the normal functioning and productivity of ecosystems.

The data of development of microfocus desertification of the sandy deserts of Central Asia , Kazakhstan and Kalmykia showed that the scheme of dynamic under cattle breeding impact (overgrazing) has universal character in different climatic zones.

Anthropogenic changes of the river runoff, reconstruction of hydrographic net, irrigation, fluctuations of the sea level simulate the development of dynamic processes and appearance of hydromorphic microfocus processes, which indicated the biocoenotic cover transformation through the chain of subsequent ecological links, the processes of the ecotonization.

It is shown that the character and scale of microfocus processes in the same landscape is conditioned by the influence of factor that initiated them.

The method of evaluation of transformation is based on the compete consideration of changes of representation of the ecological groups of plants in microfocus habitats and the area of their development is proposed. Different chains of successions can indicate the stages of the processes. Extending of the area of the microfocus points or theirs exaggerating indicate zones of high ecological destabilization. Appearance of the species of adventive or weed flora can indicate the dangerous of the biological pollution of the landscapes.

MODELING OF NITRATE LEACHING TO SHALLOW GROUNDWATER DURING THE FALL-WINTER SEASON

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The limits for NO_3-N concentrations in groundwater and surface waters are still under discussion, but it is likely that they will become stricter. In the fall-winter period in Belgium, significant NO_3-N losses can occur due to leaching of nitrate that remains in the soil after harvest. Mineralization of organic nitrogen in soil, organic material, plant residue or manure increase in this period the leaching of NO_3-N. In order to meet the EU-norm of 11.3 mg NO_3-N l^{-1} in surface and

groundwater, the Flemish Government in Belgium states that the residual mineral nitrogen, measured in the soil profile of cropland (0-90 cm), may not exceed 90 kg N ha^{-1} between first of October and 15 of November. The nitrogen processes that occur within the soil play a major role in determining the nitrate leaching to shallow groundwater. In this study the transport and fate of nitrate within the soil profile was analyzed by comparing field data with the simulation results of a mathematical model. The objective of this article is to study the transport and fate of nitrate within the soil profile and nitrate leaching to shallow groundwater for the fall-winter season, by applying the methodology in Elverdinge experiment, situated in the sandy loam region in Belgium, form the first of October, 2000 to 31 March, 2001 (leaching period). Furthermore, the analysis by comparing field data with the simulation results of DRAINMOD-N model is given. To run the model one needs only time series of daily rainfall, evapotranspiration, maximum and minimum temperature, and few fertilizer application data together with site specific parameters relatively easy to derive. Another important feature of the DRAINMOD model is that it simulates the lateral subsurface flow of water and the NO_3-N flux to field drains, ditches or drains tubes. The analysis indicated that, the DRAINMOD model after calibration and validation can be used as a useful fertilizer management tool in predicting the nitrate transport and transformation in the soil profile and the nitrate leaching to shallow groundwater and surface waters. The model can be used to help define as a function of the local conditions, the crop cultivated and the climate, the fertilizer package composed of organic and inorganic fertilizers that does not exceed the leaching limits imposed by environmental regulations. Furthermore the model can be used as an environmental control when the environmental objective has a greater importance than profits in agriculture.

MODELING THE EFFECT OF TOXICANT ON THE STRUCTURE OF AQUATIC ECOSYSTEMS

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Prediction of the effect of chemicals on aquatic ecosystems is the key problem of ecotoxicology closely binding with water quality regulation. There exist standard tests allowing the survival ability of separate species under toxic load to be assessed. Sublethal toxicant doses obtained in these tests (e.g. EC50 and LC50) relate to batch populations. However in natural conditions species do interact with each other constituting a biological community so that the toxic load affecting natural competitive interrelations among species will undoubtedly change the species composition of the community. Within the community the survival of every species is now complicated by both interspecies competition and toxic load. In nature there are usually not one but plenty of toxicants. It was shown in literature that multiple toxic effect on the population can be reduced to a single equivalent toxic dose by summing the ratios of toxicant concentrations to characteristic concentrations such as water quality criteria or the sublethal doses EC50 or LC50. The aim of this work is to quantitatively analyze changes in species composition of a competitive community with toxic load.

In order to explicitly observe the effect of toxicant on the community structure, a model of the community is developed on the basis of the following statements: 1) all species in the community compete with each other for a common food source that within community dynamics is usually expressed in terms of the competition coefficients a_{ij} defining the action of the *j*th species on the *i*th one; 2) the entire system is supposed to be spatially homogeneous and, in addition, there is no transfer of individuals between the internal environment and the outdoor medium; 3) nutrient content, toxicant concentration and other ambient conditions hold constant; 4) the *i*th species growth rate r_i depends linearly on toxicant concentration *c*,

i.e. $r_i = r_{i0}(1 - c/L_i)$,

where r_{i0} is the growth rate without toxicant, L_i is the margin of toxicity defined as the toxicant concentration putting the actual growth rate of population to zero; this quantity characterizes the resistance of the species to the toxicant; 5) the carrying capacity K_i of the *i*th species is proportional to the population growth rate r_i that is apparent from experiments on *Daphnia magna* batch cultures;

hence $K_i = K_{i0}(1 - c/L_i)$,

where K_{i0} is the carrying capacity without toxicant; 6) the total effect of the entire community on the *i*th species can be described by a single mean-field parameter α_i instead of the set of competition coefficients α_{ij} that essentially reduces the number of model parameters. This approach named the 'mean-field approach' is worth-while provided the neighbors of every individual fast change over. The quantity α_i characterizes the force with which the community competition field affects the *i*th species.

It is known that the evolution of biological community with properties 1-3 can be described by the system of logistic-type equations

$$dN_i/dt = (r_i/K_i)N_i\left(K_i - N_i - \sum_{j \neq i}\alpha_{ij}N_j\right), \quad N_i \geq 0, \quad i = \overline{1,n},$$

where N_i is the ith species density, n is the number of species, t is time. The growth rate of population r_i accounts, on one hand, for its natural recruitment and, on the other hand, the die-away of individuals and their elimination with predators. An additional account for properties 4-6 leads to the system of equations

$$dN_i / dt = (r_{i0} / K_{i0}) N_i [K_{i0}(1 - c / L_i) - (1 - \alpha_i) N_i - \alpha_i N], \quad N_i \geq 0, \; i = \overline{1,n}$$

(N is the total density of all species in the community), which has incorporated the dependence of the population growth rate and carrying capacity on toxicant concentration and again the competition coefficients have been replaced with the mean-field parameters.

Calculations based on the developed model show that under high level of competition the escalation of toxic load changes the community structure so that labile species become extinct and more resistant species come to existence. The ith species lethal dose denoted c_i can be defined as the toxicant concentration that reduces the population density to zero. Within the competitive community the lethal dose is shown to be always less than the margin of toxicity, i.e. $c_i < L_i$. The only exception is the most resistant species for which both these quantities coincide: $c_i = L_i$.

An advance in competition level within the community substantially reduces the species existence region compared to that for batch cultures, i.e. the lethal dose becomes much less than the margin of toxicity. In these conditions labile species go to extinct with increasing toxicant concentration long before it achieves the margin of toxicity. This is important result of the modeling for water quality regulation, in particular, for setting admissible toxic load on aquatic environments.

The activation of new species with toxic load suggests that they are more resistant to toxicant in spite of their less competitive ability. At small toxic load these species are suppressed by high level of competition. As toxic load grows, less resistant species are eliminated that lowers the competition level and provokes the burst activity of new, more resistant species.

The model predicts nonlinear response of the densities of several species and the total community density on toxic load although linear dependencies of the population growth rate and carrying capacity have initially been supposed.

MODERN STATE OF THE HYDROBIOLOGICAL REGIME OF WATER BODIES OF THE BOLSHEZEMELSKAYA TUNDRA

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The active development of oil-fields in the territory of the Bolshezemelskaya tundra has caused the necessity to study surface waters, which get under the influence of bore wells. In July 2001, the hydrochemical and hydrobiological study of the glacial lake Vatyarty was held. The water surface of the lake is 23.6 km^2, the maximal depth reaches 40.0 m. The lake stretches from north to south 8 km. It is confined to the basin of the Adzva river, and is connected with it into one system through the brook Vatyartyvis. The largest watercourse, feeding the lake is the brook Komashor.

Under conditions of excess moisture, distribution of low dissolved soil-forming rocks and tundra soils, low water mineralisation was formed: lake Vatyarty (28.4-35.0), the brook Vatyartyvis (33.2-35.3), the brook Komashor (46.1-84.1 mg/dm^3). Water composition was calcium hydrocarbonate. By hardness waters of lakes and watercourses are categorized as very mild (up to 0.95). The reaction of water was closer to alkaline (pH=7.5-8.1). The oxygen regime was favourable (92.6-117 %). The surface waters under study were characterized by low content of biogenic and organic matter. Only near the east lake bank, where there are outputs of chalybeate ground waters, the iron (0.93 mg/dm^3) and silicon (7.25 mg/dm^3) concentration increased.

The increase of phenol concentration (6.0-32.6 mkg/dm^3) was revealed in humus-enriched water of the brook Komashor, as the phenolic hydrooxides are included into the composition of humic acids. The outwashing from tundra soils conditions the increased cuprum content (10.9-20.0 mkg/dm^3). There were no oil products in water of lake Vatyarty, as well as of the brook Vatyartyvis and the brook Komashor.

The systematic list of invertebrate fauna consists of 24 groups. In lake Vatyarty and streams between lakes 15 groups of zoobenthos were revealed. The greatest number of systematic groups was registered in adjacent lakes and brooks, 20 and 19 respectively. Nematoda, Oligochaeta, Hirudinea, Mollusca, Hydracarina, Cladocera belong to the most widely-distributed groups met in all studied water bodies. A number of groups live only in one type of water bodies. So, Gammarus, Tardigrada, Hemiptera and Heleidae

are found only in adjacent to lake Vatyarty water bodies, Collembola- in lakelets and brooks, Simuliidae - only in brooks, Rotatoria - in lake Vatyarty and in the brooks Vatyartyvis and Komashor.

Quantitative parameters of benthos development on sandy grounds of lake Vatyarty and adjacent lakes change from 7 up to 43 thousand individuals per m^2 and from 1 up to 87.3 g/m^2, increasing on silted spots. On stony grounds, sometimes with befoulings of filamentous algae and nostoc, the benthos density is 5-14 thousand individuals per m^2, and biomass - 6-9 g/m^2. The highest values of the number (23.2-40.7 ind/m^2) and biomass (6-221.9 g/m^2) characterize the brook Vatyartyvis. Benthos is less developed in the brook Komashor. The basis of benthos density in all water bodies is made up of benthonic crustacies, larvae chironomids, oligochaets, mollusc, and sometimes nematodes. In benthos biomass the leading role belongs to mollusc, chironomids and oligochaets. Mollusc fauna in water bodies of the lacustrine-fluvial system of lake Vatyarty includes 19 species, all of them, except Lymnaea balthica were known earlier for water bodies of the Bolshezemelskaya tundra. The species composition of mollusc induces beta-mesosaprobic zone in water bodies, at which one there is no its noticeable transformation.

MODERN STATE OF THE VOLGA BASIN WATER ECOLOGY (ON A PROBLEM OF ASSESSMENT OF PARASITE EFFECT ON FUNCTIONING OF ECOLOGO-GENETIC MONO- AND BISEXUAL FISH COMPLEXES)

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Studies on a reticulose evolution and naturally occurring clonal forms of vertebrates are among the most perspective areas of modern biology.

The most promising results in this area were found after discovery and studies of complex of di-, tri- and tetraploid forms from genus Cobitis in Moscow river (Vasil'ev, 1981). Similar complexes of these fish were found in some rivers of the Black Sea basin (Vasil'ev, 1990) and also in Western Europe rivers (Boron, 1992; Rabee, 1995). Study of these complexes allowed us to show that they include not only two normal bisexual species (Cobitis taenia and C. melanoleuca), but also clonal forms (tri- and tetraploid ones), and a tetraploid bisexual with unclear method of propagation (Vasil'ev et al., 1983; Vasil'ev et al., 1989). Clonal forms from such complexes are hybrids and coexist with related bisexual species. Clonal forms, though isolated genetically from the bisexual species, are closely connected with them by their gynogenetical way of propagation, as gynogenesis requires males, whose gametes stimulate ova without true fertilization (male and female pronuclei don't come together). Clonal and bisexual forms were observed to form an ecologico- genetic system with reverse interrelations . Functioning of such systems depends of many parameters: genders' relative numbers, relative numbers of complex' forms, degree of similarity between these forms ecological niches, etc.

Profound studies on functioning of mono- and bisexual complexes of fishes as ecological and genetic systems, and effect of parasites, in particular, on these processes, becomes now necessary. No data on connections between functioning of mono- and bisexual complexes and parasitism was present . Particularly, there is no data on differences in diversity of parasites between clonal and bisexual forms from the same complexes.

At the same time, different micro- and macro-, endo- and ectoparasites with different localization (parasites of blood, intracellular, intramuscular, intestinal, dermal and branchicolous ones), can affect strongly on mechanisms of their natural propagation and clone structure, clone structure, and also ecological relations between bisexual and clone forms.

There are some data on different groups (Protozoa, helminths, crustaceans, etc.) endo- and ectoparasites from genus Cobitis (Bykhovsky et al. 1962; Sokolov, 2000, etc.) in ichtio-parasitiological literature. However, data on effects of parasites on occurrences mentioned above, is absent.

We have, for the first time, tried to find out connections between functioning of fish clone-bisexual complexes and parasitism. The main thoughts on probabilities of finding differences (in parasitological aspect) between parthenogenetic clones and bisexual forms of the fishes, were formulated. Study of a place of parasites in functioning of ecologo-genetic mono- and bisexual complexes of fishes has begun. Similarities and differences in parasites composition from Moscow and Saratov regions were studied, as well as similarities and differences between bisexual diploid and clone poliploid forms (on example of ... C. taenia and C. melanoleuca), and also di- tri- and tetraploid complex of fishes. The study was aimed at finding out the place of parasites in origin of poliploid bisexual species and naturally occurring clone propagation.

NEW APPROACH AND METHODS OF NATURE PROTECTION ACTIVITY MANAGEMENT IN ARAL SEA REGION

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One of a key questions of a problem of nature conservation is the preservation of the green cover of the Earth. It is the most dynamical component of a landscape plays leading role in stabilization of biosphere. At the same time, endemics, relicts and wild relatives of the cultural plants and plants, which are dangerous in connection with transformation of places of their habitates, should first of all become keeping objects at a level of a species. There are 176 endemic species in flora of Southern Aral Sea region (from them there are 10 endemic species occurring in Karakalpakstan only), 15 relicts and 33 natural relatives of cultural plants. The floristic composition of the dried part of the Aral sea includes 62 species, representative of 47 genus and 18 families. Here 14 cenotypes and 36 formations are allocated. In conditions of ecologically destabilized environment a large role belongs to reservations and preserved territories. Until recently the main part of reserves were formed with the purpose to preserve a genetic pool of specific rare and vanishing species. Now a question is raising much wider - it is necessary to preserve all ecosystem on the whole, biocenoses and even some physico-geographical regions with multicomponent landscapes.

Our fieldwork on this area permitted us to divide some area for preservation. As patches of the gypsium desert with their flora and fauna was suggested eastern fall band of Usturt, region Belltaw. As sample of sandy desert was divided a north part of Kyzylkum desert area. Organization of a big salty reserve in depression Barsa-Kelmes and South-Usturt also is expedient. It is planned tcreation of nature protection zone on the territory of the dried part the Aral Sea bottom.

To preserve unique wood and shrubby communities of tugai (riverin flooded), forests keeping an ecological balance and aesthetic advantages of territory, the organization of reservations in low-course and delta of Amu-Darya is absolutely indispensable.

However, from our point of view, most cardinal and effective measures on preservation of existing tugai forests and their partial recovery would be the creation of unified reservation on all territory of Amu-Darya bottomland in places of tugai vegetation, with incumbent condition of surface splashing down for near-bed facieses.

The territory, proposed for conservation, except for tugai communities, includes all the basic types of deltaic landscapes inter-bed areas, bed and near-bed levees, massifs of near-oasis and intra-oasis lumpy-patched, sand-dune-patched, and lumpy sands, pratum in different conditions of water supply, limnetic cavities, saliniferous complex, pieces of quasi-zonal communities on takyr (dry clayey) soils.

Thereby the state reserves are regional research and organizational centers on a natural conservation, the creation of tugai reservations in low-course and modern delta of Amu-Darya in this aspect is rather prospective. Except a gene pool preservation and exploration, here it is possible to organize monitoring of tugai and meadow ecosystems dynamics, to conduct researches on the development of ecosystems management. Within this territory had been proposed for reservation tugai forests of miscellaneous ages - from young shaping underbrush up to the steady shaped communities and desertificated modifications. In conditions of a preservation the scientific problems of rehabilitation of the wetland communities with renovation of regular watering, composition and productivity of tugai and meadow communities will carrying out.

NEW DATA ON THE POLLUTION OF THE AZOV AND BLACK SEA ECOSYSTEM BY PESTICIDES

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Pesticides belong to toxicants which are very active in processes of deformation and functioning of water ecosystems in the Azov and Black Sea basin.

In 2000-2001 the studies on the spatial distribution, the year-to-year and seasonal dynamics of pesticide pollution were continued.

In the period of industrial decline and structural economic reconstruction on the Russian territory of the Azov and Black Sea basin a great reduction was observed in the agricultural production and, consequently, in the amount of pesticides used.

By the end of the 20th century the concentration of the widespread stable organochlorine pesticides (OCP) in the Azov Sea water had dropped to 5 ng/g (0.5 MPC) compared to the average 60-80 ng/l concentrations of OCP in the late 1980s (the period of the biggest pollution). And the maximum values of OCP at some sea stations decreased from 800-900 ng/l to 70 ng/l.

In 2000-2001 the trend towards lowering of the sea pollution by stable pesticides persisted. The annual concentrations amounted to 3-7 ng/l, i.e. they did not exceed 1 MPC.

In bottom sediments in 1988-1999 the content of OCP decreased also, though less so than in water: from 5-6 ng/g to 2 ng/g.

In 2000-2001 the concentration of OCP in the bottom

sediments averaged 1-2 ng/g, such a great reduction in the levels of pollution of the habitat with commercial ichthyofauna involved the lowering of pesticides' accumulation in them. The content of OCP in such vital organs of sturgeons as liver and eggs decreased from 600-800 μg/kg to 300-50 μg/kg. It has improved noticeably the physiological state and the reproductive system of fishes.

A similar dynamics of pollution by stable pesticides was observed in the northeastern part of the Russian area of the Black Sea. From 1993 to 1999 the average concentration of pesticides in the seawater dropped from 3-4 MPC to 1-2 MPC. In 2000-2001 it averaged 1 MPC.

In 1993-2001 the concentrations of OCP in the coastal water were much higher than in deep waters and exceeded MPC 2-8 times. In some bottom sediments of the Black Sea coast the concentrations of pesticides were also rather high. Thus, for example, the OCP concentration amounted to 0.5 ng/g in 1996, while in 2001 it was 1.8 ng/g. No decrease in stable pesticides' accumulation was observed in the Black Sea fish either. The concentration of OCP in sprat was within the 60-90 μg/kg range in 1994-1999 and amounted to 60-130 μg/kg in 2000-2001; in liver of whiting the concentration of OCP was within the limits of 700-1000 μg/kg both in 1993-1994 and 2000-2001. Over the last years the nomenclature and amounts of the pesticides used have increased. The amount of preparations in the Rostov region rose from 1.9 th. t in 1999 to 2.1 and 2.6 th.t in 2000 and 2001, now they number about 200. So the following pesticides whose concentrations sometimes exceed MPC dozens of times have been found lately in the water of the Azov and Black Seas: deltamethrin, α-cypermethrin, fenvalerate, iprodione, tenatimol, difenoconazole, lambda-cyhalothrin, chlorothalonil etc.

ON DEVELOPMENT OF MEASURES AGAINST POLLUTION OF THE VOLZHSKY WATER SUPPLY SOURCE OF THE CITY OF MOSCOW

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The Volzhsky source of domestic and potable water supply includes the Ivankovskoye, Ikshinskoye, Pestovskoye, Uchinskoye, Kliazminskoye Reservoirs and the Moskva Canal (126 km). Water quality is the most detailed studied in the Ivankovskoye Reservoir - the main source of potable water supply to the city of Moscow. Its water is possible to beassigned to a *moderate polluted* class. In spite of the reduction of waste water discharge and volume of pollutants coming to water objects, a considerable improvement of water quality is not observed now except the base metals.

The water objects along the Moskva Canal can be divided into three classes of water quality (from moderate polluted to dirty).

The most contaminated water objects are the Kliazma, the Sestra, as well as the small rivers receiving municipal and industrial discharges from large human settlements and cattle-breeding complexes. The safer water objects of the region (*moderate polluted - polluted*) are the Ikshinskoye, Uchinskoye, Kliazminskoye Reservoirs and the Moskva Canal).

The main limiting water quality indexes where excesses of the domesticcommunal water supply standards in force are observed are colourness, general iron, fluorine, organic substances by COD, ammonia nitrogen, oil products, phenols, formaldehyde.

Over 40 cities and settlements (18 of them are at the territory of the Ivankovskoye Reservoir), military units, recreation areas and agricultural objects are situated at the water collecting area of potable water supply belonging to the Volzhskaya System. In recent years hundreds of individual farms including those owned by city-dwellers. Considerable areas of the cultivable lands at many water collecting territories and in the river valleys are "overfed" with mineral fertilizers. A large number of livestock farms, many of them do not have the equipped manure storages and treatment facilities, are situated at the floodplain edges. Poorly equipped fertilizers and toxic chemical storages as well as fuel and lubricants depots increase the number of river pollution sources. At many places water protective zones, rivers and reservoir shores suffer from recreation overloads and motor transport. The housing and communal service enterprises are the first among the point sources of surface water contamination. Industrial discharge reduces year after year proportionally to the industrial production fall.

The analysis of the contaminants sources along the water supply route shows that the main part of impurities along the route discharges into the Moskva - Volga Canal and further goes to water intakes from the territories of the Klinsky and Dmitrovsky Districts. The most powerful sources of impurities are concentrated discharges of waste water and to a lesser degree - pollutants supply with surface runoff (storm water). Agricultural contamination, ground water pollution and recreation play an insignificant role.

Now the authors develop recommendations for the creation of optimal complexes of water protective and nature protective measures of surface water objects protection against pollution.

