ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Analysis Of Groundwater Monitoring In The Territory Budennovsky And Levokumsky Districts Of The Stavropol Territory.

Stanislav Vladimirovich Odintsov*, Alexander Viktorovich Loshakov, Elena Vyacheslavovna Pismennaya, Vladimir Aleksandrovich Stukalo, and Nikolay Yur'yevich Khasai.

Stavropol State Agrarian University, Zootekhnicheskiy lane 12, Stavropol 355017, Russia

ABSTRACT

Regime observations (groundwater monitoring) are the basis for predictive calculations for water resources. The effectiveness of solving water management tasks largely depends on the completeness and reliability of information on the state of groundwater. It has been established that the current monitoring system for groundwater does not fully fulfill its functions. It requires a serious reorganization and further development on a modern scientific and technical level, because the management of underground water resources is impossible without a quantitative prediction of the state and properties of groundwater.

Keywords: groundwater, groundwater, first aquifer, Kuma River.

Corresponding author

ISSN: 0975-8585

INTRODUCTION

In general, groundwater is used wherever quality and quantity make it possible to consider them an economically viable source of water supply, as well as in those areas where the water supply is decentralized, that is, in small settlements, at certain agricultural and industrial facilities for which the laying of long pipelines or channels is impractical.

Underground waters in the territory of the Stavropol Territory are widely used in the eastern regions. Groundwater resources allow carrying out household and drinking water supply of all settlements as centralized large water intakes, exploiting deposits with approved reserves, and small autonomous water intakes of individual settlements and farms outside the distributed fund of subsoil [1].

In the north-western, northern and central parts of the province, where groundwater resources are low, water supply is carried out in a mixed scheme with the involvement of surface water resources [2].

Remote settlements with populations of up to several hundred people have autonomous water intakes from wells or springs. Usually, such intakes are rarely confined to groundwater deposits with approved reserves and, often, are outside a distributed subsoil fund.

In general, groundwater is used wherever quality and quantity make it possible to consider them an economically viable source of water supply, as well as in those areas where the water supply is decentralized, that is, in small settlements, at certain agricultural and industrial facilities for which the laying of long pipelines or channels is impractical.

Where surface aquifers have increased salinity, water is often used only for livestock watering.

It should be noted that surface water aquifers on most parts of the region are generally unsuitable for household and drinking water supply and are poorly protected. However, they are found and used for various needs almost everywhere, i.e. need protection from pollution as well as fresh water from groundwater deposits.

Water-filling and irrigation

Geographical conditions of the Stavropol Territory are characterized by scarce natural resources of fresh natural waters. The main waterways - the rivers Kuban and Terek, spread in the western and eastern directions, occupying only part of the territory of the province. The internal steppe rivers Egorlyk, Kuma and Kalaus are low in water and have a poor quality of water.

Own resources of underground waters of Stavropol Territory are also insignificant. With the total resources of fresh and brackish groundwater, approaching 2260 thousand m^3 / day, or, approximately, 0.66 m^3 / day. for 1 person, economic activities and economic development are unlikely, and given the extreme uneven distribution of groundwater resources across the territory (in different regions from 5-6 thousand m^3 / day to 400-600 thousand m^3 / day), it is generally impossible.

In this connection, from the 30th of the 20th century, additional water volumes were supplied to the territory of the krai from outside the Great Left Bank channel of the Terek-Kuma OOS. Later, the Nevinnomyssky Canal (1948), the Right-Egorlyk canal (PEK, 1958), the Tersko-Kumsky Canal (TKK, 1959), the Kumo-Manych Canal (KMC, 1960), the 4th stage of the Greater Stavropol (BSK, from 1970 to 2000) were built. g.) channels, currently supplying fresh water from the Kuban, Terek and Malki rivers to the territory of the region in the amount of more than 7,000 thousand m^3 / day. This value is ten times higher than the natural run-off of internal rivers, creating a significant load on the environment.

MATERIAL AND METHODS

Monitoring of groundwater resources is aimed at the rationale for rational use of groundwater resources and is a system for conducting observations and collecting information for assessing the state and predicting changes in the system of water abstraction in relation to solving the tasks of managing the

operation of groundwater abstraction. When organizing such monitoring, object and territorial monitoring of groundwater resources is allocated.