ON METHODOLOGY OF STUDY OF PARASITE SYSTEMS OF WATER BIOCENOSISES

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The search for (informational) methods for assessment of integral characteristics of parasitic systems formed by four species of parasites, *B. luciopercae*, *P. percae*, *C. lacustris* and *A. Lucii*, was made. The method of non-metric multidimensional scaling (Davison, 1988), similar to that of main components and information logic analysis was used to find out structure of multitude of objects studied and reveal the most meaningful ecologo-morphological characteristics.

Matrices of paired similarity of parasitic systems in each block studied which were calculated using Sewrensen index from initial ones were used as similarity matrices.

Non-metric multidimensional scaling allowed us to build two- and three-dimensional configurations for co-functioning parasitic systems, on which data matrices of their three-scale coordinates were based. Two- and three-dimensional graphs for 3 modules and two-dimensional graph for accumulation module of 2nd order were built giving a visualization of multiple objects' structure.

Matrices on different system modules related to different stages of parasite life cycles were formed from common primary matrix. Multitude of primary elements of «*Neutral Environment*» disperse module from each parasite system were grouped from physical and chemical environment components, together with some characteristics of parasite's free-living stages. *Accumulation module* included data on parasite's stages of development, such as groupings of parasite's specimens in invertebrate intermediate hosts, invertebrate consumers, and groupings of parasites in fish, second intermediate (additional) hosts. *Generating module* included information on different growth and development stages of parasite, together with groupings of specimens from definitive host populations associated with them, as well as biological and physical components of biocenosis.

The method described allows to select out of multitude of initially found characteristics so as together a relatively small number of parasite systems integral characteristics. In this way we can compare processes going on in parasite systems with less chance of mistake, and also find out "biological niches" of multiple parasite species co-existence in biocenosis.

The article is an attempt to enrich methods of factors'analysis establishing relations both inside and between parasite systems so as to include informational models together with verbal ones. We propose that quantitative methods, such as those included in this study, allow a new point of view on a biological process having being already studied qualitatively, and can carry not only function of explaining a process, but also show us new approaches to study of those parasite systems which have been already studied separately but can also function together (e.g., in one biocenosis). Furthermore, such quantitative methods may lead us to counter-intuitive results, i.e. those which would be impossible to achieve using a traditional descriptive method of creating a verbal model.

ON MINOR AND MIDDLE RESERVOIRS CONDITIONS MANAGEMENT

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Minor and medium reservoirs that are predominant on the territory of Russia have been made and are being made to secure adequate public and technological water supply. In the process of their creation hydrological regime of rivers, and small rivers in particular, significant changes. Beside changes of hydrological regime the reservoirs change hydrochemical regime too, as they are often, due to the situation at the catchment and water area, the bodies that produce a certain type of pollutants (for instance, organic ones).

It should be mentioned that reservoirs are created to satisfy some economic demands that require certain water quality. Researches show that on the territory of Russia there are practically no reservoirs created for the water supply purposes where water quality meets the necessary standards. This causes either substantial increase of water treatment costs or considerable degradation of treated water quality. The main ingredient that negatively affect water quality are organic matter produced by the reservoirs ecosystem and the products of their transformation. These processes are overlapped by organic matter transformation in the reservoirs water aftermath.

Life of the reservoir ecosystem is production of autocthonous and utilization of allocthonous organic matter and other components from outside. Relationship of these processes and their morphometric and hydrological parameters are the factors that determine the reservoir state. The most part of small and medium reservoirs of Russia are highly euthrophic reservoirs where production exceeds destruction and the former is determined by both natural and anthropogenic factors, morphometric as well as hydrological. Natural factors are connected with the water body ecosystem change from a river one to a lake one, the latter is more productive in comparison with a river one, provided that the

nutrient loads are the same. Anthropogenic factors are connected with nutrients supply increase initiated by economic activities. Morphometry and hydrology, i.e. depth and flow to the substantial degree define the reservoir production abilities.

As a matter of fact, the reservoir conditions are determined by matter and energy streams flowing to it, internal energy streams and the energy withdrawal. If all theses streams exist, they are measurable and, in principle, controllable. The controllability degree today is measured in the range from zero to portions of a unit. For example, today it is impossible to regulate such factors as mind strength, solar radiation, water and air temperature. But it is possible to regulate supply of nutrients and pollutants initiated by economic activities. (It should be noted that today anthropogenic supply of nutrients to water reservoirs is one of the main factors that change trophic status of Russian water reservoirs). To a certain extent it is possible to control such factors as flow and average depth of water reservoirs. Today technical capabilities permit to form water flows in reservoirs and, consequently, matter and energy flows. It is also possible to regulate some internal energy and matter flows within reservoirs. For instance, it is possible to control water exchange with bottom sediments by changing their area and volume, or by inactivating their surface or by regulating biomass of supreme aquatic plants. Regulating of internal flows is possible through the use of this or that features of the reservoir ecosystem links. The use of biomanipulation permits to change considerably the reservoir trophic status.

To attain the desirable effect in the flows regulation it is necessary to understand clearly enough direction and intensity of impact. Modern concepts of reservoirs water quality and ecosystems formation permit to formulate a complex of measures to manage reservoir conditions. One of the most simple instances: changing of the flow configuration by replacing of surface water discharge by bottom water discharge in one of the Urals water reservoirs permitted to prevent formation of anaerobic conditions in it.

ORGANIZATIONAL ASPECTS OF THE CIS COUNTRIES INTERNATIONAL ECOLOGICAL/INFORMATIONAL SYSTEM (IEIS) ESTABLISHMENT

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The objective of the IEIS establishment and development is the ecological information integration and exchange, as well as information, information resources, products and services in the sphere of environmental protection and nature use at the international level in accordance with the Agreement on informational cooperation of the CIS countries in ecology.

The IEIS organizational system is formed as a multi-level structure and comprises various national and international sub-systems. At the system top level the IEIS main terminal and common data bank are formed on the basis of the CIS Inter-state Ecological Council to facilitate integration and information exchange at the international level of all member countries of the IEIS Agreement.

The main sub-systems at the IEIS second level, in view of the close co-operation between neighbouring countries, should be formed of ecological/information systems of neighbouring partner states, such as Russia and Ukraine, Russia and Byelorussia, Byelorussia and Ukraine, Russia and Kazakhstan etc.

The third level, that of territorial sub-systems, contemplates informational interaction between adjacent frontier oblasts and regions of the CIS countries in accordance with territorial or basin principle. Information systems of this level can be formed on the basis of oblast committees on environmental protection and natural resources, departments on natural resources use, basin water administrations, basin fishery administrations, territorial departments of Rosgidromet etc. Nowadays such information systems already exist and function, to a different extent.

To secure the information systems adequate operation and development, information processing and transfer it to the IEIS in structural form, it is necessary to establish the IEIS executive structures (task groups) on the base of governmental agencies of the appropriate level (institutes, scientific/production enterprises) with additional functions, including implementation of informatization and information exchange projects in the sphere of ecology and environmental protection. Task groups are responsible for specific sections of information exchange.

Relations of the information exchange subjects with information users should be based on individual agreements that fix the information exchange procedure and protocol in accordance with the IEIS Regulations and other general system legal regulations that are to be worked out as priorities of the IEIS establishment. These documents should state, in particular, the procedure of information arrangement and transfer, property rights for information, informational resources, informational structures and technologies, definition of access level and regulation of access to information, protection of copyrights on the basis of international law, economic mechanism of the IEIS operations etc.

ORNITHOLOGICAL COMPLEXES UNDER THE CONDITION OF WATER LEVEL CHANGES OF THE VOLGOGRAD RESERVOIR

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Reservoir has strong impact on the environment, including its flora and fauna. As a result of this impact ecotone systems with biotops are formed. Their existence and development are directly depending on perennial, seasonal and daily regime of the reservoir's level. Such an influence of water factor on birds' community was studied on the islands of middle zone of the Volgograd reservoir (Beregovoy, Krugliy, Serina, Khomutinskiy, Bezimyanniy, along Sherchak and Seven Trees Bay) situated to 5,5 - 8 km from the village Rovnoe of Saratov oblast in 1998 - 2000. The registration of birds was carried out daily on strictly fixed itineraries on the 50 meter-wide lane in the morning and in the evening. Birds' density was calculated based on these results.

During 3 years of investigations seasonal level of water changed many times. It changes annualy as follows: 1998 - middle level; 1999 - low level; 2000 - high level. This fact influences the islands birds' population. For instance, on Khomutinskiy island during nestling period (July) the author registered 82 birds species, 76 ones nest on the island every year and only 6 of them were noticed once (*Calidris alpina, Motacilla citreola, Tringa glareola, Coracias garrulus, Lanius collurio, Larus minutus*). It turned out that among 7 main biotops (water, near-water (reeds, sandbanks and beaches), flood-land forests (poplar and willow), water-meadows, forests, and meadows (zoning vegetation, steeps). 3 biotops have biggest bird species biodiversity. These 3 biotops are directly related to water factor: water (32 species), near-water (42 species), as well as areas of flood-land forests (35 species). The minimum is meadows (10 species).

Small area of the island contributes to its obliteration and the development of new habitats (sandbanks, water-meadows, reads, willows) which are actively occupied by species of march-near-water complexes. All mentioned above contributes to the widening of birds species biodiversity. For example, recently the appearance of new species was registered on the islands and neighboring territories (*Acrocephalus agricola, Phalacrocorax carbo, Egretta alba и Ardea purpurea*). Some of them, particularly *Acrocephalus agricola*, in a short space of time not only occupied all the flood-lands but also increased in the number serving as a dominant species on some territories.

The birds density varies through the years: in water - the highest density was registered in 1998 (3837,7 birds/sq. km), middle was in 1999 (2672,7), lowest was in 2000 (1302,1); in near-water - the same density was in 1998 and 1999 (577,9 and 616,8 consequently), decreasing in 2000; in water-meadows - high in 1998 (480,0), middle in 2000 (250,0), and lowest in 1999 (100,0); in meadows - density was the same and low all 3 years of observation (50-70).

According to the relationship between the species and a number of biotops they live in 3 groups were singled out: *polytopic* (species lives in more than 4 biotops), *mesotopic* (no more than 3 biotops), and *stenotopic* (1 or 2 biotops). It was revealed that polytopic species are not prone to water level changes (*Buteo buteo, Merops apiaster, Remiz pendulinus, Passer montanus, Corvus cornix, Pica pica, Lanius minor*).

Mesotopic and stenotopic species are vulnerable to island floods. Their population is negatively related to the annual water level and to the reservoir water level changes in the nesting period. The *species sensitive to* minimum water levels are: *Milvus migrans, Falco tinnunculus, Actitis hypoleucos, Charadrius dubius, Acrocefalus arundinaceus, Emberiza schoeniclus, Phoenicurus phoenicurus, Upupa epops, Phylloscopus collybita, Fringilla coelebs, Phylloscopus trochilus* etc. Their population in such years reduces from 4% to 0%. The species sensitive to maximum water levels are: *Cygnus olor, Falco subbuteo, Circus melanoleucos, Anas platyrhynchos, Aythia fuligula, Gallinula chloropus, Egretta alba, Ardea cinerea, Larus argentatus, Acrocefalus dumetorum, Sylvia communis, Oriolus oriolus* etc. Their population increases from 0 to 13% in maximum water years. The *species sensitive to* muddle water levels are: *Aythia ferina, Asio flammeus, Ardea purpurea, Ixobrychus minutus, Chlidonias nigra, Haematopus ostralegus, Acrocefalus scirpaceus, A. agricola, Panurus biarmicus, Luscinia svecica, L. luscinia, Motacilla alba* etc. Their population increases from 0 to 5% in these years.

OSCILLATIONS OF WATER INFLOW AND THE LEVEL OF CASPIAN SEA

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The influence of inflow oscillation to the level and water balance of Caspian Sea is researched by the method of mathematical modeling. The solution of differential equation of lake water balance permitted to elaborate a model, where dynamics of mutually related Caspian Sea characteristics (level, water surface area, evaporation and flow of water to Kara-Bogaz-Gol Gulf) are the response to inflow (river run off, precipitation and groundwater run off) oscillation.

Oscillation of inflow causes the variation of sea level, area and water balance components. The extremes of sea characteristics have a time lag if compared with inflow extremes.

The amplitudes of variations of sea characteristics and the time of their delay from inflow were calculated for different values of inflow and for the large number of periods. The dependencies of amplitudes of sea characteristics and the time of their delay comparing with inflow from period of variation are exposed on the special nomographs.

On the base of the method of least squares the observational data for Caspian Sea level and water inflow was approximated by periodical functions. The relations of level and inflow amplitudes and the time delay of level to inflow of approximation functions and calculated by the model were compared.

PECULIARITIES OF SLOPE RIVER RUNOFF TRANSFORMATION IN CONNECTION WITH PASTRY DEGRESSION (BASKORTOSTAN AS A STUDY CASE)

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One of the main directions of impact on water resources quantitative and qualitative characteristics is agriculture, including pastry cattle breeding, that not only contributes to natural complexes degradation, but transforms slope and river runoff.

In order to study the laws of slope and runoff changes depending on natural complexes degradation, in 1998-2001 the Chair of Physical Geography and Hydrology of the Bashkir State University conducted observations at a water-balance stationary range arranged near the village of Makhmutovo within the boundaries of Mountain Bashkortostan.

At the stationary range within the limited territory there is a possibility to study formation of slope runoff and its transformation. Here slopes of various exposure and steepness used for different purposes and differently affected by human economic activities are represented. Water balance observations were conducted at 6 runoff plots and 6 representative provisional watercourses, as well as at the Septinsky spring and the Belaya river.

It was found that within the stationary range snow melt starts April 1-5.

The most complete spring observations including snow measurements and snow melting process analysis were conducted in 2000 and 2001.

Comparative analysis of the surface runoff characteristics over two years of observations shows that in general there are certain laws of slope runoff formations, depending on natural and anthropogenic factors.

It was found that considerable differentiation of the runoff modules and coefficients occur depending on the anthropogenic load scale, natural complexes degradation, including soil cover over-density, as well as slopes exposure and preservation of forests. It was found the maximal values of the runoff coefficient and module at the degraded catchments are observed at provisional watercourses, as well as first order rivers. At the same time the first indicators reach up to 0.45-0.50, and the second indicators are up to 450-600 l/s km^2. Depending on the runoff transformation at the catchment, at the second and third order rivers the decrease of the above said indicator was observed.

At the catchment territories where natural complexes stay well preserved the soils water-absosption ability is not disturbed. Due to this fact the runoff coefficients there were 2.0-2.5 times less, this facilitated formation of corresponding relationships of the runoff module.

The obtained laws reflecting maximal water flow increase within the limits of the territory under study permit to correct the runoff characteristics calculations. Besides, it is proposed to use them in future for assessment of erosion and river-bed processes peculiarities in small river basins.

Further researches will permit to rise the obtained results reliability.

PILOT PROJECT ON TRANSBOUNDARY WATER QUALITY MONITORING AND ASSESSMENT IN ORDER TO IMPLEMENT PROVISIONS OF INTERNATIONAL LEGAL REGULATIONS

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The economic and environment importance of transboundary watercourses and international lakes is significant. More than half of 31 European rivers with a total watershed area of 50,000 km^2 have transboundary basins. Moreover, many small and medium size water bodies cross the borders of two and more countries.

The 1992 Helsinki Convention on the Protection and Use of Transboundary Waters and International Lakes covers the following aspects: transboundary water monitoring and assessment, evaluation of measures on mitigation, elimination and reduction of adverse transboundary impact,

information exchange between riparian countries and public awareness on results of water and effluents sampling.

To implement the provisions of the Helsinki Convention on the Protection and Use of Transboundary Waters and International Lakes, Guidelines on trans-boundary water monitoring and assessment were developed by the UN Economic Commission for Europe (ECE) Task Force on Monitoring and Assessment. After the Protocol on Water and Health (1999) was signed it was decided to include its provisions as part of the Guidelines.

The process of monitoring and assessment is a sequence of interlinked activities starting from the identification of information needs and up to use of the information product. The monitoring cycle is shown on Fig.1.

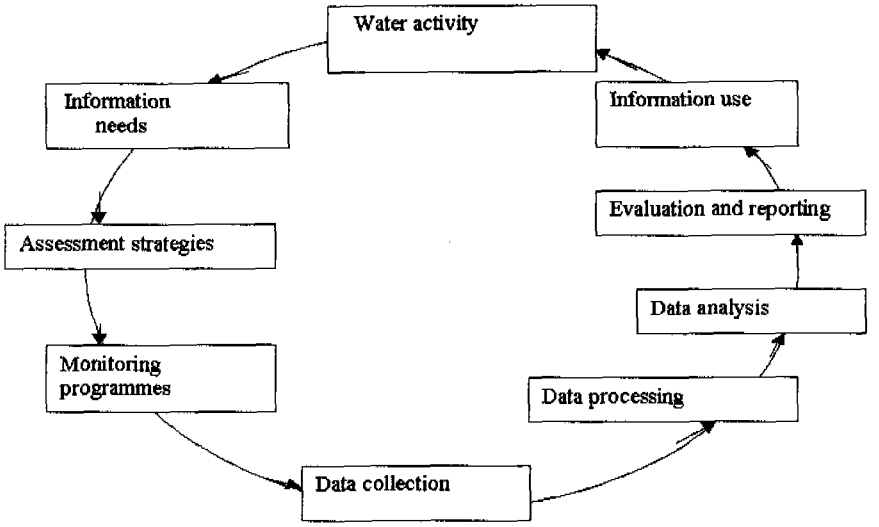

Fig. 1. Monitoring Cycle.

Each stage of monitoring cycle needs to be defined and planned in compliance with the required information product and specification of the previous component of the "chain". In developing monitoring and assessment programmes riparian countries are to consider all stages of the monitoring process.

Assessment of the information received can lead to the development of new information requirements or to the correction of previous requirements and to the initiation of a new sequence of activities. Thus, the monitoring process is improved. This promotes more effective implementation of the main monitoring objective such as accurate identification of long-term tendencies in changes of river parameters.

To implement the above approaches and provisions of the Guidelines it was decided to develop pilot projects on transboundary water quality monitoring.

Eight river basins were chosen as pilot studies for testing the UN/ECE Guidelines on Monitoring and Assessment of Trans-Boundary Rivers.

Ipel/Ipoly	Slovakia, Hungary
Mures/Maros	Romania, Hungary
Latorica/Uzh	Ukraine, Slovakia
Morava	Czech Republic, Slovakia
Bug	Ukraine, Poland, Belarus
Severski-Donets	Russian Federation, Ukraine
Kura	Georgia, Armenia, Azerbaijan
Tobol	Kazakhstan, Russian Federation

Work started on the first five in 1998. In December 2001 Tacis negotiated a contract with Mott MacDonald/Arcadis EuroConsult for the last three pilot projects and also the Pripyat (Ukraine, Belarus) because it has characteristics that suit it for inclusion.

The first stage of the project corresponds to Chapter 2 of the Guidelines and involves an assessment of the circumstances in each basin, and in particular of the trans-boundary zones. Historical data is collected and a preliminary assessment made of the factors likely to affect the quality of the water in the trans-boundary areas. Actual and potential sources of pollution are identified and the nature of the pollutants likely to be present, and their probable concentrations, assessed. National legislation and international agreements are evaluated for the extent to which they support the needs of trans-boundary cooperation in river basin management and in water quality monitoring. The responsible Ministries, agencies and institutions are identified in each country. Trans-boundary issues are identified.

Three things concern us at this stage. First, whether all the data, some of which may be regarded as politically sensitive, will be made available to the project; secondly whether the data will be sufficient in quantity, spread over space and time, to provide an adequate basis for assessment; thirdly whether the data is reliable. Some attention is therefore given to collecting additional new information to complement and check on existing data.

The second stage is to determine what information is needed in future, by whom and for what purpose. An essential activity at this stage is the development of an information dissemination and management system that will ensure that information quickly reaches those who need it.

The third stage is the development of a monitoring strategy that will routinely provide the data necessary to support the management of the river basin and meet the needs of all the users.

This must be coupled with an assessment of the monitoring capabilities of the local institutions who will carry out the monitoring. In some cases it is expected that monitoring capabilities may be limited, although other donors have provided investments in laboratories, some of which now have a high level of equipment. The Tacis project itself has a limited budget for investment in laboratory facilities. There is also provision for training. Laboratories that have been the beneficiaries of large investments in equipment often lack the experience and know-how to operate the facilities efficiently and do not always have the resources to pay for consumables that can place quite severe demands on operating budgets.

Trans-boundary monitoring on its own is unlikely to provide sufficient work or revenues for a modern laboratory. It must be accepted that laboratories must attract work for a wide range of customers if they are to be sustainable. A high workload also promotes consistency of results. This implies a clear separation between those who collect data and those who use it and emphasises the importance of data and information management systems.

The monitoring strategy and information management system will be implemented in a series of field studies as models for continuation after the project is completed.

The results of all the pilot projects will be used to propose improvements to the Guidelines.

PROBABILISTIC ESTIMATION OF LONG-TERM STREAMFLOW FLUCTUATIONS USING COMBINED ANALYSIS OF OBSERVATIONS OF GROUPS OF HYDROLOGICALLY HOMOGENEOUS BASINS

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Combined analysis is required for using not only the results of direct observations of separate objects, but also all the cumulative hydrological data obtained for many decades in studying the distribution of streamflow values probabilities. As is shown in the paper, in some cases the use of hydrological relationships allows us to diminish appreciably the geographical component of dispersion by reducing maximum streamflow characteristics to uniform formation conditions. From this viewpoint, the procedures to be considered are a kind of a tool making it possible to estimate objectively these relationships.

As applied to maximum streamflow evaluation, combined analysis of hydrometric observations is the only way of enriching the information on separate basins and extending it (that is most important) to the domain of small excess probabilities.

Two kinds of data have been used in the studies: (1) data of probabilistic modeling of random successions, simulating long-term maximum streamflow observation series; (2) data of hydrometric observations of maximum runoff of the rivers of the former Russia (153 measuring sections in its European Territory and in the steppe zone of Kazakhstan).

The method of combined analysis, suggested by S.N. Kritskiy and M.F. Menkel (1970) is applied to the investigation of various characteristics of maximum runoff and runoff-forming factors on some watersheds, in order to out what characteristics (and under what conditions) may be effectively refined by group analysis, as compared to individual observations on a single section or point, as well as to determined the most effective procedures of combining these characteristics.

The procedures of probabilistic analysis are used in this work. One of them consists in separating the dispersion of the estimates of probabilistic maximum streamflow parameters of the ensemble under consideration into random and geographic components. The distribution of parameters estimates and qualities and the assessment of quantiles can be regarded as a result of compositions of distributions, expressing variations in the hydrological values in time (the random component) and in space (the geographic component). If the latter is small, the characteristics of the random component may be used to estimate regularities of all the basins in a given group.

Another procedure of combined analysis is studying the probabilities of exceeding the extremum maxima, observed on the objects of the ensemble, and comparing the distributions of these maxima to the theoretical ones, using probability curves.

The concrete method of combined analysis depends on the adopted concept of the statistical homogeneity of combined hydrological values. The characteristics (most of them being meteorological ones, conditions of their formation are considerd to be similar), assume the possibility of the fact, the distributions of their probabilities for jointly analyses observation points practically coincide. Observation series for annually data predprecipitation maxima at 10 meteorological stations in Ukraine were used to study the characteristics of this type.

The value of the parameter to be determined, accepted for the final estimation, is based on both sources of information. Each of them is introduced ento estimates with the weight, inversely proportional to the dispersion of the respective estimate.

Random errors of quantiles of three-parametric gamma-distribution were obtained from the results of statistical tests on estimating the parameters using the maximum likelihoof method.

PROBLEMS OF ECOLOGY IN CENTRAL ASIA (REGIONAL PROBLEMS AND SOLUTIONS)

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In the present theses the questions of definition of priority regional ecological problems in Central Asia are considered. Revealing that of problems is necessary for governments to form more concrete schedules of measures and to fulfil operations with the greater efficiency on improvement of an environment and ecology.

1. Ecological problems of safety are phenomenon or processes at native and social capable to put damage of stability and processes of progressing of society.

The practice demonstrates, that in accordance with solring of ecological problems already becoming habitual (water, soil and air pollution), there are appeared new, more global problems. Reasons of deterioration of a status of environment are unstable and increasing consumption of natural resources, high density of the population imposing an overloads on resources of environment, the local and regional armed conflicts which are carrying on to stressful effect on environment and to its degradation. The problems are aggravated by the insufficient attention to problems of an environment in national and regional management and also limited financing of nature protection measures in comparison with other ways of activity. In the quidelines UNEP underlines necessity of developing more reasonable multilaterial and complex of the program of activity on environmental issues.

2. The largest territory in Central Asia is the basin of the Aral Sea, which one con- solidaty southern areas of Republic of Kazakhstan (South-Kazakhstan and Kyzyl-Orda), Kyrgyz Republic, Republic of Uzbekistan, Tadjikistan and Tyrkmenistan. Characteristic feature of locale is the closure of creation and usage of water resources, unity of environmental conditions, commonality of social concerns of the population.

3. The deep ecological crisis covered this territory has received World fame. The indicator of crisis is drying of Aral Sea. Swamping and salted of lands, wind erosion of land, are reasons of degradation of lands and to desertification. More than 60% of territory from all territory of Central Asia is under of desertification:-7 % was desertificated - 34% is in moderation and other part is weakle to degraded. Nonrational use of water resources of locale has resulted in almost utter annihilation unique woods in apron plains and deltas of the rivers serving which were by environment inhabitant of species of birds, fishes and mammals.

4. In the present time in the states of locale are developed and realized the schedules and measures on improvement of an environment and ecology, outgoing from internal conditions and problems. However efficiency of a solution of problems and undertaken operations will depend on execution by joint efforts of the states of locale of measures having regional nature, since territories of the states of basin of the Aral Sea on landscape and to nature-climatic tags, as it was marked earlier, are uniform, that predetermines influencing on a status of an environment and ecology in region of undertaken measures on their improvement in each of the states. In this connection it is necessary to determine what of existing ecological problems in Central Asia are regional and priority.

5. At definition of priority regional problems were selected, are parsed and estimated up to 15 existing common integrated ecological problems represented by the experts as national, thus the assumptions, that the list of national problems are not finality.

6. As working definition of a regional ecological problem the following approaches were accepted:

The regional problems - problems existing in one or few countries CAR, which requires regional involvement in their solution that:

- mechanisms (reasons) creating a problem, under the nature are regional;
- solution of a national problem (by virtue of any reasons),can not be achieved in this country;
- the solution of a national problem can be achieved more effectively with the assistant of measures in other country (other countries);
- the measures deciding a national problem, create problems in other countries.

7. The final definaition of priority of regional problems made on the basis of concrete examples and substantiation of reference by that or other problem to regional within the framework of accepted definition.

8. As a result of a conducted estimation the regional ecological problems in Central Asia were defined, which are conditionally divided on 3 blocks: the block A - ecosystem degradation to the basin of Aral Sea, block B- regulated by the global conventions, block C - other type of problems.

9. The block diagram of priority regional problems is developed. In the block diagram are indicated both regional problems and the reasons entailing originating of these problems, in particular, on a problem "degradation of lands"- are indicated reasons: downthrow waters of collektdrainage from adjoining countries, deposition of salts from an atmosphere, flooding from territories of adjoin, high waters also lodge, nonrational water use, the reasons on other problems are similarly indicated.

10. The defined list of priority regional problems was a basis for developing at sup-port of UNEP of the project: "Regional Environment Action Plan in Central Asia".

The list of priority regional problems will be also the basis for acceptance of the and development of solutions by governments of countries of Central Asia on realization of policy of sustainable development and ecological Safety.

PROBLEMS OF PROTECTING AND USING THE SURFACE WATER OBJECTS IN TOMSK REGION

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Last decades there is an appearance and intensification of crisis situations in a water economy in many regions of the world and Russia. There are complicated water and ecological conditions in Tomsk area within the bounds of Ob basin. A plain relief and superfluous humidifying have resulted in wide spreading the swamps and swamped grounds (more than half of Tomsk area or about 160-170 thousand км^2). Approximately 75 % of the populated area and most part of industrial and agricultural companies are located in the south of Tomsk area in Tom and Chulym undercurrent, which are the largest inflows of the Ob. There are oil and gas companies in northern and northwest thinly populated territories. Production of the oil and gas companies is moved with water means of transport and with pipelines along the Ob across the Tomsk area territory.

All above mentioned conditions form unique combination of water problems in Tomsk area. In view of it the analysis of the water and economy activity and the water resources of Tomsk area was held. In result, the main problems of using and protecting the surface water objects in Tomsk area were formulated. In nearest 10-15 years they will connect with poor quality of surface waters and strong swamping the territories. We enumerate some of the problems.

1. Very much wide spreading the swamps and swamped grounds essentially limits economic activity and degrades life conditions of the population. Especially we mark, that swamping determines poor quality of the surface waters.

2. If to apply the rules of water protection, using for an european part of Russia, to huge swamps of Western Siberia, it is necessary to stop economic activity on the most part of Tomsk area (specially in oil and gas producing territories).

3. The existing methods of estimating the anthropogenous factors on water objects are badly adapted to applying in conditions of wide spreading the swamps and heightened natural contents of some substances.

4. The clearing the sewages, as a whole, is unsatisfactory. The pollution sources, dispersed on the area, practically, are not controlled.

5. The existing system of monitoring does not allow in time to control a condition of water and economy complex and water resources of Tomsk area. Poor financing is one of the reasons.

6. Imperfecting the existing management system of Tomsk area water resources is one of the most important reasons of an unsatisfactory condition in a water economy. In result of it the water users don't interested in the water objects care.

The listed problems are interrelated. For some reasons they cannot completely be resolved in the near future. Nevertheless, we consider, that at the solution of last problem there will be considerable improvements in the protecting and rational using the water resources of Tomsk area.

PROBLEMS OF WATER AS OF COMPONENT OF ECOLOGICAL INFRASTRUCTURE SUPPORTING LIFE MEDIUM

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All things in World are interrelated and interdependent in "global network of life" and it is impossible consequently to solve problems of water separately from all problems of interaction of man and nature. The water is one of major components of nature; it takes part in set of processes of interaction of nature and man. In interaction of person and nature a relation between natural landscape components both resources and natural components and resources, conversed by person, continuously varies. This relation is permanently transformed, and it term as dynamical (quasistationary) state. From primary ecological equilibrium of nature of Earth based on balance natural environment-generative elements and natural processes, the state of interaction of nature with the man has transferred to secondary natural - anthropogenic, social - ecological equilibrium, at which with primary balance of natural environment- generative elements and natural processes have interfered urban and agricultural - cenosis. In nature its interior dynamic equilibrium (homeostasis) is supported to stationary renewal of its basic structures, of its material - energy composition, by self-regulation of its components. Its components are included in a circulation of matters, thus almost all substance, except for small volume of sediment, is in a constant circulation (in composition of components enter basic material - energy amounting of ecological systems: energy, atmosphere, water, soil, autotrophs and heterotrophs). Ecological components provide a circulation of matters and natural passage of stream of energy in biosphere. The plants produce with the help of photosynthesis organic matter with engaging of gases of atmosphere and mineral substances from soil. Animal and parasitic plants consume the organic matter of plants, and then vegetative and animal matter again is decomposed after destruction of organisms by decomposers to prime compounds reverting then in atmosphere and soil. The water actively participates in all these processes as major component of nature creating medium of life.

Medium of life of person is a dynamical system of interactive

among themselves natural medium ("first nature"), of quasi-nature medium ("second nature"), completely artificial medium of cities and housing medium ("third nature"), socially - psychological medium and socially - economic medium. Abundantly clearly, that these mediums can not be separated legible from each other: actually all of them are intimately interdependent and interact among themselves, therefore it is possible to term their plurality dynamical, taking place in fixed process of changes. There is binary set of kinds of true medium of person's life, from completely natural, theoretically clean and free from anthropogenic pollution, - up to almost completely technogenic, artificial, filled by unnatural subjects. The retentive medium of life ecological infrastructure includes water.

Ecological infrastructure is broadest and dynamical complex of interacting among themselves natural, natural - anthropogenic and artificial objects and systems providing a requirements of conservation of medium of person's life (of environment of man). Let's mark, that in compliance with this content of ecological infrastructure it is supreme and defining complex supporting and retaining medium of life, and consequently the activity of the man should be devoted to support of its high quality. As the mankind is part of nature, first of all in this complex enters nature - all materially - energy and information world of Universe. The nature is totality of natural conditions of existence of human society, with which it interacts directly or obliquely. On the second place is the second nature - converted by mankind ecosystems - field, gardens etc. It is not capable to self-maintenance during long-lived time. On the third place is medium most near to man in modern settlements nature, environment of the man in city, with elements of second and first nature (traditional. In system of ecological infrastructure all synthetic elements should be ecologized. Only in this case ecological infrastructure can maintain medium of life, and including provide the inhabitants of all settlements with water.

It is possible to mark three questions, connected with problem of water as major component of ecological infrastructure retaining medium of life:

1. All problems, concerned with water, have appeared as a result of growth of cities and of them man-caused evolution, that has given in many problems, starting from pollution of water and finishing its overconsumption. Therefore one of major problems is ecologization of existing cities, the making of ecological cities with minimum pollution of environment and with minimum water consumption. If the mankind sometime will solve this problem - it will be its largest reaching for all history.

2. It is impossible to solve problems, concerned with water, without the solution of questions of ecologization of all technologies and makings of ecological (biopositive) technologies and objects of technique. For example, author has made a complex of biopositive coast-protecting structures, which also clean water, contacting to them, with the help of aqueous plants and animal, which live in these structures. It is necessary to learn course "ecological infrastructure" for making exact representation about its role in making medium of life, including in support by water.

3. The third question: who should possess water of our planet - some countries or all mankind? Author considers, that in view of very major value of drinking water it should be not only subject of cares, but also property of all mankind. It is necessary, that any insufficiently developed and insufficiently well-educated society has not spoiled a major inland reservoir with drinking water, belonging to it. It is necessary to make "World Water Code" and accept it by all states (maybe, it is already?). The mankind should have the right to check a state of the most valuable reserves of drinking water.

It is especially important, as the different researchers offer permanently sharp restriction of number of mankind to provide it with resources, including water. So, per the last years any researchers proposed the idea of "ecological trace" ("footprint") for an estimation of "optimal" number of mankind. "Footprint" is required area and volume of nature, components of landscapes, including water, for support of high-quality medium of life of one man and for maintenance of ecological equilibrium, conservation and reduction of bio-variety. As a result of considerable volume of an ecological trace it is offered to leave on the Earth a "gold" billion. Usage of ecological infrastructure as basis of ecological construction (mastering) of territories, ecologization of technologies, for making high-quality medium of life, will allow to solve problems of provision of mankind by water.

PROBLEMS OF WATER RESOURCES USE MANAGEMENT ON TRANSBOUNDARY WATER BODIES

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Contemporary water-economic systems are complicated dynamic stochastic systems that comprise a big number of interacting elements. These systems management is a complex process that requires analysis of numerous random components and their relationships. Complexity of management multifold increases when necessity of management organization arises in the river basins if water resources of the latter were formed and used on the territories of several states.The Severskiy Donets basin is a typical example in this respect, as two states, namely Russia and Ukraine, jointly use its water resources. Accordingly, water distribution management on the basin territory should be organized in such a way that to take into account economic interests in the sphere of water resources use of the both states, as well as requirements to water quality valid on the territories of both countries. In this case coordination or agreement concerning all issues of joint use of the basin water resources are meant.

In order to secure an efficient mechanism of taking joint decisions SevKavNIIVKh has created an integral automated information/advising decision support system. Its aim is, on the one hand, to provide those responsible for decision making in water management with a tool able to optimize water resources use on local (within the boundaries of one state) basin parts and, on the other hand, to make these decisions transparent for both Russian and Ukrainian parties.

Consensus in adoption of a joint decision can be reached the fastest if the parties similarly assess consequences of these decisions. It this particular case it is secured by integrity of mathematical support and software used by experts of the Severo-Donetsk (Ukraine) and the Don (Russia) basin administrations.

QUALITY OF WATER AND HYPOTHETICAL ALGAL TOXINS

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As far back as beginning of twentieth century A. Putter expressed an opinion that the aquatic lives (hydrobionts) feed mostly dissolved organic substances (DOS), especially releases of algae. However only modem techniques enabled to collect the material, representing essential reasons for wide generalizations.

S. Lukas (1964) and K. Khaylov (1971) set forward the hypothesis about ecological metabolism of aquatic lives that allowed to realize anew regulating mechanism of hydrocenosis structures and evolving oforganoleptic properties of water.

The investigators from many countries in their numerous works have found that the substances being formed in algae releases are attribute to their metabolism and cell structures. It is well known that algae excrete a considerable (up to 60%) part of the substances synthesized by them. Interest to this problem has increased in connection with construction of reservoirs, channels and other hydrotechnical structures accompanying with "blossoming" of water, especially with blue-green algae. The latter often cause toxicoses of fishes, birds, animals and people (Telitchenko M., Gusev, 1964; 1966). Many investigators considered the antibiotic algae releases as a cause for mass poisoning of water etiology. A. Harder was one of first who indicated it (1953). M. Zavarzina (1959) found that phytoplankton taken from some "blossoming" lakes is self-inhibited. It has been confirmed in course of laboratory experiments that *Scemdesmus quadricauda* evolves worse in filtered water taken from "blossoming" water than in nutrient medium. On this basis the conclusion has been made that algae "blossoming" on reservoir through their releases suppress evolving of the competing forms. Further increase of inhibitor concentration leads to self-poisoning (Gorem, 1960). These inhibitors have been called respectively chlorellin, scenedesmin, microcistin etc. S.V. Gorunova (1966) suggested that chlorellin and similar to it releases of other green algae are regulators of growth and evolving for the latter. This suggestion is confirmed by Sud's experiments in course of which full (100%) substitution of cultural medium with filtrate containing algae releases inhibited evolving of chlorella whereas 25% substitution of cultural medium with such filtrate stimulated its evolving. Under these conditions chlorella filtrates in intense growth stage stimulate evolving of algae while chlorella filtrates in stationary growth stage suppress evolving of algae (Telitchenko M. and others, 1973; Tauts, 1968).

The above-mentioned data indicate toxicity of old algae cultures. In reservoirs toxicoses are observed in area of wind-induced algae ebb where the algae die away.

In course of the numerous investigations fatty acids, opsonins, antrachinons etc. were identified in algae releases. Professor M. Telitchenko and his colleges by means of thin-layer and fluid chromatography methods have found sterols, triglicerides, phospholipids and free fatty acids with 4-20 carbon atoms in cultures filtrates of *Chlorella vulgaris Beyer* and *Scendesmus obliquus (Turp.) Kutz* in logarithmic and stationary growth stage. Lipid fraction almost identical for both of these algae was estimated to be 20% - 30% DOS (Shesterin, 1972).

In 1896 - 1897 Bach - Engler formulated peroxide theory of oxidation. The main idea of biological oxidation came to the following: during activation of oxygen molecule only one chemical bond is torn and peroxide group - 0 - 0 - is formed. This group is attached to oxidizing combination, causing its further oxidation. At present the numerous investigations showed the products of peroxide oxidation of DOS have biological activity. (Vladimirov, Archakov, 1973; Kudryashov and others, 1961; Tarusov, Zhuravlyov, 1965). Obviously these products play the role of the "medium hormones" (Odum, 1985) or xenobionts (Park, 1973). Apparently metabolites of algae, especially their lipid fraction, as a result of peroxide oxidation transform to algal toxins causing toxicoses and self-poisoning of the producers (Telitchenko M. and others, 1972; Telitchenko M., Telitchenko L., 1972; Telitchenko M., Chernyshov, 1971).

The investigations carried out by our group have confirmed: firstly, the presence of free-radical oxidation of DOS in algae cultures; secondly, in intensive growth stage the algae releases have antioxidant properties which attenuate as the algae cultures get older. The similar regularities we have found also in nature.

Thus, the plankton algae through antioxidant releases actively form a medium for their life. Their dying is accompanying by free-radical oxidation of DOS and accumulation of toxic products - hypotetical algal toxins in water. This conclusion is confirmed by the following:

- high reaction capacity of DOS in algae cultural and "blossoming" reservoirs;
- the presence of the unsaturated fatty acids (the active substrate of peroxide oxidation) in the latter;
- the presence of organic peroxides inDOSlipids:
- intense excretion ofantioxidants in quick-evolve algae cultures.

RESTORATION OF POLLUTED LAKES BY ECOTECHNOLOGY - A CASE STUDY IN TAIWAN

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Ecotechnology and ecological engineering are new fields in the science of ecology, which can be viewed as designing or restoring ecosystems according to ecological principles. Ecoligical engineering thus combines basic and applied science to restore, design, and construct aquatic and terrestrial ecosystems. The goals of ecotechnology include the restoration of ecosystems that have been substantially disturbed by human activities such as environmental pollution or land disturbance, and the development of new sustainable ecosystems that have human and ecological value. Chung-Cheng Lake is located in Mei-Non, which is a beautiful agricultural village with in south of Taiwan. The lake was initially functioned for irrigation and flood control. However, it has been polluted seriously by sewage, swine wastewater, and non-point source pollution from crop fields. Especially for swine wastewater, there were over several hundreds thousands pigs raised in this village. The average concentrations of chemical oxygen demand (COD), suspended solids (SS), ammonia nitrogen (NH_3-N), and phosphate (PO_4^{-3}) were measured equal to 18, 18.6, 3.5, and 0.11 mg/L, respectively. The point source pollution of the lake was believed coming from Jung-Tzi-Liao creek and its branch Tai-Tzi Ken creek, which discharged into the lake in the northeast. Since the two creeks flow through the crop fields and feedlot areas, large amounts of untreated swine wastewater and tail water from crop fields are discharged directly into the creeks to make them be polluted. In 1998, Japanese researchers constructed an artificial lagoon in Lake Kasumigaura at the river mouth of Kawajiri River which flowed into the lake to control both of point and non-point sources of pollution of the lake. The artificial lagoon was functioned as a stabilization pond to treat the polluted river water before being discharged into the lake. Inside the artificial lagoon, several artificial floating islands were put near the openings of the lagoon connected to the lake. A floating island is an artificial floating body on which aquatic plants such as common reeds grow. They could not only purify water but restore aquatic ecosystems. According to Japanese experience, Chung-Cheng Lake was also designed to construct an artificial lagoon and several artificial floating islands pollution control and restoration. However, since the rivers flowing into the lake were seriously contaminated, a constructed wetland was built in the littoral zones of the lake near the river mouth and artificial lagoon to treat the polluted river water before being discharged into the lagoon. The water quality of the lake after being treated by constructed wetland, artificial lagoon, and artificial floating islands in series was improved. This ecotechnological treatment facilities could cut 10-50% of SS, 30-50% of total nitrogen (TN), and 30-90% of total phosphorus (TP). It was concluded that using ecotechnology was not only an efficient but also economical way to restore polluted lakes.

RESTORATION OF SMALL RIVERS

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With restorating of small rivers we must aspire to removing, disturbance factors that allow the small river to restore itself over time.

Ideally, the successful restoration will involve only periodic monitoring, to check that the system is suiting itself through natural processes.

In addition, imbalances system can result in local and regional climatic changes, disease, fire and catastrophes like earth uakes, hurricanes, eruption, volcanic, landslides and floods.

The restoration place is determined most fundamentally by the features of the landscape that must be affected to achieve restoration goals. This sites should be marked visible stakes and more preferable by temporary fencing (usually a bright - colored sturdy plastic netting).

Emphasis should be placed on protection of existing vegetation in river region and sensitive habitat, erosion and sediment control, protecting air and water quality and providing for soil waste disposal.

Restoration effort should be made to prevent erosion. For this goal measures, which provide a significant degree of filtration for sediment - bearing runoff are using.

One method of controlling sediment is the use of a silt fence, which is normally made of filter fabric.

To help prevent failure of structure, the lower edge of the fabric should be placed in a 4 to 12 - inch - deep trench, which is then brackfilled with soil or gravel.

Straw bales are also common sediment control

measures. Bales should be placed in trenches about 4 inches deep, staked into the ground with their ends (not just corners) abutting each other.

In many small river restoration areas, the goal of this structures is to provide temporary stabilization vegetation develops and assumes those functions. Sites that are very wet and poorly drained might require extra preparation before restoration.Subsurface water can be intercepted by a perforated pipe, but the topography must be favorable to allow positive drainage of the pipe to a surface outlet.

Loose soil on a steep slope is prone to erosion or land sliding. Even on gentle slopes surface runoff should not be allowed since the stability noncompacted slopes is generally quite low.