Object monitoring is carried out in the areas of water intakes of centralized water supply within the area of influence of water withdrawal on the flow of groundwater and solves the problems of optimizing the work of water intake, based on water management requirements; multi-site monitoring is carried out in a territory that covers several objects (for example, water intakes and other facilities in urban areas) with significant interference between them. Territorial monitoring is carried out in the territory of the subjects of the federation, proceeding from the planned development of centralized water supply in this territory.

Object monitoring includes the performance of control measurements and observations with special forecasting surveys.

Regular measurements are carried out for regular monitoring of the condition of water intake wells and the quality of extracted water. Regular measurements include measurements of dynamic levels and costs of water abstraction in water wells and the determination of polluting components in water. A special case of regular measurements takes place if there is a clear deterioration in the conditions of water abstraction (accidental decline in productivity or excess pollution by indicators of the surface aquifer).

Predictive surveys are conducted to justify the optimization of water intakes. The tasks of such surveys are related to the solution of water management issues, taking into account the improvement of water quality in the water intake. Predictive surveys are usually conducted within the framework of operational reconnaissance to reassess the operational reserves of groundwater at this water intake. A special survey is carried out during work on the recovery of water wells, and have the task of assessing the effectiveness of these works.

RESULTS AND DISCUSSION

The total water balance in the territory of the Stavropol Territory in recent years is characterized by the following indicators, indicated in Tables 1, 2.

Table 1: Water coming from outside the region in km^3 / year (thousand m^3 / day)

The arrival of water from outside the edge	km^3 / year	thousand m^3 / day
From the river Kuban along the Nevinnomyssky Canal and the BSC	2,1	5753
From the river Terek by TKK	0,5	1369
Total:	2,6	7122

Table 2: Water discharge beyond the edge km^3 / year

Water discharge beyond the edge	km^3 / year
Transfer to other SF by channels	-0,7 (1917)
Balance:	+1.9 (5205)

With a total area of irrigated massifs of about 200,000 hectares, the average irrigation load reaches a value of 0.5 to 0.7 from atmospheric precipitation.

The functioning of watering and irrigation systems with such parameters for 50 years has led to the following changes in the natural environment:

In the central and north-western regions of the region, where the natural drainage of the territory provides for a more effective drainage of the irrigation infiltration of the PEC and the BSC, in the east, the situation is still considered favorable. Nevertheless, in these regions processes of salinization of lands and flooding of settlements connected with the use of surface waters are observed.

In the eastern regions of the region, where there was a general rise in groundwater by several meters, all settlements were flooded. Many drainage salt lakes have sprung up where groundwaters once were at depths of more than 5 meters. Aridity of the climate facilitated the secondary salinization of soils along the main and distribution canals, rainfed lands adjacent to irrigated massifs and river terraces. The deterioration of the situation was facilitated by the lack of drainage systems adequate to water supply systems.

The change in the ratio of the levels of groundwater and pressure water to the reverse (when the groundwater level in large areas rose above the groundwater level of the underlying horizons) facilitated the convective-diffusion transfer of salts deep into and contamination of fresh sub-water.

Discharges of drainage and transit waters into rivers also led to changes in natural conditions. So, increased because of discharges of irrigation water, water costs in the river. Kume intensified the erosion of the channel in the middle reaches, causing the accumulation of sediments in the lower reaches, contributing to periodic floods or areas in the villages of Levokumsky, Vladimirovsky, Zaterechny and others.

The influence of settlements on the state of groundwater is manifested, mainly, in the pollution of fresh groundwater by sewage domestic and industrial waters. Observations showed that the actual pollution of aquifers, which is of anthropogenic nature, was noted, mainly, in the areas of the distribution of insufficiently protected non-pressure or sub-water. According to groundwater monitoring data, freshwater of alluvial sediments of some rivers was affected by technogenic pollution.

The main polluting components in the groundwater contamination sites were nitrates, ammonium, petroleum products, heavy metals, pesticides.

Another, if not the main, problem related to the influence of the territories of settlements is the facts of technogenic flooding. The problem of such territories is associated with flooding, landslides, suffusion, salinity. Observations testify to the poor efficiency of constructed vertical and horizontal drainages in the villages of Levokumsk, Achikulak, and others.