The shape at the top of the slope is also important because if it forms a straight abrupt edge, plant regrowth will be nearly impossible. A rounded edge that forms a gradual transition between upland and slope will be much more suitable for growth.

The vegetative material fortifies a channel and banks of the river by the root system. It prevents weathering and destroying of channel parts. In addition, plants growing about water and in her itself, sustain self-cleaning ability of the river. It is consist of settling here microorganisms swallow from water of organic matters and, oxidizing, convert them into mineral oddments. These stuffs and applied at building with their help engineering-biological methods of works allow hereinafter to utillize ability of a vegetative material to neogenesis and self-regulation of the population, to intensifying the influence on a stream and on a channel, to long-lived maintenance of the work capacity.

Native species should be used where possible to strengthen the banks of river. This species must be suitable for that purpose. Competing plants, which commonly do not provide long - term protection of erosion, should be eliminated during the first years or two after planting.

With the restorating of small rivers nature conditions are mostly suitable, and then the small river will respond following conditions:

- Absence on a channel the rectilinear by way of regions;
- Availability of areas with intensive support of an agriculture, flooded in a high water period;
- Presence of alternating channel regions, shaded and unshaded by vegetation;
- Changing geometry of a channel cross section with variable depths, breadths and current velocity of a channel;
- Individual natural hydrological mode of a stream;
- Availability of the representative channel forms.

rH2 SCALE USAGE FOR REDOX CONDITIONS ESTIMATION OF THE LOWER DNIESTER

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The indicator rH_2 comprises information on Eh, pH, water temperature and that is why it is a high informative indicator, which characterizes the oxidation-reduction condition of the natural environment. Within rH_2 scale from 0 to 42.6, it is possible to characterize all the degrees of water solution saturation by hydrogen and oxygen. In other words, rH_2 is a quantitative measure of the aerobic of the system. A "Neutral" point in the sense of oxidation-reduction conditions for water solutions is considered rH_2=28. The calculation of rH_2 indicator is made by using this formula: $rH_2 = 2pH + Eh/0.029$, where Eh is the oxidation-reduction potential, pH is the negative logarithm of hydrogen ions concentration.

Thanks to participation into the "ECODNIESTER-2001" expedition, organized by "ECOTIRAS" Association and funded by "REC-MOLDOVA" foundation on the Dniester's section from Dubosari dam to Ciobruci village of Slobodzia district, there were measured such parameters as oxidation-reduction potential, pH, water temperature and electroconductivity. The measurement of these parameters was made during summer time by means of a portable device Water Tester (Portugal by Hanna company). For each pair of Eh and pH modules, there was made a calculation of rH_2 indicator. The results received are showed on the chart $rH_2=f(n)$. The chart shows the dependency of $t^0C=f(n)$, where n is the place and date of the parameter measurement. The deciphering of n is presented below (Fig.1).

The chart shows very clearly the fall of rH_2 oxidation-reduction indicator from 28.2 to 24.4, a fact that reflects the transition from normal (neutral) oxidation-reduction status to one where the reduction processes prevail the oxidation ones. During the expedition time, the level of the Dniester water was constantly increasing. This happened because of the additional water flow from Dubosari water reservoir. The coming water from the reservoir probably, contain a big quantity of easy decomposed substances which facilitate the development of microorganisms, which during their lifetime reduce the oxidation-reduction potential of the environment.

With the low Eh levels the probability of anaerobic status appearance and death of hydrobionts vastly increase. There by, the oxidation-reduction conditions in such a situation showed the adverse changes in the ecological balance of the river.

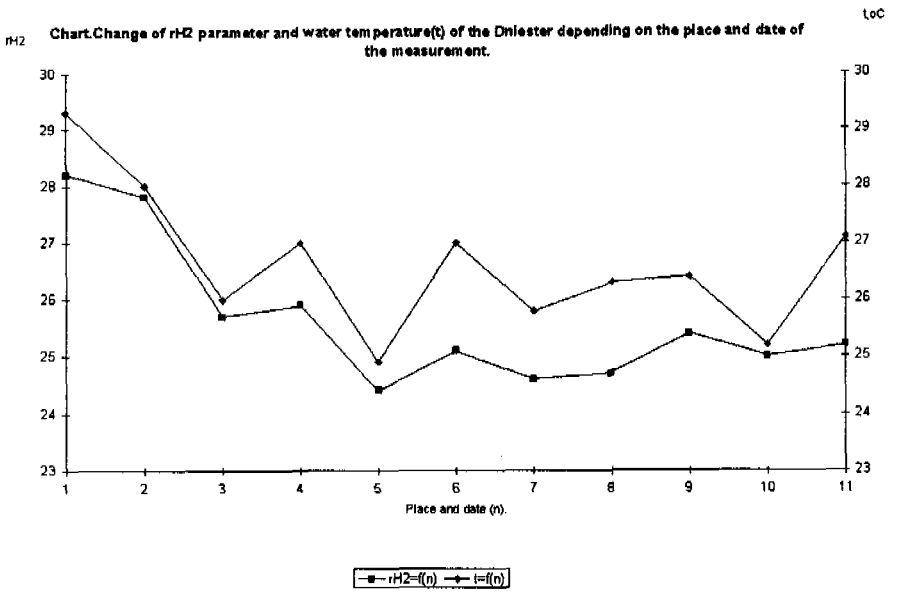

Fig.1. Change of rH_2 parameter and water temperature (t) of the Dniester depending on the place and date of measurement.

1) above the Dubosari dam-28.07.01;
2) below the Dubosari dam-28.07.01;
3) 500m below the Dubosari dam-29.07.01;
4) after the Reut confluence -29.07.01;
5) below of the Vadului-Voda city -31.07.01;
6) below of the Grigoriopol city -31.07.01;
7) near the village Gura Bicului-4.08.01;
8) after the Bic confluence -4.08.01;
9) below the bridge near Bender city-5.08.01;
10) 0.5 km above Tiraspol city-6.08.01;
11) near Ciobruci village-8.08.01.

RIZA CO-OPERATION IN RUSSIA

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The Netherlands Institute for Inland Water Management and Waste Water Treatment RIZA is one of the knowledge institutes within the Ministry of Transport, Public Works and Water Management. More specific, RIZA is the Dutch national knowledge center for integrated fresh water management. International initiatives of RIZA are guided by the "Partners for Water" Programme of the Netherlands Government, one of the objectives of which is to promote the concept of integrated water management and sustainability of resources use.

Main responsibilities of RIZA include also research and policy advice on matters of fresh water ecosystem management, including the ecological restoration and conservation of the water infrastructure and the wise use of wetland ecosystems. RIZA's concern for water and nature extends beyond the borders of the Netherlands, through transboundary ecological relations via rivers, seas and migratory flyways, and the impact of Dutch activities on environment and nature abroad. RIZA's Wetland Development and Restoration Department focuses on acquiring and applying expert knowledge on the functioning and interaction of processes in water-related ecosystems, guided by the river basin approach. This knowledge is to be used for policy advise on the wise use of water systems - promoting their sustainable utilization for the benefit of mankind in a way compatible with the maintenance of the natural ecosystem values.

RIZA's co-operation projects in the Russian Federation are embedded in the Joint Programme on Environmental Co-operation 2001-2003, agreed upon in the framework of a bilateral Memorandum of Understanding in the field of water and environment, as signed between 3 Netherlands Ministries and the Russian Ministry of Natural Resources. Ongoing regional co-operation projects are executed in the Pechora river basin, the Lower Volga region and the Tura river basin.

In the Tura river basin RIZA co-operates with RosNIIVKh on policy preparation and evaluation as well as on scientific aspects of monitoring and assessment in relation to integrated water management, including aspects of (regional) economic development. The co-operation stimulated the introduction of the concept of integrated water

management in the new Water Code of the Russian Federation.

In the Lower Volga region and the Pechora river basin RIZA co-operates with regional Committees for Natural Resources. Initially these co-operations aimed at increasing scientific knowledge on ecological processes in natural delta ecosystems as reference for ecological restoration initiatives in the Netherlands. Since 1999 the co-operation projects broadened to provide also ecological and economical input into the analysis of regional planning and management options for the combined use and conservation of river system and wetland resources in Russia as well as in The Netherlands.

ROLE OF FREE - RADICAL PROCESSES IN BIOLOGICAL FULL VALUE OF WATER ENVIRONMENT OF THE CASPIAN SEA

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The Caspian Sea is unique fish-productive a reservoir of Russia, on which share it is necessary about 90 % of world stocks sturgeons. Last years the tendency to sharp decrease of number of valuable breeds of fishes (including sturgeons) is observed, that is by the indirect certificate of adverse changes in aquatic medium of them habitat, therefore study of quality of natural water of the Caspian Sea, of its biological full value has both scientific, and practical interest.

In connection with possible consequences the caused changes natural (for example, climatic, hydrological) or anthropohenic factors (for example, at realization of geological-geophysical works on development of sea deposits hydrocarbon raw material) arise questions on the factors of influence limiting conditions of biological community habitation, about levels of chemical pollution and assimilation ability of water environment of the Caspian Sea concerning various polluting substances, in particular, oil-products.

In a reservoir the polluting substances can collect in bottom sediments and hydrobionts, be exposed biological destruction and chemical transformation as result of hydrolysis, photolysis or oxidative-reductive transformations, and also as a result of activity of hydrobionts. The set of all these processes determines ability of water environment to self-purification, that is directly connected to conditions of hydrobionts habitat.

For an adequate estimation of a condition of natural water environment state and its ability to self-purification, study of mechanisms aquatic chemical-biological processes is necessary, among which production-destruction, photochemical and oxidative-reductive processes connected with biological circulation of oxygen and carbon is necessary. The anthropohenic influence on these processes also causes, at the end, observable changes in water ecosystems.

The important role in self-purification of natural water environment is played processes with participation of products of activation of oxygen - of hydrogen peroxide, hydroxyl and superoxide radicals. In particular, under influence of radicals OH in water environment is carried out transformation most persistent pollutants.

In formation of free radicals in natural waters the importance has solar light and catalytical processes with participation. of hydrogen peroxide, living products of algue and metals of variable valency.

On the basis of the researches, carried out by us, on water area Northern Caspian, north-west part of Middle Caspian, Terek and Sulak-rivers and also on base of experiments, which have been carry out on modelling systems, principal role aquatic oxidative-reductive processes forming biological full value of water environment and its ability to chemical self-purification is shown.

The ecological condition of the investigated water areas of the Caspian Sea on the basis of an estimation oxidative-reductive and free - radical processes with participation of hydrogen peroxide, and also hydrochemical and hydrobiological parameters specifies presence of water areas with disbalance aquatic processes in direction intensification or oxidative, or reductive processes. The high efficiency of chemical processes self-purification is found out. The ability of water environment Northern and north-west part of Caspian to chemical self-purification from organic pollutants appreciably is determined by the contribution of free - radical processes with participation hydroxyl free radicals.

Effect of a drain of Volga-river influence on free - radical processes in sea water environment has inhibitory character and can be observed on border Northern and Middle Caspian (island Chechen-peninsula Mangushlak).

Thus, both on Bottom Volga, and in Northern Caspian during mass flowering of blue-green alga reductive processes is intensificated, resulting to seasonal occurrence of toxic redox-state of water environment.

Flow Terek and Sulak-rivers results to intensification of free - radical processes in sea environment of a coastal zone, that is accompanied by formation of a super-oxidative redox-state of water environment, at which the ions of manganese pass in reactive-ability form Mn (III, IV), last can be represent danger for hydrobionts, having gills breath.

On the basis of a method of a quantitative estimation of efficiency of free - radical processes of pollutant transformation, the ability to self-purification of Kizlyar-bay is calculated in relation to phenol, oil-products and chlororganic compaunds.

ROLE OF THE HUMANITIES IN SOLVING WATER PROBLEMS

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1. Current exhaustion of water bodies, deterioration of their regime and water quality are the cause of ever growing concern for the existence of the biosphere and future of the mankind. This is explained by: unique properties of water as a natural environment component; its irreplaceability and occurrence in all the Earth spheres; its tremendous role in physical, chemical, biological and geological processes forming these spheres; permanent and quick response of ecosystems to water abundance or deficit; highly dynamic character of water itself; and finally, its participation in all production spheres.

2. Any economic or other human activity necessitates accounting of mutual impact of water resources and the environment: any environmental changes affect water resources and vice versa - variations in the water bodies regime entail environmental changes.

3. Research carried out in different countries of the world convincingly show that currently dominating purely "consumptive" attitude of human beings (both decision-makers and people on the whole) to the biosphere shortens its life and, therefore, the life of the mankind. To preserve life on the Earth, we need to learn to live in harmony with nature and its laws. And it is first and foremost water that people must change their attitude to.

4. Every human being must be made aware of the fact that we have created such technogenic sphere that cannot be endured by our common home - the Earth. Owing to the fact that water resources conservation depends, to a certain extent, on everyone, increasing the role of culture, educational level and ethics of all social strata should be paid special attention to in the concept of the state water management policy and in the activities of governmental bodies.

5. Many years of endeavour, both in this country and worldwide, have proved the futility of purely administrative, engineering, legal or economic measures to reverse the current negative trend, in spite of tremendous capital investments.

6. It is now becoming ever more evident that the age of noosphere is only for the society, every member of which is highly intellectual, responsible for the fate of the biosphere and acting in accordance with such responsibility. This can be achieved only drawing on the treasure of knowledge, culture, education and ethics accumulated by the humanities over millennia.

7. It is necessary to develop a detailed program of education and upbringing of young generation, from nursery and secondary schools to special courses for professionals in different branches of economy and political and economic decision-makers. Special attention should be paid to the preparation and publication of popular science literature and visual aids, destined for different social strata, as well as to weekly scientific and highly artistic radio and TV educational programs.

8. It is necessary to intensify fundamental studies of the effect of culture on water resources rational management and protection under the conditions of market economy.

RUSSIA, INTEGRATED WATER RESOURCES MANAGEMENT, AND THE GLOBAL WATER PARTNERSHIP

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Global Water Partnership

Water issues are not academic. In many communities around the world, they are a matter of life and death. For example, arsenic in groundwater in Bangladesh and India, or the heavy metals entering rivers and drinking water because of poor wastewater treatment systems, or the importance of data and management systems for dealing with scarce water in arid zones, or the information needed for managing areas which are at risk from flooding - these are all life threatening issues.

So, what do we need to do to address these issues? Paramount is that we must get decision makers to understand that all users of water - government departments, academics, community groups, NGOs, the private sector and other interest groups - need to get together to share information, understand data and work together to solve their problems. We must persuade them to move away from the present fragmented, sub-sectoral practices and instead, integrate water resources management policies and practices to provide holistic cross sectoral water management.

There are several key lessons that need to be learnt. First, there is no useful purpose is served by characterizing irrigation as one of the 'enemies' - instead, the task that lies before us is to 'reinvent irrigation for the 21st century'. In most areas for example, actual water application varies considerably from the required irrigation practices. Consequently, there is high potential for water savings by improving water use efficiency. In other words, we must devise clever means to obtain *more crop per drop*.

Second, we need to improve the financial situation. The World Water Commission reported to the Hague Ministerial Conference last year that while $70 billion dollars are currently being spent on water management, $170 billion per year is needed to spent if the world is to address the problem

of 1.2 billion without water access, 2 billion without sewage *and* to take on some of the environmental damage. To address this gap, greater community involvement is required and the energies of the private sector need to be harnessed so they can serve the poor with more cost effective options. We need desperately to find new and innovative financing mechanisms, perhaps through the global capital markets.

Third, *we need to change the way we manage water.* Decision makers must understand that solutions to current and coming crises will not, for the most part, be found in new and extraordinary technological advances. Instead they will be found through changing our patterns of water use and the way we manage water. Sectoral approaches lead to fragmented and uncoordinated development and management of the resource. There is a better way. It's called integrated water resources management (IWRM) - an approach to water management that seeks to balance human, industrial, agricultural and environmental needs. The three fundamental elements of IWRM are: the enabling environment, institutional roles, and management instruments.

The Global Water Partnership (GWP) network is dedicated to tackling the huge issues involved in changing the way we manage water and, most importantly, on promoting water management procedures taken in the context of river basins as a whole. Through its network of partners, GWP is trying to get the right people to talk together and help them get the tools they need to make better decisions to promote cross sectoral dialogue on common water problems and to develop action plans to resolve these problems.

But, moving forward with the new integrated approach is not just a question of bringing in innovative ideas and actions from all sectors and water user communities together, it also means changing those actions that are creating the problems, and especially encouraging political commitment to create the necessary changes.

From the outset, the Global Water Partnership was conceived as a partnership among all those involved in water management. Today, GWP has nine regional offices - in China, South East Asia, South Asia, Southern Africa, West Africa, Central Europe and the Mediterranean, Central and South America, and several more are in the process of being established, most notably Central Asia and Central Africa. Together with GWP's Associated Programs (autonomous organizations that address important cross-sector water and IWRM issues), the GWP network lies in a unique position to bring people together to promote change.

The issue for discussion in this Congress is how Russian and GWP water professionals may better interact with each other for the purposes of information exchange on how to put integrated water resources management into practice.

SETTING OF WATER QUALITY TARGET INDICATORS INSETTING NORMS OF MPAI (THE CHUSOVAYA CATCHMENT AS A STUDY CASE)

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Many-year practice has shown that the still valid in Russia system of setting norms based on maximal permissible concentrations-maximal permissible content is insufficiently adequate and does not correspond to contemporary requirements and concepts on ecosystem approach to water management. With maintaining of the given system of the norms setting attaining of the Water Code goals, i.e. setting norms at the catchment level in order to reach aims of ecological/economic safety, setting norms of maximal permissible adverse impact, does not seem possible. The accepted Concept of state policy in the sphere of water bodies use, restoration and protection stipulates transition from MPC-MPC norms setting system to more flexible and realistic system of target indicators of the water body state.

Introduction of the target indicators system in Russia will permit to harmonize the main approaches to water management and water bodies protection with those accepted in the European Union countries.

Target indicators define limit conditions of surface water bodies water quality, that prevent degradation and secure attaining (maintaining) of the best possible (attainable) status of aquatic ecosystems directly depending on the water bodies state. Accordingly, setting of the MPAI norms should be based on the water body target indicators.

Since 2001 in accordance with assignment of the Sverdlovsk Oblast Ministry of Natural Resources RosNIIVKh is involved in activities on development of MPAI norms for the Chusovaya river catchment The Chusovaya is important for the national economy and at the same time it is one of the most contaminated water bodies of the Urals Region. The main goal of these activities is to work out and implement in water management practice the above norms as facilitating water resources rational use, practical realization of sustainable water use principles with taking into consideration catchment features, as well as aquatic ecosystems restoration and preservation etc. One of the main stages of this work is setting of regionally adopted target indicators. There is no experience of target indicators practical setting in Russia and this work is a pilot one.

The water body target indicators were set on the basis of available monitoring data in the following order:

- assessment of natural conditions and human activities in the Chusovaya catchment by fund materials and nature observation materials;

- critical analysis of the available information on the water body target use, economic activities on water bodies and the catchment, and on the water bodies state;
- completion of structured water-economic/hydrographic scheme of the catchment and isolation of calculated plots with fixation of the preferable water use status;
- zoning of the catchment in terms of ecological situation pressure and ranking the plots and individual bodies in accordance with their role in forming of the water body water quality;
- hydrochemical zoning of the catchment and determination of background concentrations for the main hydrological seasons;
- assessment of actual state of the plots in accordance with the ecological classification;
- determination of the composition of hydrochemical indicators accepted for setting norms;
- setting of water quality target indicators for the isolated calculated plots.

The Chusovaya catchment area within the boundaries of Sverdlovsk oblast is nearly 11500 km^2, this is about 6 % of the oblast territory. The Chusovaya and its tributaries runoff is significantly regulated, inter-catchment redeployment is effected from the Ufa river. The Chusovaya catchment is the principal source of urban and industrial water supply of the Yekaterinburg industrial area. About 200 water users are located in the catchment, industry, communal utilities and agriculture are highly developed there. At some plots water resources use reaches up to 60 %. On the basis of water/economic situation assessment 12 calculated water/economic/ecological parts were identified, at 6 out of them urban water supply is the priority.

The list of indicators being controlled comprises 26 ingredients specific for the region. On the basis of many-year data from 32 monitoring stations the catchment hydrochemical zoning was performed (5 zones), for them united pollution background values were set. In this process exceeding of MPC for fishery and urban water supply purposes by the natural background was registered for a number of ingredients (iron, manganese, copper etc.).

Assessment of actual water bodies condition in comparison with the background values permitted to identify and to rank the plots by degree of their ecological stress. The most crytical situation was observed on the Chusovaya range in the vicinity of Pervouralsk, in the Severushka river and at the range between dams of the Verkhnemakarovskoye and Volchikhinskoye reservoirs. Priorities in terms of pollutants were determined for each range, planning of water protective measures should be focused on mitigation of these pollutants content.

On the basis of the performed researches the target water quality indicators were proposed for 12 calculated ranges with taking into account their hydrographic hierarchy. They were set by the method of expert evaluation on the basis of rational combination of general sanitary-hygienic and ecological requirements to water quality, regional features of the natural waters hydrochemical composition permitting the ecosystems characteristic changes within the natural succession range, and real social/economic situation within the catchment territory.

SETTING UP STANDARD FOR AND MANAGEMENT OF SURFACE WATER QUALITY: NEW APPROACH

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This report discusses an approach to a restriction on the supply of chemical substances for surface water bodies by setting up a standard for a permissible chemical load (PCL).

Permissible chemical load $M_p(x,T)$ is considered to be a mass of priority chemical substance entering a water body and its catchment area for year (T) as a result of economic or other activity which together with "natural" component $M_n(x,T)$ does not lead to an increase in concentration of the given substance in downstream cross section (x) above the standard for the maximum permissible concentration (C*).

$$M_p(x,T) = \max(0, Q(x,T)C^* - M_n(x,T)).$$

Here Q(x,T) is annual runoff in the downstream cross section of the reach.

To calculate PLC value one should choose water courses (or their reaches) characterised by reasonable homogeneity in forming their hydrological and hydrochemical regimes. They should be considered together with their catchment areas within the limits of administrative boundaries.

The standard for MPC (C*) is to be established taking into account the end use of the water body below the downstream cross section as well regional characteristics of forming hydrochemical regime of the water bodies.

PCL value is primarily calculated for priority substances chosen on the base of monitoring data.