The regime of surface aquifers is largely determined by such external factors as climate, lithology of water-bearing sediments, the degree of natural drainage of the territory, geomorphology and anthropogenic load.

Objects of monitoring of the surface aquifers of the Levokumsky and Budyonovsky areas of interest as sources of water supply or for other purposes not related to their use are shown in the scheme "Surface aquifer monitoring objects and observation network" in Tables 3, 4 and 1.

Table 3: Groundwater monitoring objects in the territory of the Stavropol Territory

№	Location, boundary contours	Regional Features Purpose of observations
In valleys of large rivers with regulated drainage		
1.	Underground waters of channel and terrace deposits of the basins of the Kuban and Kuma rivers. (The numbers of the observation network posts are shown in brackets)	The aquifer is developed in alluvial deposits. Features of the regime of groundwater, the factors of violation, the negative consequences.
Irrigation regions		
2.	Underground waters of the accumulative plain of the alluvial-marine genesis of the eastern regions of the region. Levokumsky, Neftekumsky, Stepnovsky, Kursksky districts.	Sandy-sandy loamy, (closer to the north, loamy) deposits, saturated with ground waters of variegated composition from fresh to brine. Region of intensive irrigation activity.
Large industrial facilities		
3.	Surface aquifers in conditions of technogenic industrial pollution Stavrolen LLC, Azot OJSC, Luminophor OJSC,	Technogenic contamination of aquifers.

ISSN: 0975-8585

№	Location, boundary contours	Regional Features Purpose of observations
	Rosneft-Stavropolneftegaz facilities, CPC Oil Pipeline, Stavropol industrial zone, Pyatigorsk and Nevinnomyssk and others.	

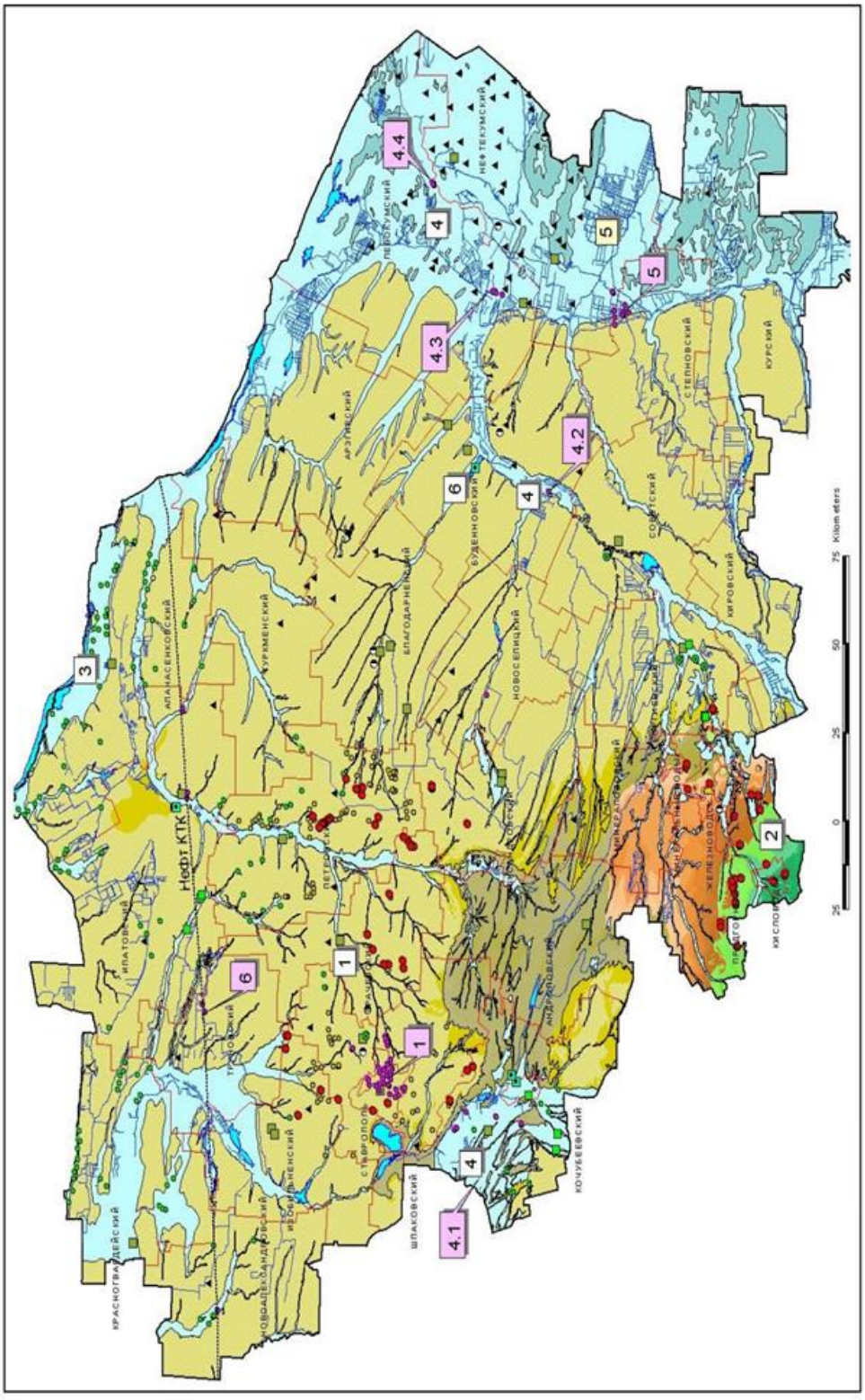

Figure 1: Monitoring objects

Wells of the TNS, which monitored the state of PVH, are shown in Table 4.

ISSN: 0975-8585

Table 4: List of wells of the TNS observation network

No of the post on the diagram, Fig. 1.	Location of the observation site	Name of the observation point	Aquifer index
Surface aquifers of channel, floodplain and terrace sediments of river valleys.	4.2. Archangelsky Kuma river	Arkhangelskoye 10	apQnI-II
		Arkhangelskoye 4	apQnI-II
		Arkhangelskoye 5	apQnI-II
		Arkhangelskoye 9	apQnI-II
	4.3. Vladimirovsky Groundwater and sub-water	Vladimirovsky 160	a(QnIII-QH)
		Vladimirovsky 161	a(QnIII-QH)
		Vladimirovsky 162	a(QnIII-QH)
		Vladimirovsky 19 я	am(QnIIhz-QnIII
		Vladimirovsky 20 я	am(QnIIhz-QnIII
	4.4. Velichayevsky Kuma river	Velichayevsky 102	a(QnIII-QH)
		Velichayevsky 103	a(QnIII-QH)
		Velichayevsky 104	a(QnIII-QH)
		Velichayevsky 105	a(QnIII-QH)

Surface aquifers of river valleys are confined to channel, floodplain and terrace sediments of quaternary ages of different lithologic composition and genesis.

Deposits of mountain rivers - Malki, Kuban, Podkumka are gravel-pebble lithological composition with sandy aggregate. The terraces of the flat rivers - Kuma, Kalaus, Egorlyka, etc. are represented by sandy-clay interbedded sediments.

Groundwater, confined to these sediments, is also characterized by different chemical composition and mineralization. For mountain rivers it is mainly fresh water with a predominance of hydrocarbonates, which can be used for water supply. The mineralization of the groundwater of the terraces of the flat rivers fluctuates to a great extent from the fresh waters in the sources to the brines in the lower reaches.

Surface aquifers of channel, floodplain and terraced sediments in the KMW region (on the rivers Podkumka, Malke, and Yutse) are operated for HPV and PTW purposes in the cities of Pyatigorsk, Essentuki and others. The productivity of water intakes is impressive. Essentuki water intakes of NS 4 and NS 5 to 5 thousand m^3 / day, Yutsky water intake to 8 thousand m^3 / day, Pyatigorsk - more than 20 thousand m^3 / day. Currently, these enterprises continue to operate in accordance with licensing agreements.

Surface aquifers of river valleys as an independent monitoring object appear not as a source of water supply, but as a horizon capable of exerting (including negative) the state of the watercourses of their shores and river bed.