At present, the concept of a natural component of chemical flow from an area is a matter of convention. So, it would be more properly to consider $M_n(x,T)$- value as a relative natural component of hydrochemical regime which can be calculated on the base of the background monitoring data in observation points located within the limits of the given water body. In the event of data lack the value can be calculated for analogous water bodies as well on the base of the retrospective observation data.

It is significant that PCL value cannot remain constant year after year, it depends on a hydrological regime of water courses and the conditions under which the hydrological regimeis formed. At the same time, the conditions of economic activities on the catchment area presume some stability as to entering chemical compounds into the environment (water consumption, discharge of sewage and air emission, the use of fertiliser and plant protection means). The level of a real anthropogenic load (on chemical compounds) cannot vary significantly for a short period of time. So, the possibility always exists of exceeding the standard (desirable) water quality. It means that setting up the standard for permissible anthropogenic load can be interpreted in terms of probability. It is possible to point out the load level able to ensure (with some confidence) that the required water quality would be kept, but the probability always exists that the desirable water quality would not be reached in spite of our attempted to mitigate anthropogenic effects.

Thus, the standard value for permissible chemical load (PLC) is determined by the given level of assurance in keeping required water quality p or probability of its exceeding (1-p) - $M_p(p,x,C^*)$. If the latter is the case, ecological risk can be discussed. In some sense, setting up the standard for PCL is analogous to a concept of ensured (with certain assurance) water supply of consumers under the conditions when some uncertainty exists as to forming water resources. Note, that the choice of p-value cannot be made in the framework of PLC calculation. It is determined by social and economical factors.

After singling out a number of reaches of the stream characterised by their own control downstream cross sections (x_i) and calculating $M_p(x_i,T)$-values for each of them, the standard for PLC can be calculated within the inner reach of the water body as the difference between PLC-standards for downstream and upstream cross sections according to the equation

$$\Delta M_p(p_i,x_i) = Mp\ (p_{i-1},\ x_i,C^*_{i-1}) - \Sigma_k\ M_p\ (p_i,x_k,C^*_i)$$

Here, both the standard for water quality and assurance of its keeping are determined by the requirements of the downstream reach.

The study covers some examples of application of this approach to catchment areas of Kundryuchya-river (Krasnosulinsk district of Rostov Oblast), a reach of Kama-river within the limits of industrial complex Solikamsk-Berezniki (the north-eastern area of Perm Oblast), a reach of Chepets-river (within Kirov Oblast).

SIMULATION RAINWASH FROM CATCHMENT AREA

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For account of statistical parameters of characteristics of mountain mud floods the following initial data's and equations are used.

Input data's are the next:

- quantitative characteristics of mudflow forming precipitation H, T, J;
- corner of an inclination of a slope, α_s;
- volumetric of soil water corresponded to a level by least moisture capacity (field capacity), θ_{fc};
- porosity of a ground, ε;
- coefficient of a yielding of soil to erosive washing off, from χ';
- the threshold intensity of runoff formation, at which begins appreciable by washing off a ground, q_0;
- coefficient infiltration, f_0;
- time of runoff transformation in river basin, τ.

The solution of the task spatially scratches of a system of random fields of atmospheric precipitation be based on a possibility of usage of all privileges of the normal distribution for performances of rains and singularity of definition of a zone (boundary of a field) rainfall under the condition of simulation of markovian fields. For an amount (height, H) and duration (T) of precipitation the following system of transformations of input data's H > x > u (T > y > v) is used at the expense of two sequential operations: normalization x (y) and standardization u (v).

The random process of rainfall intensity is characterized by an average level of a pulsing and amplitude of oscillation an intensity.

The statistical parameters of random process of surface runoff formation depend on an average intensity of a rain and the parameter of infiltration of soils and grounds of unit-source watershed. Standard deviation of intensity surface runoff formation

$$S(q)=\sqrt{2J^2-2Jf_0+f_0^2+2f_0^3/J\left\{\left[J/(f_0+J)\right]^2-J/(f_0+J)+J/2(f_0+2J)\right\}-\left(J^2/f_0+J\right)^2} \quad (1)$$

Standard deviation of the smoothed process intensity of runoff formation

$$S(\bar{q}_\tau) = \eta'_\tau S(q), \quad (2)$$

where $\eta'_\tau = \frac{4{,}472}{\tau}\sqrt{\tau - 10\left[1-\exp(-0{,}1\tau)\right]}$ (3)

For calculations mathematical expectation of total intensity of runoff formation and erosive washing off random process qΣ (t)

$$M(q_\Sigma) = \left[1+\chi\cdot(1+\xi)\right]\cdot\left[J^2/(J+f_0) - q_0\right] + q_0 \quad (4)$$

where $\chi = \chi^* \cdot \sin\alpha_{ск}$, (5)

$$\varsigma = \Theta_{HB}/(1-\varepsilon). \quad (6)$$

Variance of total intensity runoff formation and erosive washing off random process qΣ (t)

$$D(q_\Sigma) = Z_1\left(1+2Z_2+Z_2^2\right) - 2q_0 Z_3\left(Z_2+Z_2^2\right) + q_0^2 Z_2^2 - M^2(q_\Sigma), \quad (7)$$

where

$$Z_1 = 2J^2 - 2Jf_0 + f_0^2 - \left(f_0^3/J\right)\left[\frac{2J}{f_0+J} - 2\left(\frac{J}{f_0+J}\right)^2 - \frac{J}{f_0+2J}\right], \quad (8)$$

$$Z_2 = \chi\cdot(1+\xi), \quad (9)$$

$$Z_3 = J^2/(J+f_0). \quad (10)$$

The maximal intensity of total runoff formation and erosion is determined under the formulas: at $T_q < M(t)$,

$$(q_\Sigma)_{\max} = M(q_\Sigma) + S(q_\Sigma)\eta'_\tau\sqrt{2\ln\left(\frac{T_g-\tau}{2\pi\eta'_\tau\tau}+1\right)}, \quad (11)$$

at $T_q \geq M(t)$,

$$(q_\Sigma)_{\max} = M(q_\Sigma) + S(q_\Sigma)\eta'_\tau\sqrt{2\ln\left(\frac{M(t)-\tau}{2\pi\eta'_\tau\tau}+1\right)}, \quad (12)$$

where T_q -duration of runoff formation, determined by the formula ($T_q = T - T_0$.);

$S(q_\Sigma)$ - standard deviation of random process qΣ (t);

M(t) - total duration of time intervals during loss mudflow forming precipitation under condition of $i \geq i_{cr}$, determined by the formula ($M(t) = T\exp(-i_{ск}/J)$).

Density erosive washing off of a ground from a slope at the maximal intensity of runoff formation

$$\gamma = \frac{\chi(q_{\max}-q_0)(\rho+\rho_0\xi)+\rho_0 q_{\max}}{\chi(q_{\max}-q_0)(1+\xi)+q_{\max}}. \quad (13)$$

The maximal discharge mountain mud flood

$$Q_{\max} = 16{,}67\cdot F\cdot(q_\Sigma)_{\max}; \quad \tau \leq Tq, \quad (14)$$

$$Q_{\max} = 16{,}67\cdot F\cdot(T_q/\tau)\cdot M(q) \quad ; \ \tau > Tq, \quad (15)$$

where M(q) - mathematical expectation of intensity surface runoff formation, determined by the formula

($M(q) = \frac{J^2}{J+f_0}$).

Volume of mountain mud flood:

$$W = 60\left(\frac{K}{B}\right)T_q Q_{\max}, \ T_q < M(t), \quad (16)$$

$$W = 60\left(\frac{K}{B}\right)M(t)Q_{\max}, \ T_q \geq M(t), \quad (17)$$

$$K = \frac{\tau}{t}, \quad (18)$$

where $\bar{t}$ - is determined under the formula

$$\bar{t} = \frac{\bar{m}}{N}\sum_{i=1}^{N} M_i(t)$$

( ).

Model rainwash from catchment area of approbation for an estimation of probability characteristics of surface runoff formation and operating short-term prognosis of mudflows in mountains Zailiyskiy Alatau (Kazakhstan).

SOCIO-ECONOMIC MODEL (SEM) - AS DECISION SUPPORT SYSTEM (DSS) FOR ESTIMATION OF SUSTAINABLE DEVELOPMENT OF THE STATES OF ARAL SEA BASIN

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In conditions of sharp deficiency of water resources and arid a climate of Aral sea basin, stability of perspective development of the states of basin are in direct dependence on available water and ground resources. Irrigated agriculture in Central Asia has history of more than 5 thousand years. But during the last 40 years the overuse of the water resources resulted in the Aral Sea

crisis when almost all water that used to go to the Aral Sea was being used for irrigation.

Now in the third millennium we face an enormous dilemma: due to economic developments the demand for water could increase again, even to a level using all available water leaving nothing for the Aral Sea.

By the way, the yearly available amount of water is enormous: if it was Cola, every person on earth could drink 60 bottles a year that is 120.000.000.000 liters in total!

The question of an estimation of the future even approximate always was important for planning strategy of perspective development for each state. The tool for such assessment is mathematical models of demographic, economic, ecological and other processes, and more often their combination. They do not give the direct answer to a question well or badly we shall live in the future, but may give values of indicators or criteria, which will help to assess economic, social and ecological well-being of the state.

Socio-economic development model (SEM), created in SIC ICWC (Tashkent), under the direction of professor V. Dukhovny, helps to understand to decisions-makers how steadily the region, by means of the chosen criteria and indicators, may develop.

Model consists of the set of models including social-economic, hydrological and Aral Sea model, which connected through the user interface (fig. 1).

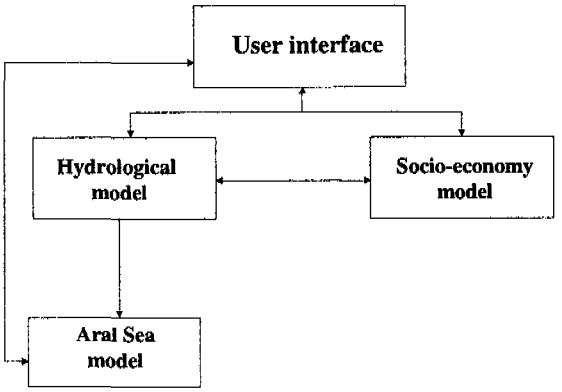

Fig. 1. Structure of model.

The social-economic model tries to predict, what will happen with social and economic system. The model is based it on the following parameters:

- the population (rural and city)
- economy (GNP, GNP per capita, contribution in GNP from all sectors of economy)
- water (water demand of all sectors economy; availability is calculated by hydrological model)
- agriculture (irrigated lands productivity, crop yields)
- investments (investments in economy, investments in agriculture, direct foreign investments, investments in land reconstruction, investments in new land development)
- power (production and consumption)
- nutrition (calories production and consumption, with regard for food basket)
- account of climate change impact on water resources and an agricultural production etc.

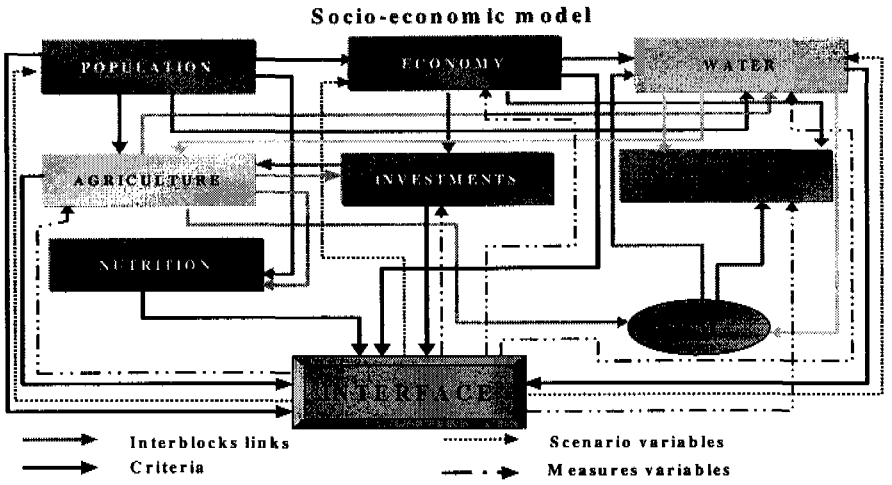

Fig.2. Structure Socio-economy model.

User management of future development scenarios.

By SIC ICWC are offered 6 scenarios of the future development:

1. optimistic scenario under close cooperation.
2. optimistic scenario without cooperation
3. pessimistic scenario with strengthening of cooperation.
4. pessimistic scenario without cooperation
5. scenario zero - all existing tendencies are kept.(Business as Usual)
6. scenario average expected - average between scenario 1 and 5.

SPECIAL FEATURES OF THE RAFESETTIND OF THE SERIES OF THE RIVERS DRAIN FOR THE ENGINEERING CALCULATIONS

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Study for a long time of river's drain is a basis of many technical characteristics calculations in water supply branch, in protection against harmful water influence, etc. Usually, it is supposed, that the fluctuations of water quantity in the future will be similar to the last period of study. However, as showed by researches of many authers such assumption is not right. The long-time climate study shows that in XX century it was warmer and this process change the cycle of water quantity fluctuations of the rivers. This changes in not unequivocal, that is why it is necessary to study and calculate it both on the regions and on the drainage rivers basins. The laws-governed nature of climate change in Transbaikalien southeast are revealed by authors. This changes causes the alteration of rivers water quantity in drainage basin of Upper Amur.

The economic development in XX century, especial in its second halt reflected in change of the rivers drain, expressing in "the change" of an integrated curve of the drain. The action of climate and anthropogenous reasons has resulted in change of the quantity characteristics of water objects, which brings in the essential errors to standarts. So, use of the not updated series of drain study for calculation of parameters of the flood protective structures on r.Chita results in understating of settlement water quantity of 1% probability on 91,5 m^3/s, and maximum water level - on 0,2 m, with the account very shallow fine and wide floodplain will result in floodings and essential damages.

The authors offer a technique of rate setting of rivers drain long-time series of Upper Amur drainage basin with the account of climatic and anthropogenous changes. It consists in definition of the moment of uniformities infringement of series, splitting it for the periods divided by a point "of change", check of an initial series and generated selections of uniformity with the help of Student criteria and Fisher criteria and further linear approximation of selections with definition of correction coefficient for ratesetting of the not broken period the modern conditions.

This allows to specify engineering calculations of the various technical standards and structures for water objects for indicated region.

It can be applied and for other regions at presence for a long series of drain study with climatic and anthropogenous changes.

SPRING SURFACE HILLSLOPE A RUNOFF IN BASIN OF VOLGA

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A spring surface hillslope a runoff (SSHR) is one of the major elements of a hydrological cycle of watersheds, which to a large extent determinc quantiaty and qualitative condition of water resources of the small and average rivers. It is the least regulated part of a runoff, and therefore is the main reason of floods, soil erosion and various polluting substances from the watershed in the rivers and water objects, including toxic elements. At the same time in droughty area of SSHR it is one of the basic sources of filling of soil waters. In other periods of the year a surface hillslope runoff on the greater part of the Russian plain, including the basin of the Volga, increases only acasionally and considerably concedes the size of the runoff spring. Thus it means, that slopes are understood as the part the watershed, which is generally situated above gulchs, beams, river valleys and other elements of a hydrographic network. It is on the slopes that and plakors sites, the basic part of agricultural fields, are located.

To calculate annual normal SSHR we use the connection between magnitude of an normal annual river runoff in the area of water balance stations location in basin of the Volga and meanings of SSHR on runoff-plot on various lands on clay and sand of soils for the period of supervision. Total volume of SSHR for this or that territory, and also for each subject of the Russian plain, completely or partially included in the basin of the Volga, was determined as average weighted magnitude of a runoff from separate lands and soil differences in view of their ratio for the period of supervision.

The SSHR maps for the basin of the Volga are made. The analysis of these maps has shown, that on clay soils the magnitude SSHR for lands with autumn ploughing changes from meanings more than for 100 mm in northern areas of the Volga basin and less than for 5 mm in the southern one. For fields with the soil, condensed by spring, (autumn ploughing, winter crop) a range in the meanings of SSHR is from almost 120 mm, up to less than 20 mm. In the forest SSHR varies from more than 40 mm in a forest zone, up to zero meanings in steppe. From the separate subjects of Russian Federation in the basin of the Volga the highest meanings of SSHR are characteristic for Kostroma area. Here on clay soil in the forest it makes 44 mm, while in winter crop and fields with condensed of soil its magnitude makes 99 mm. The least magnitude of SSHR are characteristic Astrakhan area: 0, 2, 18 mm - accordingly. On the whole, on the area of the field in the basin of the Volga the normal annual SSHR is close to 60мм, that exceeds 25 км^3 - magnitude comparable with the Don river. The major part of this volume forms a river runoff, smaller part lingers over in the negative forms of relief and on sites with high infiltration properties of soil.

Due to the acricultural measures by the middle of the 80-s' years of the XX century the magnitude of SSHR in the basin of the Volga was reduced, at least for a quater, and annual runoff of Volga for 2%. It is interesting note that in a forest zone the runoff of the small rivers was reduced less than for 5 %, in forest-stepp zone - for 5-15 %, in steppe zone - more than for 15%. In the 90-s' in connection with socio - economic crisis of the national economy, the efficiency of water control measures on watersheds has seriously decreased, that promoted the increase of SSHR. This fact was also influenced by the phase of the increasing wetting at the end of the 70-s, especially in winter periods. At the same time, very warm winters have become an important factor of the increase infiltration properties of soil during spring high water and reduction of SSHR.

Inevitable in due course revival of agriculture will result in application of new technologies of regulation and management of processes of formation of SSHR aimed at the increase of soil moisture, and also reduction of carry out toxic elements and fertilizers with a runoff from the fields. In these conditions such regulation needs to be normalized. Criteria thus on the one hand can be regulation of magnitude of SSHR up to safe meanings in the erosive aspect, on the other hand it can be preservation of necessary minimum of SSHR , ensuring ecological function of the rivers, first of all small one, the alimination of which occurs in the spring period.

STREAM CHARACTERISTICS AFFECTING BANK STABILITY UNDER A LARGE FLOODING EVENT

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Streambank changes were examined to determine the relationship of various stream characteristics resulting from a large flooding event that occurred during the summer of 1993 along river courses in the Central Plains area of the United States. It was considered in the magnitude of a 100- to 500-year category. Water covered riverbanks and farmlands for a 2- month period. The study area was in the Lower Republican Watershed, which covers about 10 thousand ha in the north central part of Kansas, United States of America. The specific zone of study was a 30 km portion near Concordia, Kansas at about 40 degrees N latitude and 98 degrees W longitude. Elevation is approximately 470 m. The width of the stream at Concordia, Kansas is about 46 m which increases to 300 m at the highest flood stage date in July. The river flows southward through the Central Lowlands Province crossing a stratum plain formed by sediment formations, where loess (till 30 m) lies on fundamental Cretaceous (partial Permian) bedrock. Erosion relief is developed. Elevation of the streambed decreases by 33.5 m along the study course. The large Rocky Mountain barrier to the west provides a typical northern continental climate with periodic droughts, and mean annual precipitation is about 710 mm in the study area. Heavy showers occur mainly during the growing season providing nearly 2/3rds of the annual precipitation. Natural vegetation generally is mixed, including mid- and tall-grass prairie and prairie savannah. Crops cover about 81% of the landscape, and only 13% is forested. The riparian woody vegetation consists of many deciduous broadleaf forest species, including Populus deltoides Marsh, Acer negundo L., Acer saccharinum L., Celtis occidentalis L., Salix and Ulmus species.

The 1993 flood of historic proportions inundated areas that had not been affected by recent previous floods. Record peak stream-flow discharges were recorded by United States Geological Survey (USGS) stream-flow gaging stations throughout the Republican River Basin. Stream flow at the far southern point of the study was six times the historical yearly averages. The highest daily discharge was 1133.3m^3/sec on July 22, 1993. Approximately 10-year cycles of high water occur, but the last flood of major significance in the area was in 1950. During the flood the maximum water level reached 6 m at the nearest measuring station, Concordia, Kansas, which is about 25 km downstream.

Aerial photographic images were the chosen to compare pre- and postflood conditions (slides were taken in December 1992 and December 1993), because features

such as riparian vegetation and streambank edge can be identified easily. Local offices of the Consolidated Farm Service Agency (CFSA) provided slide images of the study area. Soil types were taken from USDA National Cooperative Soil Survey Manual.

Photocopies of the slides were digitized with a CalCompl digitizing tablet into a LandCADDI R12 computer-aided drawing (CAD) program file format. The photocopies were calibrated to previously digitized USGS 7.5 minute topographical quadrangle maps to enable accurate scaling and analysis of the images. Only features useful in calibrating the slide images, such as roads, railroad tracks, and mile section lines, were digitized from the quadrangle maps. Once the base maps were digitized, streambank edges from the 1992 and 1993 slide images of the Republican River were digitized. Notes as to land-cover and channel-position conditions were made within the drawing as needed. Then a river centerline was interpolated within the CAD drawing using the 1992 streambanks as a guide. The centerline served as a reference line for river position and hence channel-position demarcations of land cover classification.

Data collection points were established at regular 150-m intervals along the centerline in the study area from a total of 280 points on the right and left side of the steambank, but less was used for the analyses due to manmade structures along the riverbank. At these points, channel position and land cover were classified using the 1992 aerial photographs as references. Erosion and deposition amounts were estimated by measuring the perpendicular distance from the 1992 streambank to the 1993 streambank at data collection points.

Land cover vegetation types in the 30m zone next to the 1992 streambank were categorized as follows: forest land, cropland, grassland, or single tree-row. A forested streambank is one on which the dominant land-cover type (>51%) is woody vegetation. A cropland or grassland streambank is one on which the dominant land-cover type is either agricultural crops or grass. A single-tree row streambank is one on which a single row of trees exists adjacent to a non-forest land-cover type. Channel position was classified as straight, outside curve or inside curve. Soils were separated into sandy or loamy types. Channel position for the study area was as follows: 38% straight, 35% outside curves, and 27% inside curves. About 83% of the banks had sandy soils, and 17% had loamy soil. Many of the stream banks were entrenched. Data points for vegetation were classified as follows: 78% forest land, 2% as cropland, 2% as grassland, and 18% as single-tree row; thus, 96% of the banks were tree lined. Many of the streams were entrenched.

Channel position was significant at the 5% level and soil type at the 3% level, but the interaction between the two variables was not. Analyses of the digitized slide images showed us that the inside curve channel position lost the least soil, with a mean erosion of 2.1 m, whereas the straight and outside channel positions lost 8.9 m and 14.2 m of land area, respectively. Thus, streambank stability was highly related to channel position. Results indicate that the four land-cover vegetation types did not significantly affect the amount of erosion of the lateral streambank, presumably because of the small number of nonforest points. However, forest and singletree did differ by about 2 m when compared without the cultivated or grass types. With only a limited amount of data, we found cultivated cropland vegetation types eroded about 2 times the amount as the grassland areas. Sandy soils showed an average of 10.2 m erosion; silty soils less than 1 m.

We evaluated lateral streambank movement as an indicator of the amount of erosion or deposition. Determing the volume of soil erosion or deposition caused by the flooding waters was difficult and no accurate estimations of the volume of soil erosion or deposition were made. However, we predict that the volume of soil erosion and deposition would be similar to the extent of streambank movement. The volume of soil eroded probably was considerably greater than the volume of soil deposited as a result of the runoff of clay suspended material. Such investigations can provide us to find a way to prevent streambank disturbance during extreme flooding events.

STRUCTURAL MODIFICATIONS OF HYDROBIOCEONOSIS OF A RIVER POLLUTED WITH HEAVY METALS

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Heavy metals in water exert toxic impact upon living organisms, and the former toxic properties increase when these heavy metals are present in water simultaneously. Heavy metals are supplied to an aquatic system as a result of migration from rocks, due to anthropogenic pollution with urban and industrial waste waters, and via atmospheric precipitation. The heavy metals problem is topical for the Urals region where mining and processing industries are well-developed.

In 2000 an integrated research of the Salda river (a tributary of the Tura, the Ob basin) was performed. In the framework of this research the Salda hydrochemistry, phytoperiphiton and macrozoobenthos were studied in terms of the gradient of heavy metals concentration in water decrease. Metals were supplied to water from the Krasnouralsk copper-melting factory sludge depository open fields through the Sorya-Aiva small rivers system. The observed metal concentrations varied in the self-purification

and dissolution processes within the following ranges: copper - 1.78-0.142 mg/l, zinc - 5.73-0.518 mg/l, cadmium - 51.0-4.64 mkg/l, lead - 28.1- 0.5 mkg/l. As it can be seen, heavy metals maximal concentrations tens and thousands times exceeded MPC for fishery water bodies.

In the peryphiton algae phytoceonosis reliable structural modifications were registered at the observation ranges in the pollution dissolution gradient. Algae species diversity increased from 14 to 63, complex of domination algae Achnanthes minutissima and Oocystis sp. was replaced by Lyngbia sp. and Synedra ulna complex. At the same time number and biological mass also significantly changed from 0.001 to 2 mg/cm^2 and from 1.5 to 10 thousand cl/cm^2 , respectively.

In macrozoobenthos bioceonosis reliable changes were also observed in the heavy metals concentration gradient. It should be noted that in the most contaminated range and downstream zoobenthos organisms were not found at al, and first species, like Hexatoma, Palpomyia, Limnodrilus, Limnochironomus nervosus appeared only in the 4th range out of 7 observation ranges, while 59 taxons of invertebrate were found in the reference range. Analysis of the invertebrate communities structure has shown that leeches, molluscs and May-flies are the most sensitive to heavy metals groups of zoobenthos, and flies and Oliggochaetae are the most stable.

Beside structural modifications of bottom bioceonosis, aftermath of metals toxic effect on a number of aquatic organisms were registered. Thus, morphological deformations were found with Achnanthes lanceolata и Synedra sp. algae, and caddis-flies of Hydropsyche. Unfortunately, correlation analysis did not permit to reveal factors responsible for morphological deformations.

The studies results permit to conclude that the Salda hydrobioceonosis was considerable ecologically damaged. It will take several years after termination of toxic discharges to the river, a number of recreational measures and disposal of toxic bottom sediments will be required to remedy this damage. The Sorya bottom sediments are a fine dispersed pulp precipitated from the water supplied to the river from the sludge depository.

STRUCTURE OF A MODEL WATER RESOURCES MANAGEMENT INFORMATION SYSTEM OF THE BASIN LEVEL

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An automated information system for water management is a direct development of the decision support system and represents a higher level of management processes simulation automation with taking into consideration the authentic information. In view of the water management and planning current practice the functional structure of the river catchment water management should be considered as an aggregation of perspective, current and operational planning tasks to be solved on the basis of typical DSS tasks.

The perspective water use planning sub-system comprises the following tasks: simulation of the catchment water economy perspective development scenarios, formation of the river basin water sector information model with taking into consideration the perspective development scenarios, formation of water balance and water management simulation technological scheme, simulation of water balances on typical years, calculation of water balances on many-year (including simulated) runoff series, analysis of water resources availability for al stakeholders, analysis of major reservoirs and main channels management rules, archiving of water sector models and results of water calculations for various perspective development scenarios.

The current planning sub-system comprises the following tasks: modelling of water inflow to the calculated ranges in the periods of high water, low water and current year; assessment of available water resources for the planning period under consideration with taking into account expected inflow, current water resources in reservoirs and possible water resources subsidies; assessment of water users requirements to water resources use regime, including account of ecological, transit runoff and water qualitative state; development of major reservoirs and channels management plans; development of water resources distribution for main water users for the current period; development of water balances for the plan period (high water, low water, current year); development of measures on safe water works use and prevention of adverse water impact.

The water resources use operative management tasks are as follows: keeping of electronic log of water bodies and water economic systems regimes; modelling of the catchment water situation schemes on the basis of GIS technology; operative control and assessment of permissibility of the current regimes from the point of view of reliability of the main water users supply, safe use of water works and prevention of adverse water impact; operative reservoirs and channels management; forecast of water bodies hydrological situation development, including analysis of emergencies aftermath; water quality management in emergency situations.

Currently the above systems are being developed for water bodies of Southern Russia and for the Don catchment, with taking into consideration transboundary nature of this water body.

STUDIES OF SYNTHETIC SURFACE-ACTIVE SUBSTANCES DESORBTION FROM BOTTOM SEDIMENTS UNDER ANAEROBIC CONDITIONS

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Nowadays not only directly discharged waste waters but bottom sediments accumulated as a result of intensive economic activities become powerful water bodies pollution source. In natural water bodies with suspended matter high content and considerable contact of water mass with bottom sediments synthetic surface-active substances content is decreased by 20-50 % in comparison with those supplied with waste water, due to adsorption and co-precipitation.

Formation of thick layers of sediments causes retardation of the organic matter mineralizing processes and considerable accumulation of SSAS makes bottom slit a source of secondary pollution of water bodies.

Experiments on investigation of possibilities of SSAS desorbtion from bottom sediments under anaerobic conditions were conducted at the ambient temperature (20-22°C) and at lower (8-10°C) temperature with addition of residues of supreme aquatic plants and without such addition, in one of the versions the bottom sediments were pre-screened with a layer of clay not polluted with SSAS. The anaerobic conditions of the experiment imitate establishment of ice cover in the winter low water period when the process of under-ice vegetation dying out starts under the low temperature conditions.

According to the experimental data (fig.1), with coming of anaerobic conditions gradual outcome of the ingredient from the bottom sediments saturated with it starts, and desorbtion value increases steadily with time.

Presence of plants residue in the system increases the desorbtion value in comparison with the similar conditions without plants residue. Lower temperature accordingly decreases the desorbtion value facilitating the process retarding in time.

The value of pH changed insignificantly in the course of the experiment. In the range of 29 days it 1.04-1.14 times increased in comparison with the background value. By the time of the experiment completion the dissolved in water oxygen content in the systems decreased practically down to zero, this was caused by intensive oxygen consumption for decomposition of plants residue. At the same time Eh decreased to the reduction conditions zone and acquired negative values, this being accompanied by SSAS migration from bottom sediments to water. Vegetation decomposition seems to develop biochemically in the reduction medium conditions, this is proved by a stable sulphuretted hydrogen smell when taking samples.

Under anaerobic conditions SSAS containing bottom sediments coverage with clay does not prevent the SSAS outcome to water.

Mathematical processing of the experimental data was performed with the "Statsgraphics" applied software package. On the basis of the kinetic curves analysis a supposition was made that the SSAS desorbtion from bottom sediments process is described by the third degree polynomial:

$$C_{спав} = A\tau^3 - B\tau^2 + C\tau + D \quad (1).$$

In the conditions of water low stable temperature typical for the Urals water bodies during the most part of the year biological processes of water quality regulation are retarded and SSAS sorbtion by bottom sediments play significant role in the self-purification processes. At the same time the amount of SSAS desorbtion from bottom sediments is not high. With any changes of conditions in the layer close to the bottom, or with the decrease of dissolved in water oxygen content and the Eh drop, supply of the said ingredients to water due to desorbtion is possible from both bottom sediments and from the vegetation surface in the process of the latter dying out.

Low content of the dissolved in water oxygen during winter period causes practically anaerobic conditions, as a consequence of this the self-purification process intensity considerably decreases. Anaerobic conditions facilitate active water secondary pollution with SSAS, especially in presence of easy-oxidizable organic matter of dying vegetation that consumes water oxygen.

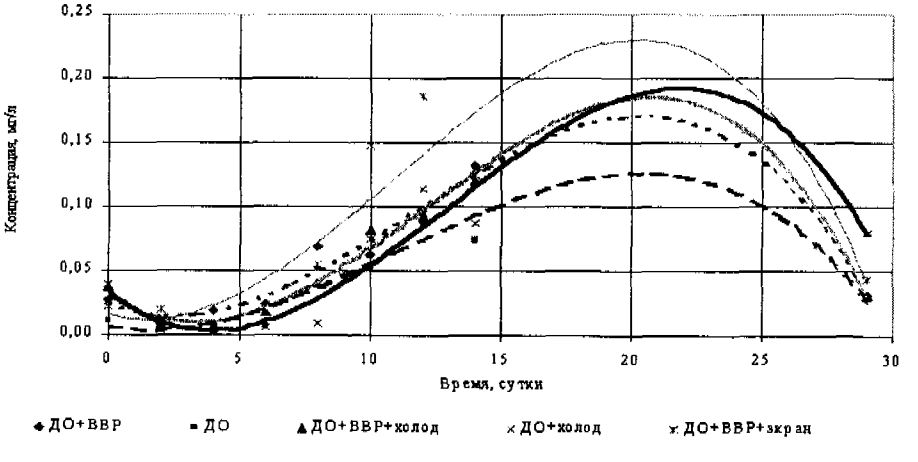

Fig. 1.

SUSTAINABLE DEVELOPMENT OF A REGIONIN THE ZONE OF ECOLOGICAL RISK (THE ARAL SEA AS A STUDY CASE)

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One of today's peculiarities is that technogenic loads on environment become so high that they already have exceed permissible limits, this causes local, regional and even global ecological problems. Nowadays human pressure on environment is not limited by small areas but embraces enormous territories. In some regions environmental changes are dangerous for human life. These regions relate to the category of ecological risky areas.

The Priaralye (Aral Sea zone) relates to such areas, as the environmental situation there is disastrous.

The Aral Sea zone is one of the regions of contemporary Kazakhstan and Uzbekistan where today the most prominent environmental changes occur. These changes are prominent at the regional level, not only at the local level. Catastrophic environmental changes of the Aral Sea zone are mostly connected with drying out of the Aral Sea, deserting and landscape degradation.

The Aral Sea zone is located in the arid climate belt, where land deserting processes are intensive enough. Destruction of immanently vulnerable soil-vegetation cover in arid and sub-arid is caused by many factors, such as cattle over-pasture, careless use of groundwater, various building activities, use of trees and bushes as a fuel, excessive water abstraction from natural water bodies (rivers and lakes) for irrigation.

Deserting processes are widely spread in the world and are typical for great regions. It is sufficient to mention Sahel, a transition zone between Sahara and African savanna. On the territories of Middle Asia and Kazakhstan deserting processes reached great scale in the Aral Sea zone, around the Kara Kum Channel, near oases and along valleys of the Amudarya, the Syrdarya, the Tedzhen and the Mugab. These processes resulted from human activities and as a result caused triggered the Aral Sea drying out processes. In its turn, the sea, the greatest water body of the region, drying out promotes further climate aridity and deserting processes intensification. Observation data show that the Aral Sea zone climate has changed under the influence of the Aral Sea area.

In the USSR times attempts to save the Aral were made but, unfortunately, with the collapse of the Soviet Union all restoration programs were postponed. Now it is hardly probable that the situation might change to better in the nearest future. Current environmental changes in the region primarily negatively affect health and living standards of the local population.

The Aral problem is a multi-spectral issue with meteorological, climatic, ecological, social, economic, medical, and sanitary-epidemiological aspects. Environmental disaster that nowadays happens in the Aral Sea zone is one of the greatest catastrophes of the past century.

SYRDARYA RIVER WATER RESOURCES MANAGEMENT AND ENVIRONMENTAL IMPACT OF NATURAL RIVER REGIME

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Civilized water resources use for population of Central Asia is most important task. Water has always been question for discussion at external power levels.

Among Syrdarya basin water users water resources are distributed in following way: about 92% are used for irrigation needs, 3.5-4% - drinking and municipal water supply, 2% - industrial technical water supply, 1.5% - agricultural water supply; rest volume is distributed among other water users.

Main Syrdarya basin water user is irrigated agriculture, total irrigated area is 3.38 mln.ha, directly from river 1.73 mln.ha are irrigated. Water account of diversions from rivers and subordinating canals is carried out on 430 points, from them: 21 headwork water intakes, 36 stationary pumping stations, 172 portable pumping units, and 201 points at water inlets to distribution canals. Surface river water account is fulfilled mostly by hydromet services of republics, and on water intake structures - by water management bodies of Central-Asian states.

Flow of rivers Naryn, Karadarya, Chirchik, and Syrdarya along reach from Toktogul to Chardara reservoir with length about 1000 km is regulated by Naryn-Syrdarya cascade. There are 5 most important reservoirs: 3 upper carry-over storage reservoirs - Toktogul (19.5 km^3), Charvak (2.0 km^3), Andijan (1.9 km^3), and 2 channel seasonal storage reservoirs - Kairakkum (4.0 km^3) and Chardara (5.4 km^3).

Water losses under delivery by main canals are 20% of total water intake; water losses under delivery by on-farm canals - 24%; operational losses - 24%; on fields 21% of supplied water is lost; under lands leaching - 6%. Given figures show search of ways to reduce unproductive water

losses as much as possible. They are several:

- introduction of water use tariffs;
- awareness increase of people involved in agrarian and water sector;
- stimulation for water saving technologies use;
- water use control;
- improvement of hydro-reclamation systems' operation.

Syrdarya flow regime change has led to severe water shortage for irrigation and brought great damage to Fergana Valley and downstream area. Here water logging and deterioration of lands reclamation state, flooding of dwellings, highways, etc. Without any benefit for irrigated agriculture during winter periods more than 30 km3 Syrdarya water were released, which was needed much for growing period irrigation. In result Arnasay lakes level rose more than 8 m. Great areas have been flooded in Syrdarya, Jizak, and Navoi oblasts. Broad environmental crisis zone was formed, thousands square kilometers of pastures and cropping areas, wells, koshars, fishing stations, roads, and bridges were flooded. Damage is great. Irreversible river water losses released in Arnasay sink have emerged and are increasing because of inability to release water in Aral Sea in result of limited river flow capacity in Syrdarya downstream; releases in Arnasay bring damage to flooded place and its all infrastructure; negative flood impact means not only retirement of part of area from agricultural development, but also means that under next water level decrease dried seabed will be difficult to be re-cultivated, and flooded areas wouldn't be used effectively in agriculture for a long time; inability to bypass water along Syrdarya channel downstream Chardara results in flooding of Kzyl-Orda suburbs as well as water losses increase in winter periods. Environmental sustainability of Syrdarya water systems has been lost - in winter river channel is flooded and incapable to divert return waters, in summer tense environment-epidemiological situation emerges as channel, especially in midstream, is close to desiccation; under next channel filling additional water losses are observed, which are used for filling dried lowlands and small lakes.

Advanced technologies introduction on number of headwork structures, which are under BWO "Syrdarya" charge, will allow to significantly increase water management efficiency including water losses and hereunder increase land and water productivity.

To carry out operative management by hydro-technical structures of BWO "Syrdarya" water management complex headwork structures, hydrounits should be equipped by measuring-regulation devices and communication systems appropriate for modern level and should provide:

- task decision on hydrounit management including automated maintenance of established regulation parameter;
- collection of information of controlled parameters and information reliability control;
- increase of control and management effectiveness;
- reliable communication with higher level organization;
- test-control of all technical complex means.

It is necessary to provide obligatory maintenance of river water resources complex use, effectively organize deliveries and stabilize Naryn-Syrdarya reservoirs cascade operation that can mean maintenance of normal life conditions of million people locating along Syrdarya banks, prevention and forecasting of any negative consequences under joint water use as well as strengthening of normal relations between states of region.

THE ANALYSIS OF WATER QUALITY DYNAMIC OF THE KARKACHUN RIVER

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The rivers of Armenia plays important part as source of hydro-energy, irrigation and water-supply.

As is known, anthropogenic impact on the biosphere provoke also changes of quality of River Ecosystems. These changes are in direct relation from the Level of Development of country. Evidence of it is analysis of long-term observations of Water Quality of the rivers of Republic.

The intensive using of Water Resources had provoke the increasing of technogenic loading and deterioration of Water Resources, and in the some regions - exhaustion of it. Observations shows it on the example of Karkachun river. Catchment's basin of Karkachun river disposed in the north-west part of apical belt of Aragats mount on the 3200 m above sea-level. River flow is formed from subterranean waters, snow and rain feed. Flood takes place in the spring-summer period (April-July), mean water occurs towards the end of the July and is continued till next April.

Karkachun river run-off is regulated by two reservoirs: Mantash and Vardaqar. Mantash reservoir (W=8.2 mln m^3) designed for irrigation and water-supply of some settlements. After 30 km downstream disposed Vardaqar reservoir (W=5 mln m^3) for irrigational use.

Analysis of Water Quality characteristics (data for 1991-1994), conducted by Laboratory of Institute of Water Problems and Hydrotechnic, allow to come to following conclusion.

Decreasing of run-off of river on the length of cannel by regulating in reservoirs exerts the negative influence on the quality characteristics of water flow. Therefore, at the estimation of sanitary drawdown value from reservoirs it is necessary to based on the hydrological characteristics and on the balance of Water Quality of water-current.

THE ARAL SEA BASIN - RUMORS, REALITIES, PROSPECTS

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The Aral Sea Basin had been for many years appearing in global and former Soviet mass media as an example of rapacious attitude to Nature on the part of socialist society. For the last ten years Central Asia has been subsisting and surviving under conditions where the regional countries closely interact with the whole world community. Though the Aral Sea Program, which was laid down at the Paris meeting in 1994 remained generally unfulfilled, cooperation between Central Asian states as to joint water resources management has not only managed to survive but proceeds to develop. Still new rumors continue to stigmatize the Aral Sea Basin by over-stressing current controversies that are allegedly ripe to develop into "war for water" in the region. As a matter of fact cooperation between the countries carried out by water management agencies and Interstate Commission for Water Coordination (ICWC), which celebrated its 10-th Jubilee in February this year, has been progressing regardless of complexities and differences in environmental, social, political, natural situation in the countries and gaps between levels of their development, and this cooperation enjoys confidence of their future success giving objective appraisal of achievements and drawbacks as well as ways to survive. Fair assessments and realistic approach are needed on the part of those, who are earnestly willing to help the region or at least there should be non-interference and silence on the part of those, who are not interested.

THE CONCEPTUAL PROBLEMS OF ECOLOGY OF THE WATER ECONOMY

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The problem of Water Deficit makes the strong influence on the social-economical development of some regions. In this connection the questions of cleaning, conservation and transportation of water to the consumer without prejudice to environment are very important, and they are the area of great international interest.

The researches on revelation of interference in the water-soil-plant system in the different landscape-climatic zones of Republic, which are different by conditions of agricultural developing, type of soils, cultivated crops etc., allows to argue about correlation by some quality characteristics.

At the present time at the development and construction of hydrotechnical structures (HPS, melioration systems etc.) it is necessary to take into account the factor of ecological state of environment. This factor is regulated, first of all, by value of leaved in the currents conservational flow, its value and quality characteristics are assigned individually for each object with take into consideration of varied climatic, morphometric, anthropogenic and other characteristics.

The problem of regulating of water consumption and water conservancy in the basins of Transboundary Rivers dictates the advisability of intergovernmental Data Exchange concerning state of water environment, oriented to creating of Intergovernmental informational-methodical Centre on Water Cadastre.

Necessity of creating of this Centre is very important in connection with increasing role of anthropogenic factor in the forming of mudflow and erosive processes with great destroying influence.

THE D AND ^{18}O RELATIONSHIP FOR THE NATURAL WATERS IN THE SOUTH-WEST OF BRYANSKAYA OBLAST

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The surface water data (of August-September 1992 - 1999, the rivers of Besed', Iput', Snov, Demenka and stream Gremuchka) have shown a minimal scatter of the isotopic composition (IC) as compared with other types of water at mean values of δD=-70± 4 ‰ и $\delta^{18}O_{ср}$ = -10,3±0,5‰, which indicates to homogeneous conditions of their recharge by precipitation and discharging groundwater (GW), and an effective mixing of them. The investigations of the rivers were carried out during the mean water period, therefore the main role in their recharge belonged to the underground run-off and "fast" run-off of summer precipitation. The isotopic composition was determined in the flowing water reservoirs (on the rivers of Korna (Novozybkov Town) and Demenka) and the low-flowing lake of Kozhanovskoye.

In the flowing water reservoirs δD and $\delta^{18}O$ values are within -85‰ - -72‰ and -11,2‰ - -9,7‰ respectively. The highest δD and $\delta^{18}O$ values were registered in August 1998 in the Kozhanovskoye Lake: δD=-34‰, $\delta^{18}O$=-4,2‰. The δD and $\delta^{18}O$ values for the Kozhanovskoye Lake are leveled by the $\delta D=6,7\delta^{18}O-7,0$ - line: its lower slope and free term (excess-parameter) is caused by accumulation of heavy isotopes of hydrogen and oxygen in lake water due to unequal evaporation.

The shallow groundwater (SGW) was studied in the exploited and abandoned dug wells and some springs. The SGW isotopic composition varies within a rather wide range - from -82‰ to -62‰ (δD) and from -11,7‰ to -9.3‰ ($\delta^{18}O$) with a T-content of from 14.0 TE (in Starye Bobovichi Village, 04.11.97) to 80 TE (in Demenka, 22.09.93). The previous and present observations show that the SGW isotopic composition (δD and $\delta^{18}O$ values) actually does not depend on T content (i.e. on the mean residence time of water (RTW)). Thus, regionally its recharge is homogenous and is formed within a few years. The mean RTW, calculated by tritium on the basis of the complete mixing system model (CMS), varies within 5-11 years, which agrees with our earlier estimates and direct observations. The stationary observations of the areas with similar density of surface radioactive contamination have revealed a direct link between the isotopic composition (IC) and content of Chernobyl radionuclides in groundwater. In the dug wells with a "heavier" water IC, the specific activities (SA) of ^{137}Cs and ^{90}Sr are higher. Thus, in Svyatsk Village the waters have SA of ^{137}Cs equal to 3.7 Bq/l) and ^{90}Sr - to 1.0 Bq/l with a "heavy" isotopic composition of water (δD= -65‰, $\delta^{18}O$= -9.6 ‰). The same was observed in the water of Zaborije Village where the maximum SA of ^{137}Cs (14.7 Bq/l, 01.11.97) was agreed with the "heavy" isotopic composition of water (δD= -63‰, $\delta^{18}O$= -9.3‰). The dug wells are not exploited since 1995, as they are located in the zone with removed population. The "stagnant" regime of dug wells has made, on the one hand, the water IC "heavier" due to evaporation, but on the other hand, it has led to accumulation of anthropogenically-originated radionuclides due to penetration of them with "heavy" (by isotopic composition) rain run-off. Such situation is not observed in the springs and exploited dug wells, recharged by shallow groundwater; the isotopic composition of water here is "lighter".

The groundwater in the Upper Cretaceous aquifer (GW UCA), used for centralized water supply, is characterized by a more homogenous isotopic composition (δD= -85±5 ‰ и $\delta^{18}O$= -11.5±0.5‰) with T ÷ 1-5 TE. The lightest was the water in the UCA, extracted by a well in Spiridonova Buda Village: δD=-93 ‰ и $\delta^{18}O$ = -12,9 ‰. It can be supposed that the "light" isotopic compositions were formed on the investigated territory in the period of Late Pleistocene - Early Holocene when the climate in this region was approximately by 2°C colder than the present-day one. To confirm or disprove this supposition is possible through determination of the radiocarbon age of this water. The regression equation of δD to $\delta^{18}O$ for GW UCA is actually the same (δD= 7,7 $\delta^{18}O$+3,1 ‰ (r=0,52)) as for the shallow groundwater and indicates to a good interconnection between these two kinds of water and homogenous conditions of its formation. Hence, SGW and GW UCA are relatively vulnerable to Chernobyl contamination, except the waters with a very low T-content (<1-3TE). A slight decrease of angle coefficient and free term in the regression equations (δD to $\delta^{18}O$) for SGW and GW, as compared with the global line of meteoric waters ($\delta D = 8\delta^{18}O+10‰$), indicates to a low influence of evaporation while their recharge by precipitation. The comparison of the GW UCA mean isotopic composition with the seasonal variations of δD and $\delta^{18}O$ in the precipitation shows that of dominance in the recharge of this aquifer is the precipitation of a cold season (≈ 60%).

THE ELABORATION OF SYSTEMATIC APPROACH TO THE ASSESSMENT OF WATER RESOURCES USE IN LARGE INDUSTRIAL CENTERS

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Long-standing investigations on the problem of productive power's location with regard to water factor helped to elaborate a system of estimates of water supply on the territory under study. Social-economical, technological and ecological factors have been brought into account, too.

Systematic approach includes a number of methodological principles, the mechanisms and features of ranking, a system of initial and calculated indices.

The calculation shows that the use of ideal indices together with absolute values completely reveal regional characteristics of the territory's water supply.

The comparison of water supply with the intensity of water use coupled with spatial location and concentration of the largest water consumers allows us to assess the scale of disproportion on the territory under study.

The scale and dispersion of disproportion are the basis for qualification of the territory according to the tenseness of hydroeconomic situation (ranking).

Further specification and detailed assessment of existing disproportion reveal themselves through the assessment of technical economical indices of water supply which help to estimate both its qualitative and quantitative constituents as well as calculate the effectiveness of water supply.

For instance, based on the methodology calculations of the effectiveness of water resources use in the US industry confirmed large-scale application of water-saving technologies in industry during last 25 years. This advancement helped to reduce the volume of water use and, consequently, waste discharge.

The proposed system of criteria and estimates allows water

specialists to assess in a new fashion water supply situation, character, structure and regime of water use that creates necessary prerequisites for making decisions according to social economical, technological and ecological factors. Recently, the increase of the role of psychological factors in solving ecology-related problems has been noted.

THE ESTIMATION OF ECOLOGICAL CONDITION OF BAIKAL BASIN RIVERS

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One of most important problems of fundamental researches is the specific variety investigation of water ecosystems. The hydrobiocenosis species composition can give important information about the water quality. It is especially actual for preservation of unique Baikal ecosystem as the piece of world legacy. In connecting with it the information about the quality of those water objects, that can exert influence over Baikal ecosystem, is most important.

Khilok and Chikoi rivers are among the main water flows of Baikal basin in Chita region. Its species composition is researched not completely. We are carrying out researches of phytoperiphyton, zooplankton and macrozoobentos for the exposing of hydrobiocenosis structure and it is functioning under anthropogenic load.

In phytoperiphyton were found algae, which are related to five branches: diatom, green, blue-green, golden and red algae. Diatom algae are represented in greatest amount among them - 80,2%. Phytoperiphyton algae size changes between 0,023 and 9700,78 mln. cells per m^2. Biomass changes between 0,0046 and 3035,30 mg/m^2. Most varied geniuses are Navicula - 14 species, Gomphonema - 13 species, Synedra and Achnanthes - 9 species. Navicula cryptocephala, N. exigua, N. rhynchocephala, Synedra ulna, Gomphonema constrictum, Achnanthes lanceolata f. capitata are often appeared species. Therefore, Chikoi and Khilok water by diatom algae of periphyton over the saprobility index and concerning to second-third classes of water quality over the Pantle-Buck saprobility index in Sladechek's modification.

85 geniuses and species of invertebrates were found in zooplankton. There are 57 Rotatoria, 23 Cladocera, Copepoda - 5. Euchlanis (6 species), Trichocerca (6), Trichotria (5), are leading by number of founded species. The predominated specie is Euchlanis diletata. Chidorus sphaericus most frequently appeared among Cladocera, and Diacyclops bicuspidatus among Copepoda. Zooplancton organisms size changes between 0,009 and 8,16 thousands species per m^2. Biomass changes between 0,002 and 0,222 mg/m^3. The Shennon - Wiver index changes between 1,15 and 4,31 bit/specie. Water quality is concerning to second- third class of water quality.

The fauna of macrozoobentos is represented by species, which are related to five classes; there are Insecta, Gastropoda, Arachnoidea, Clitellata and Nematoda among them. The whole organisms size changes between 0,05 and 8,5 thousands species per m^2. Biomass changes between 21,00 and 6200,00 mg/m^2. Insecta is the most varied class, 6 orders, 16 subfamilies and 19 geniuses represent it. Chironominae subfamily, Tanytarsus and Cladotanytarsus are predominating. The second represented by number of organism group are Tubificidae and Enchytraeidae. Wudiwiss biotic index changes between 0 and 7. Therefore, water of the Khilok is estimated from second to sixth classes of water quality. Chikoi water is concerning to second - third classes of water quality.

The comparison of our results with hydrochemistry analyses shows the best conformity with data received by Wudiwiss system. It is necessary to make the complex system of water quality estimation over the hydrobiological indexes, suitable too the regional conditions.

Therefore, researches show that anthropogenic loading on Chikoi and Khilok rivers is taking place, and it can cause negative influence on the Lake Baikal. Already we can notice ecological regress in macrozoobenthos biocenosis.

THE GENERAL PRINCIPLES OF MANAGEMENT, USE AND PROTECTION OF WATER RESOURCES REPUBLIC OF ARMENIA

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A) The general principles of management and use of water resources are:

Water has an economic value, which must be taken into account in the procedures of use, distribution and maintenance of water resources. At the same time water is heritage, which has to be protected, maintained and used as such regarding the interest of future generations

Water has an economic value not only in case when it is used but also in case when it is not used.

Water alternative value consists of the utmost benefit, which could be achieved, if it has been used by any other alternative project and purpose. At the same time the state must determine regulated tariff for water appropriate to decreased price of water shortage in order to make available

the use of the minimum sufficient quantity and necessary quality of water.

In case if the determined size of the regulated tariff is less than the value of the accounting tariff, deficiency of money entrance arisen from water use has to be envisaged as transfers and grants (subsidy) to state budget. Alongside with increase of solvency of water users additional payments have to be decreased and the size of the regulated tariff have to be drawn near to accounting tariff value.

Expenses for cleaning of impure waters must be reimbursed by a person made waters impure

B) General principles for the protection of water resources are:

- water bodies are a composite part of ecosystems and their protection is conditioned with protection of balance of the given ecosystem,
- water bodies are subject to protection both in cases of being used and not used,
- in case of not using water bodies, their protection must provide balance and welfare of the given ecosystem entirely for water part,
- in case of using water bodies, their protection must provide balance and welfare of the given ecosystem for *required minimum part of waters,*
- disposal, possession and use of water bodies is implemented based on the Republic of Armenia,
- water bodies are subject to protection against pollution, littering, contamination and depletion

THE INFLUENCE OF DE-ICING REAGENTS ON SURFACE RUN-OFF

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Surface run-off produced during the snow melting process is a source of pollution for the rivers and water bodies of the city of Moscow. Snow removed from urban territory contains large concentrations of pollutants, including suspended solids, chlorides, sodium, petroleum products and heavy metals. Limited water resources of the Moskva River require special attention to the pollution of snow cover that is the river's main feeding source (65-70 percent).

The reasons for pollutants' high concentrations in the snow cover are toxic substances emissions produced by industrial enterprises and transport, as well as the treatment of roads and highways with de-icing reagents.

In Moscow during the winter of 2001-2002 the following de-icing mixtures were predominantly used: HKM (30-percent liquid calcium chloride), HKM (30-percent solid calcium chloride), Nordix, Antisnow-1 and NKMM (calcium nitrate, magnesium nitrate).

Snow samples taken from roads and highways contain the following: chlorides - 1500-2000 mg/dm^3, sodium - 1000-15000 mg/dm^3, iron - 3 mg/dm^3, lead - 0.27-0.5 mg/dm^3 and petroleum products - 75 mg/dm^3.

The average levels of heavy metals concentrations exceed the standards established for the water bodies of fishery quality: iron content - 8-27 times, manganese - 21-90 times, zinc - 3-20 times, lithium - 10-24 times and copper - 20-50 times.

The concentrations of chlorides and sodium in the snow removed from the territory of the city of Moscow exceed the MPCs established for the water bodies of fishery quality some 3-20 and 7-49 times correspondingly. These high concentrations chloride ions, sodium ions and heavy metals in melt snow water result from the application of de-icing mixtures.

In case of pavements single treatment, 2 g of calcium, 2 g of chloride ions, 44 mg of iron, 38 mg lead, 3.5 mg of cadmium, 39 mg of nickel, etc. are introduced with de-icing reagents per 1 m^2 of roads.

At present the range of applied reagents is limited to the chloride compounds group. To reduce the pollution of river water with chlorides, coming with surface run-off, it would be expedient to use de-icing mixtures based on sodium acetate and magnesium acetate.

THE INFLUENCE OF REGULATED RIVERS ON THE FLOODPLAIN ECOSYSTEMS

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The researches were carried out jointly Russian Academy of Sciences, Moscow State University and Federal Agency for Nature Conservation of Germany on the rivers Danube, Isar, Elbe, Saale (Germany) and Sejm (Russia). The complex *ecological researches were made in the broad-leaved forest* zone in nature reserves and national parks located on the banks of the river (hydrology, vegetation, soils, unconfined ground waters). The conditions of terrestrial ecosystems were compared under of natural and regulated of the river *flow. The significant negative influence of low-confined*

hydrotechnic construction and small reservoirs on vegetation and soils of floodplain was revealed. On the basis of analysis of mean annual water level and flow trends on the multi-years series (60-100 years) of the hydrometric stations on the rivers under consideration the significant influence of natural long-term variability of watering on vegetation dynamics in the floodplains was revealed.

The results of researches has showed, that under regulated of river flow the equal situation GWT under forest and meadow communities is established, and the fluctuations of GWT on seasons are considerably reduced, and frequently amplitudes in 1m do not exceed.

Watering regime stabilization, termination of floodings influence in combination with increase of total floodplain watering as the result of the river flow regulation in the lower flow resulted in higher hydromorphism of alluvial soils, in processes of bogging, in everywhere watering of lower and middle parts of soil profiles by ground waters.

The main diagnostic feature of overwatering in soils is gley process. Gley process spreading along soil profile causes the significant transformation of organic substance and organic-mineral substances, to development of reduction processes, to destruction of mineral part of soil, to loss of nutrition elements for plants, to destructurization of soil mass.

On all relief elements of floodplain there is untypical process of new communities formation overwet habitat. This sucssesion process differently mentions all complex of floodplain ecosystems, to occupying different floodplain elements, and as well as depends on intensity, duration of antropogenic impact and degree of regulated river.

There is a deterioration of floodplain state populations of floodplain oak the top floodplain terraces and their complete destruction; the most valuable, typical and most diversity elm-oak forests systematically disappear on the European plain because of occurrence toxic gley in top (less than 1-1.5 m) of soil horizons and reduction of amplitude fluctuation GWT.

The flood plain ecosystems, the ecotope which is the least subjected to the changes of the environment at the hydraulic engineering effect (the regulation of the flow) differ by the considerable annual successional changes and large species diversity. The ecosystems highly disturbed because of the hydraulic engineering effect differ with very weak successional variability and smaller species diversity of plant communities.

THE INFLUENCE OF THE NATURAL CLIMATIC CONDITIONS ON THE WATER QUALITY IN THE UFA RIVER

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The work presented in this paper is dealing with the studies of the influence of the natural climatic conditions on the variation mode of the metal concentrations in the water of Ufa River.

The Ufa River is considered to be as the main water supply source of Ufa City. It is 918 kilometers long according to the data of the hidrometeorological service. The total catchment area is 53100 km^2. The great part of the river basin is located on the Ufa plateau. The river valley is built from the coal Perm rocks, consisted to a considerable extent of the shales, limestones, dolomites, mergeles and gipsum-bearing clays. The river basin belongs mainly to the woodland zone with the coniferous forest and the broad-leaved one as well. The woodland part comes up to 59% and 3 % fall on the marshy territory. Among soils the grey, forest ones are predominated. The water conditions are characterized by the high spring water, summer rain freshet and steady automn-winter period. The main supply of the river is realized at the expense of the snow melting and also of the stable soil feeding in the remaining year time. The sum flow in the summer-automn period is formed from the surface (50-60 %) and underground (40-50 %) flows. The raining maxima can exceed the snow ones. The most low river flow is observed in winter because of the depletion of the underground water reserves. The level variation of the low river point is greatly affected by the work of the Pavlov hydroelectric power station. (HPS). The data analysis on the metal content over a period 1995-2001 have demonstrated, that all these factors one way or another may have some influence on the formation of the water quality.

The seasonal variations in the concentrations of the alkaline- and earth metals are defined by the maxima in winter and the minima - in the flood period (automn and spring). This permits to consider the river bed-bearing rocks as a main source of these clements. In addition, their concentrations in the water fail to exceed the levels of 7 mg/dm^3(Na), 2 mg/dm^3(K), 20 mg/dm^3(Mg), 100 mg/dm^3(Ca), 0.04 mg/dm^3(Ba) and 2.5 mg/dm^3 (Sr).

The variations in the concentrations of the litophilic elements (Fe, Si) are considerable during the year time. In winter the Fe-concentration is detected on the level of <0.1 up to 0.15 mg/dm^3, in flood periods (spring and automn) - to 2 mg/dm^3, in summer from $<$ 0.1 to 0.5 mg/dm^3. These limits depend on the atmospheric precipitations quantity and on the water discharge from the Pavlov HPS as well. The results obtained demonstrate the migration of the Fe-element in the river water in the suspension form.

In winter the Si-concentration in Ufa River found to be on the level of 3.4-4.3 mg/dm^3. In flood time it varies from 3.9 to 2.5 mg/dm^3, in sammer it falls inside the limits of 2.0-3.9 mg/dm^3, in automn in limits of 2-5 mg/dm^3. The maximum and minimum Si-concentrations differ by a factor of two. The lowering of the Si-concentrations in summer is likely caused by the arising the diatom aquatic plants, which assimilate the soluble forms of the Si-element. In automn the dissimilation process is occuring and the increase in the soluble Si-forms is observed.

In conclusion it can be stated, that the content of the quoted elements (with an exception of Fe) in the river water is less than the MAC-value in all year times. The Fe-content exceeds the MAC only in the flod periods.

THE INFLUENCE OF WATER REGIME TO THE POPULATION OF SPOTTED EAGLE (AQUILA CLANGA) IN THE DUBNA LOWGROUND

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Our research was carry out in south part of Volga over flow low ground in the Dubna watershed of Moscow region. Dubna watershed is the very development land. In 50-70 years of XX century there were many extremely actions to bottomland's forests and meadows in the Dubna lowground. Just the same the system of essential ecological connected with each other wetlands are conserve in this territory. The Dubna wetlands area is the 25000 hectares.

The mosaic landscape: far-flung bottomland's forests, oxbows and water-meadows (25% of territory), bogs and marshes (17%) and agricultural lands (36%) is one of the cause conservation the high biodiversity. Dubna lowground is bringing under perspective list of Wetlands of International Importance and it is the Important Bird Areas of World.

The spotted eagle (*Aquila clanga Pallas)* is the rare species in Moscow region, but in Dubna lowground the spotted eagle population is wellbeing. Actually me know 8 territories, where we regularly can observe bird's pairs. Among this 8 territories we spoted 5 nesting constructions. One spotted eagle's pair is nesting on the man-made platform. The nesting platform was building near old nest two years ago.

All nesting constructions are dispose on the alders near edge of waterlogged glades in the recess of bottomland's forests. The glade's dimensions are unstable between 0,4 and 10 hectares.

The air-photography information gave the evidences about more one hungry such places. The largest areas measure 20 hectares. The largest parts of this glade are describing low and rare vegetation *(Calla palustris L., Menyanthes trifoliata L., Comarum palustre L.).* The ground covering is at most 60%. The rest of ground covering was absence of plants and was callow of fleet water. There are rare thickets of frail near edge of waterlogged glades.

The low and rare vegetation give chance for spotted eagles to develop alike places. It is the main feeding place of spotted eagles in spring. At the time of chick's nurse spotted eagle begin high development of agricultural fields: grasslands and grainfields.

Wellbeing of spotted eagle's population in Dubna lowground depends from conservation of nesting and feeding areas. The processes of vegetation changing are depending from water regime constancy. Yearly overflow and conservation humidity of forest ground are one of the main conditions of ecosystem's stability.

Accordingly, spotted eagle can be considering the indicatory species for Dubna lowland water regime. The geobotanic research is difficult in bottomland's forests, because observation of spotted eagles are very perspective. This approach can give information about water regime movement and suffer to design gidrotechnology regulation for nature protection.

THE ISSET RIVER AND ITS ECOLOGICAL PROBLEMS

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The object of the research is ecological state of the Isset river within the borders of city Kamensk Uralsky. The Isset river springs from the head of the river Shitovskaya which flows out of lake Shitovskaya that is situated on the eastern slope of the Middle Urals, 7 km to the South-East from the settlement Kedrovaya of Pyshma region, Sverdlovsk (oblast). Up to city Kamensk Uralsky the length of the river is a hundred seventy two km, overflow area is 5400 $м^2$. The regime of the river is distorted by theinfluence of numerous water reservoirs that are situated along its whole length. From the river head up to the city there are 7 water reservoirs. The Isset river belongs to the type of rivers with strongly marched spring flood time, rain highwater in summer- autumn period and long steady winter water surveying. Snow waters play an important role in the nutrition of the river. The share of waters from melted snow in the total flow of the river is 40 % in average, reaching sometimes 50-55 %.

At present on Kamensk Uralsky territory a very dangerous ecological situation has formed. The state of such environmental elements as atmosphere, ground, drinking water makes us consider the city territory to be an area of ecological emergency.

Surface waters of city which are parts of the rivers Isset and Kamenka areused for hot and technical water supply. The Isset river accumulating theindustrial waste waters of Ekaterinburg as well as of some other cities and settlments on the overflow territory, presents in its part up to city Kamensk a collector of polluted industrial and agricultural waste waters. Many analyzed elements exeed the limits: the maximum of ammonium nitrogen exeeds by a factor of 10, copper by a factor of 40-60, oil products 5-10 pollution index is on level of 9 - 10 (extremely dirty water).

At present the river lost its fish production role. Within the

city borders the river takes about 54 m/n m^3 of waste waters in a year. From them about 12 m/n m^3 are - polluted without clearing and about 39 m/n m^3 waters polluted and not enough purified. The most share in waste waters belongs to the open join-stock company "УАЗ-СУАЛ"-9 m/n m3 waste waters without purification and to the open join-stock company "СинТЗ" - 5 m/n m^3 waste waters not enough purified. The following harmful substances penetrated info surface waters with polluted waste waters in 2000: 355t of organic polluting substances, 33t oil products, 748t suspended substances, 177 t ammonium Nitrogen, 17 t iron, 16.5 t fluorine, 22 t of aluminium, 0.093 t Nickel. The conducted investigations in city part of the river have shown exceeding the limits of nitrite by a factor of 5 - 20, the limits of ammonium, hydrate by a factor of 5 -15, which corresponds to an area of ecological emergency.

The concentration of aluminium is contstantly exceeding the limits by a factor of 10- 20, which corresponds to an area of ecological emergency. The concentration of benzinepiren in the water of the river Isset within the city borders exeeds the limits by a factor of 3 - 16, which corresponds to an area of ecological emergency. 64 % of water tests have shown that the water of the rivers don't meet sanitary standards. According of microbiological data of 82 % tests the water does not meet the requirements.

Besides there are pathogenic microorganisms mostly salmonella in every third test. The spillway of industrial waste waters into the Volkovskoe water reservoir led to the accumulation of a great ammount of ground deposits. According to the results of the investigations the amount of ground deposits is 5 mil/m^3. The annual increase of ground deposits is 150-200 thousand m3 the stratum of ground deposits is 4,6 m^3. The most part of deposits has unsatisfactory sanitary bacteriological data, which refers to an old faecal pollution, constant accumulation harmful substances by ground deposits. Within the borders of Volkov pond the formation of large silt drifts takes place, that accumulate oil product, metals and other polluting substances. The factor of ground metals accumulation shows, that the most polluted deposits on the city territory are deposits of Volkov pond. There is also the highest concentration of oil products. Strong pollution of water and ground deposits leads to oppression of life activity of water organisms: the death of certain groups of organisms in the dam area of Volkov pond as well as of below area was established. On the part of a pond area except pondside with reserved water plants ground organisms are completely disappearing. Some morphological distractions of she structure were exposed . The state of tested fish shows strong pollution , the high concentration of Nickel, chromium, cadmium in fish tissues can can be very daugerous for both fish and its consents man . As the result of constant influence of the industrial waste waters the water quality of the Isset river belongs the city Kamensk Uralsk and for many kilometres is very poor.

According to the concentration of pollution elements such as Copper, manganese, Zink, the Isset river in its part below Kamensk Uralsk can be considered near to an ecological emergency. According to the concentration of ions of ammonium can be considered as area of ecological emergency, 25% tests of concentration of ions of ammonium in the Isset river below the city which were performed recently, allow to consider the river as an area of ecological emergency (a factor of 5 - 10) and also as an area of ecological disaster (10 - 20). According to СанПиН 4630-88, extremely strong pollution of the Isset river determines its unfitness for hot water supply and recreation purposes. From the hygienic point the usage of the Isset river water is dangerous for helth of population of Kamensk Uralsk. As a result of ecological problems of the Isset river, its water resources cannot be used as household water supply. The population of the city suffers constant shortage of pure water. To defray the deficit the authorities invest large sums into organization of water supply from Novo Sysertsk water reservoir, which is situated 50 km from the city.

THE ISSUE OF SETTING NORMS FOR TECHNOGENIC IMPACT ON WATER BODIES

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To secure sustainable development of natural/territorial complexes it is necessary to correlate total anthropogenic load on environment, water bodies included, with ecological capacitance of natural complexes. To this end it is necessary to determine exactly quantitatively all material flows from industry to water bodies.

In regions with high concentration of industry aero-technogenic emissions of enterprises are a strong source of environmental pollution. When exhausting pollutants to the atmosphere industrial enterprises adversely affect not only the air but soils, surface waters and the vegetation cover. For many enterprises exhaust of a number of elements to the atmosphere are hundreds and even thousands times higher than discharge to water bodies. A portion of matter supplied to the atmosphere, metals in the first place, is washed down to water bodies with melt and rain runoff.

Enterprises are to report on their emissions to the atmosphere and to water bodies, but it is extremely difficult to determine an enterprise contribution to water bodies pollution through emission to the atmosphere. Today the norms are set for separate media. When MPD is calculated for enterprises it is usual to seek to reach observation of requirements on not exceeding of daily average pollutants concentrations in the air, without taking into consideration the discharges impact on soils,

surface waters and vegetation. Identification of the main polluting enterprises in a specific industrial area is an important stage in water quality management in the area.

Solution of this task is possible with the use of snow cover pollution monitoring in various parts of industrial-to-air-discharged pollutants dispersion geographic range. Determination of the deposited in snow cover ingredients, both in dissolved and suspended forms, will permit to identify priorities in pollutants in this or that the dispersion geographic range. Second important objective is relating prior pollutants supplied from the catchment with the polluting enterprise.

An industrial agglomeration often includes a big number of different-purpose enterprises that are different in terms of environmental impact. To identify enterprises responsible for the highest percentage contribution to water quality formation on the surrounding territory, all enterprises of the industrial agglomeration should be ranked in terms of specific discharged ingredients mass. Discharges by each ingredient are summarized, then the contribution percentage of a certain enterprise to the given ingredient discharge is calculated. Thus, the enterprises contributing most to surface waters and soils pollution by this or that ingredient in the area under consideration are identified. Beside the discharged matter mass it is important to take into consideration the matter danger class and its toxicity in contiguous media, as air-polluting matter finally will get to soils and vegetation and migrate to surface water and groundwater. If the danger class is high, damage to a water body will be higher, even in case of less discharge volume.

Thus, identification of pollutants, prior in scale of accumulation in snow cover and toxicity, and the main polluting enterprises in a specific industrial agglomeration will permit to more completely assess the damage incurred by enterprises to water bodies, and will help in taking practical target measures on mitigation of environmental pollution.

THE MAIN PROBLEMS OF THE WATER ECONOMY DEVELOPMENT OF UPPER AND MIDDLE AMUR

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Amur is one of the largest rivers in Russia and all over the world. The main part of the population in Chita and Amur regions live on the territories which are the drainage basin of this river. There are the large port oh industrial, agricultural and municipal objects of the region, and also big cities - regional centers Chita and Blagoveshensk. There is a large water reservoir with hydro-electric station (HES) on the left tributary - Zeja, other HES will be put in operation on another tributary - Bureja. The importance from the Upper waters - from the Ingoda and Onon confluence.

The main indicators of water balance oh Upper and Middle Amur drainage basin is presented in the table.

In the drainage basin of Upper Amur water consumption in average is 550 mln.m^3, and leading water away - 360 mln.m^3 per year (66% of in take). In the drainage basin of Middle Amur correspondingly - 160 and 115 mln.m^3 per year (72% of in take). In the drainage basin in whole from source of Ingoda and Khabarov Krai water consumption of Russian territory is 710-720 mln.m^3, and leading water away - 470-480 mln.m^3 (67% of in take). More than half of water intake quantity (in Middle Amur - more then 60%) is under ground water, together with the volumes of leading water away it shows a pouring of clean underground waters after its using in surface water objects. The right bank of Middle Amur and its tributary - Argun is situated on the territory of People's Republic of Chita, there is no any information about this water consumption.

The main branches of economy which needs water is power engineering, mining, metallurgy and municipal economy. Also the water objects are use without water intake - gold extraction, navigation and fishing.

Table. Balance valuing of the water resources of Upper and Middle Amur.

Indicators	Unit of measurement	Quantity		
		Chita region (Upper Amur)	Amur region (Middle Amur)	In whole of drainage basin from Upper and Middle Amur
1	2	3	4	5
Precipitation	mm	420	615	538
Whole drain	mm	170	265	227
Surface drain	mm	140	244	202
	%	82,3	92,1	89,0
Underground drain	mm	30	21	25
	%	17,7	7,9	11,0
Evaporation	mm	250	350	311
Resources of the whole drain	l/s·km^2	5,39	7,73	6,81
	m^3/day·person	163	243	200
Resources of the underground drain	l/s·km^2	0,95	0,67	0,78
	m^3/day·person	29	21	25

Utilization of the water objects without system resulted in deterioration of water quality, and living conditions of the population. There are iron, manganese, zinc, chromium, nitrogen in concentration higher than maximum permissible concentration (MRC) in the waters of Ingoda, Onon, Shilka, Argun, Zeja, Bureja and Amur, Populated, and agricultural are as floods in the periods of rains freshet. The quality of underground water is deteriorate, and problem of drinking water supply arises. The problem of safe use of hydro technical structures became more acute because of its bad management. Conditions of fish-breeding and fishing are also deteriorate.

The main way of this problems solution is the system approach which based of the drainage basin principle. In 1998 DP FGUP VostokNIIVKh worked out the conception of the territory program of utilization, restoration and protection of water objects of Chita Region, there are the ways of the aforesaid problems solution. In 2001 the same document was work out and adopted for Amur Region. The first steps of this programs was adopted as region laws - programs "Drinking water" for Chita and Amur Regions, "Flood Defense" for Chita region. Its give the opportunity to begin to realize this programs in 2002.

THE MEASURES FOR THE RESTORATION AND UTILISATION OF TECHNOGENOUS AND URBAN WATER BODY

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In 1965 the large heat power station (HPS) was put in operation in Chita. The natural water body - lake Kenon became the cooling pond for HPS. Kenon is situated in the town boundaries, it had recreation meaning for Chita. The water's intake for technical needs of HPS is carries out from the lake, and after using, this water with the risen temperature and changed chemical composition is damps back. This situation leads to violations in water, heat and hydrochemical balances. The complex of water pumping from the river Ingoda was built for compensation the technological water loss and technogenous evaporation.

During 40 years of the lake using as a cooling water body the chemical composition of water was changed from hydrocarbonous to sulfatous, the sulfate concentration constantly increased. Phosphates comes with the rivers water, and together with the warm water cause the lake eutrophication. Now using of the lake's water is impossible without it purification.

East Research Institute for Integrated Water Management and Protection carries out the detail study of the balances and modern water body conditions for working out the program of measures for stabilization and restoration of the lake. It is impossible to liquidate the HPS now. The main idea of restoration measures is to divide the lake in two parts - tecnogenous and social with water pouring only from the social to technogenous. At present the mathematical model of that division is working out. It foresee that the HPS will use only the technogenous part, and in the social part it will be supported the standards for its utilization as recreation zone. The watereconomy balances was calculated for this model both for the past period and for the future period with the account of suggested measures. An optimization of this model will give us the possibility to determine the optimal volumes of technogenoes and social parts of the lake. The basic model can be apply to the analogous water bodies with HPS influence on it.

THE MODELLING OF STORED WATER RELEASE VOLUMES AIMED AT IMPROVING THE QUALITY OF WATER IN THE MOSKVA RIVER WATER SOURCE

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The reliability of the Moscow water supply system is largely determined by the possibility to guarantee the water intake from drinking water supply sources (the Volga River and the Moskva River), which water resources are formed through the regulation of water from the Volga River, the Moskva River and their tributaries. The present-day level of water intake from the Moskva River for the sanitary replenishment of the Moskva River amounts to 51 m^3/sec for the 95 percent of provision. The lack of water yield reserve taking place as a result of water intake increase and intensive economic usage of the basin makes it necessary to set a task of providing sufficient water supply to the water intake monitoring section and additional dilution of possible pollutants in water catchment, aimed at water quality improvement.

The system of environmental water supply to the monitoring section of the Roublevsky water intake includes four water storage reservoirs located on the Moskva River and its tributaries (Mozhaisky, Rouzsky, Ozerninsky and Istrinsky Water Storage Reservoirs) with different time of water travel from these reservoirs and from the unregulated

part of the water catchment located downstream these storage reservoirs. The regulation of reservoir releases should be carried out in case of constant water flow in the water intake sites of the West and Roublevsky Water treatment plants and under the condition of correct and sufficient regulating release downstream the Roublevsky dam. The existing operating rules do not provide any variants of tackling emergency situations.

In order to optimize the solution of this problem, a special program complex is being developed. It consists of a set of several models simulating the processes of forming and transforming the water flow in the water catchment and in the channel net within the Moskva River water source. This complex is based on the model of the main hydrodynamic processes that determined the qualitative and quantitative characteristics of river flow.

The model of the Moskva River system for the water catchment part in question includes 6 main rivers - the Moskva River, the Istra, the Rouza River, the Ozerna, the Malaya Istra and the Iscona Rivers. The upstream water initial conditions in the Moskva River, the Istra River, the Rouza River and the Ozerna Riverare determined by the conditions of eater release from Mozhaisky, Rouzsky, Ozerninsky and Istrinsky Water Storage Reservoirs. The upstream water initial conditions of the Malaya Istra River (the pond in the vicinity of the village of Rakovo), the Iscona River (the estuary of the Klopovka River) and along all six rivers are determined through real observations. They are computed or predicted based on meteorological data with the application of a mathematic model for snow runoff and storm runoff formation. Efficient management of water storage reservoirs is possible only if the side input from non-regulated territory is predicted beforehand and the earliness of this prediction exceeds the minimal time of water running from water storage reservoirs. The volume of releases and a possible composition water storage reservoirs for the organization of diluting releases in case of emergency penetration of pollutants into the water intake may be determined only in case the information concerning the time of surge travel and the degree of their transformation along the channel net is available. In order to obtain such data some simulation computations were made using a model of unsteady motion in the channel net. The following pattern of initial and test conditions presetting was used for the computations: background (standard) releases from the Mozhaisky Water Storage Reservoir (15m^3/sec), the Rouzsky Water Storage Reservoir (7m^3/sec), the Ozerninsky Water Storage Reservoir (1m^3/sec), the Istrinsky Water Storage Reservoir (4m^3/sec); emergency releases (50,100,150 and 200 m^3/sec); various values of side input, corresponding to various phases of water conditions (high water periods, summer and winter low water periods and autumn period). Side input was specified for three rivers: Iscona, Malaya Istra and Medvenka. For these rivers the model computes the total values of side input from the non-regulated territory of the basin. Following a series of numerical simulation computations of water storage reservoir 6-hour releases, the model was used for calculating the time of water travel along the Moskva River channel to the Roublevsky Water Treatment Plant and along the channels of its main tributaries. The results of water flow computations were received first of all. Subsequently, using the data concerning flow velocity for individual sections and the distances between the plants (profiles), the time of water travel from every point in the channel (from the estuary of each tributary or from the cross profile) to the Roublevsky Water treatment Plant was computed.

THE NATURAL RADIOACTIVITY OF WATER WITHIN THE ZONE OF CHERNOBYL SPOT IN BRYANSKAYA OBLAST

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VSEGINGEO in 1992-1998 independently and within the RF-UNDP RUS/95/004 has measured the content of natural radionuclides (NR) in 77 water objects (springs, streams, rivers, lakes, water reservoirs, shallow groundwater (SGW) and groundwater (GW) of the Upper Creataceous aquifer (UCA) on the territory of the Bryanskaya Oblast Chenobyl-produced spot.

The summarized results of the measurements are given in the below Table.

Table.

Isotope or radioelement	Intervention level (IL), Bq/l	Specific activity (SA), Bq/l		
		Surface water	Shallow groundwater (SGW)	GW UCA
Radium-226	0,500	0.015-0.020	0.020-0.110	0.020-0.180
Radium-228	0,160	0.010-0.023	0.018-0.090	0.025-0.160
Уран	3,100	0,006-0,020	<0,001-0,003	<0,001-0,003
Potassium-40	22,000	0.060-0.150	0.160-4.200	0.040-0.190
Total б-activity	0,100	0,020-0,030	0,020-0,110	0,020-0,240
Total β-activity	1,000	0,200-0,380	0,200-0,450	0,002-1,400

The U concentration in all waters turned out to be considerably lower than IL (Intervention Level) set forth in the Standard NRB-99. The total б- and β-activities almost in all the investigated waters satisfy the requirements of the Standard SanPiN 2.1.4.559-96. The maximum U content (1.5 mkg/l) was registered in well No.2 of Kalinovsky water intake (Novozybkov Town) of 80 m deep, where Radium-226 was found also in the highest concentration (180 mBq/l). The specific activity (SA) of Uranium as recalculated for the most widely met ^{238}U isotope at a maximum concentration of 1.5 mkg/l will amount to ≈20 mBq/l. The total б -activity exceeds the level of Standard SanPiN 2.1.4.559-96 (0.1 Bq/l) in the groundwater of the UC Turon-Maastrichian aquifer, drilled through by well No.2 of Kalinovsky water intake (0.24 Bq/l) and in Krasnaya Gora Town (0.21 Bq/l). Though according to the Standard SanPiN 2.1.4.559-96, б -activity is not a "forbidden" factor for drinking water quality, nevertheless such exceeding of the Standard requires to identify and measure a specific activity of each radionuclide. The total β-activity in all the investigated waters were not above the standard levels (1.0 Bq/l).

Ra-226, Ra-228 and their daughter products, and K-40 stay still to be the most biologically significant, contributing over 90% to the summed-up man's inner radiation with consumed drinking water. In majority of investigated surface and shallow groundwater the specific activity of Chernobyl radionuclides are presently commensurable or slightly exceed that of Ra isotopes. In the GW UCA (stratum water) the water radioactivity is, on the contrary, still actually determined by natural radionuclides. In the surface and shallow groundwater on the Bryansk Chernobyl Spot (BChS) territory, the specific activity of Chernobyl Cs-137 and Sr-90 is presently comparable or exceeds the SA of natural radionuclides (this is so approximately for the third part of investigated water objects). The shallow groundwater shows a slight tendency of a Ra-226 and Ra-228 decrease with depth of investigating, which is probably caused by a decrease of Uranium and Thorium contents in water-bearing rocks with depth. In the UCA groundwater the radioactivity is now actually completely determined by natural radionuclides and does not exceed the standard level. Therefore, the radioecological state in respect to natural radionuclides on the investigated BChS territory is fit for people habitation. But each concrete consideration of radioecological state of natural water (and drinking groundwater, in the first turn), should obligatorily take into account, alongside with an anthropogenic (in the given case - ChS) component, natural radionuclides as well.

In future, in the areas affected by the Chernobyl accident the planning of population groundwater supply should necessarily take into account the both components - ChS and NR. A special focus should be done to determination (in water) of Ra isotopes and, first of all, Rn isotopes and the products of their decay, the contribution of which to the summed-up man's inner radiation with consumed drinking water can be significant.

THE OPTIMIZATION OF WATER RESOURCES MANAGEMENT ON URBAN TERRITORY

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The existing tendencies of megalopolises accelerated growth inevitably result in considerable changes in urban landscape.

Urban water resources have been traditionally used for drinking water supply, recreational, landscape and decorative purposes as well as for the removal of surface pollutants from the territory. Urban development results in disturbance of natural surface runoff within city boundaries and the changes in hydrographic network lead to changing the quality of water in water objects.

For example, the water objects within the boundaries of Moscow are no more the sources of drinking water supply, but they still remain the system-forming factor of the city and perform numerous functions.

Apart from the above-mentioned functions, these are the following ones: industrial water supply, reception of treated municipal wastewater, providing of navigation and usage of water for planted land care, bathing of citizens, etc.

The multipurpose intent of water objects results in the necessity of their purposeful management aimed at providing the required volumes and quality of water, the optimum combination of natural and man-made water bodies and waterways and the optimum conditions of their management.

Simultaneous achievement of the set goals is the purpose of water resources integrated management on urban territory. By the example of the Moskva River we have made the analysis of the existing system of water resources management, offered the trends of their optimization and formulated the principles of integrated management.

If we identify the management criterion as a complex of features that describe the goal of management, then we take the following criteria as the basic ones for the management of the water resources of Moscow:

- provision of water flow intensity for the sanitary water replenishment of the Moskva River and its tributaries;
- sufficient water supply of all categories of water users;
- provision of territorial runoff balance;
- optimum combination of the available resources of surface water and ground water sources.

The main artery - the Moskva River- may provide maximum 10 percent of the total water need of the city. The results of the water economy balance computation reveal the fact that sufficient water resources for the city of Moscow (in

case of 95 percent water supply level) are guaranteed only under the condition that the flow of the region's water objects is regulated and managed.

The management also envisages the provision of urban water resources' quality indices. Taking into account the existing technical level and the current condition of municipal economy, we come to the conclusion that in the nearest future it will be impossible to meet the requirements established for the quality of water in urban water bodies that are considered to be the water objects of fishery quality by the system of State Regulation. Under the conditions when all types of water resources within the boundaries of Moscow do not meet these high standards, the quality of water is the target function of the management process.

It is expedient to take the quality of water in the head section of the Moskva River as an interim regional standard for all water objects of the city. A specially developed Program envisages a step-by-step achievement of wastewater treatment quality regional standards taking into account the time required for the design, construction and reconstruction of hydraulic structures and treatment facilities.

Certain municipal enterprises are selected as the top-priority objects for the realization of the Program. These enterprises are the main water users in the sphere of potable water treatment and treated surface runoff and domestic wastewater disposal.

Specially developed Regulations for Wastewater Reception into Wastewater Disposal Systems are used for legal and standardizing substantiation for intensifying the application of service lines of the city aimed at tackling the problems of water resources regulation and management. The establishment of the databank for management decisions making is carried out with the application of water objects' monitoring results. The process of urban water objects' management is supported by the application of a principally new technology. The use of this technology is the result of considerable volumes of data to be processed. This technology is based on the application of the "Moscow Hydrologic Network" automated geoinformational system.

During the development of Master Plans for surface runoff catchment and treatment and the development of interim regional standards, the following principles of water resources integrated management were formulated:

- complex approach to the development and reconstruction of urban water systems and water fund;
- direction of attention towards realistically achievable quality norms and standards;
- provision of multifunctional use of water objects;
- constant monitoring of the condition of water objects and engineering systems;
- prediction of water objects condition.

The concept of urban water resources integrated management may be offered as a model concept to be used for solving the problems of large cities water economy.

THE PECULIARITIES OF FORMATION OF SUBSURFACE RUNOFF OF RIVERS IN MOUNTAINOUS COUNTRIES, THE PROBLEMS OF THEIR USE AND PROTECTION (IN ARMENIA)

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In mountainous countries the surface runoff of rivers is formed in rather difficult conditions. The system of factors influencing the runoff formation may be classified into three groups: a) climatic, b) ground surface and c) anthropogenic.

Taking into account their role and significance for river runoff formation, the following factors are specified into those:

a) causing runoff formation (precipitations and ground water);

b) intermediary (evaporation, air and soil temperature, scarcity of air humidity, the relief of drainage area, hydrogeological conditions, lakes, mires, forests, soils and anthropogenic factor);

c) conditional (volume and average height of drainage area, the gradient of slopes and river beds, the depth of river bed etc.) (Vladimirov A.M., 1976).

Each of the mentioned factors (separate from the others) may be dominant for the region depending on the relief, geological structure and climate. However, the factors shouldn't be regarded separately, especially in mountainous areas, because they form a complex structure with mutually dependent elements.

We've thoroughly studied almost all the mentioned factors for minimal runoff of more than 110 rivers (10 and more km in length) on the territory of the Republic of Armenia (RA) (Vardanian T.G., 2000). The following conclusions were drawn.

Complex mountainous relief and diverse geologic structure of the RA exclude the possibility of separating any factor having a dominant significance for the whole territory on the small area (only 29,8 thousand km^2). However, we believe that it's possible to select a group of factors playing a very important, dominant role for the rivers of RA. These factors are the average height of drainage area, hydrogeology and precipitations. Though the link of the minimal runoff of rivers with the precipitations is weakly expressed, they are still the main and determining factor.

The survey proved that the dependence of minimal runoff on the average height of drainage area is well expressed in regions of folded block-mountains of the RA and is poorly expressed in volcanic regions (Vardanian T.G., 1996). However, if, besides the mean altitude of drainage area, we