ISSN: 0975-8585

Table 5: Chemical composition of water samples taken from the surveyed wells

№ wells	Ingredient, mg / l																				
	Ph	Petroleum products	Phosphates	Zinc	Cadmium	Lead	Copper	Manganese	Iron	Ammonium ion	K+Na	Calcium	Magnesium	Nitrates	Nitrites	Chlorides	Sulphates	Hydrocarbonates	Mineralization	Dry residue	Greediness	Okis. perom.
	MPC, mg / l																					
	7	**0,1**	**1,14**	**5**	**0,001**	**0,03**	**1**	**0,1**	**0,3**	**2**	**300**	**300**	**150**	**45**	**3**	**350**	**500**	**500**		**1000**	**7**	**5**
SN-24	8,67	0,12	0	0,01	0	0	0	0,76	0,57	3,018	5380	28,06	697	0,85	0,086	7388	3566	622	17685	19756	58,8	10,5
SN-23	8,22	0,17	0	0	0	0	0	2,79	0,44	0	11854	297	2936	1,32	0	20972	8302	452	44815	55922	255,6	26,9
SN-5	6,78	0,08	0	0,55	0	0,004	0	8,84	60	8,638	11043	697	2967	0,69	0	21093	78,29	293	43992	56776	279	28,4
SN-8	9,5	0,21	0,128	0,017	0	0,001	0,002	0	0,17	5,083	385	8,02	19,44	0	0	347	155	366	1285	1484	2	2,99
SN-21	6,66	0,09	0	0,01	0	0,001	0	6,895	4,6	4,043	15303	509	3210	1,27	0	36942	9270	146	55390	70288	289,6	25,4
SN-18	6,55	0,08	0	0,027	0	0,002	0,003	9,229	122,2	9,309	12415	866	3188	1,18	0	23206	8878	793	49479	64422	305,6	37,4
9th	9,45	2,17	0	0	0	0,003	0	0	0	0,096	519	8	12,2	0	0	674	84,8	195	1493	1526	1,4	2,64
8 th	11,12	5,94	0	0,01	0	0,002	0,002	0	0	0,34	523	24	2,4	0	0	695	123	122	1490	1542	1,4	2,64
crusher	8,18	0,07	0,028	0	0	0	0,002	0	0,15	0,119	163	76,15	43,7	12,22	9,5	284	158	171	918	774	7,4	5,54
old	9	0,24	0,082	0	0	0	0	0,185	0,47	0,097	25857	20,04	799	3,13	12,05	25028	21272	2551	75543	81840	66,8	9,72

CONCLUSION

Observations of the state of groundwater of river valleys were carried out on the river. Kuban (Kubansky and Kochubeevsky posts) and on the river Kuma (Archangelsky, Vladimirsky and Velichaevsky posts).

The conducted observations showed that the hydrodynamic state of the aquifer of the Sarin and Christmas terraces, developed in almost all river valleys of the region, is determined by the regime of the river itself, there were no facts on the levels of water intake in the water intake areas.

The chemical composition of groundwater is also close to the composition of the surface waters of rivers.

The analysis of observations of the groundwater status of the first aquifer from the surface showed the following results (Table 5):

The hydrodynamic regime of groundwaters was characterized by a predominant decrease in the groundwater table by a value from 0.08 to 0.32 m. Moreover, large values fell on the central regions of the region. The greatest amplitude of fluctuations in the groundwater table was observed on the terraces of the Kuma River, where they exceeded 1 m.

The decrease in groundwater level in 2016 was not due to the extraction of groundwater for use and depended mainly on the climatic features of the year. In 2016, the decrease in the groundwater table was due to a smaller amount of atmospheric precipitation compared to 2015, the amount of which was 497 mm and 562 mm at the Stavropol meteorological station, respectively.

The hydrochemical regime of groundwater in 2016 was more stable. Underground, used for centralized water supply of settlements of the Stavropol Territory, did not undergo significant changes and, in general, water quality complied with the requirements of normative documents GN 2.1.5.1315-03 on most indicators.

When monitoring groundwater, a section of strong groundwater contamination in the sewage sump area of LLC Stavrolen (the upper part of Lake Buyvola) was identified. The amount of mineralization of groundwater in the area of these sedimentation tanks is currently as high as 70 g / dm^3. This circumstance may pose a threat to the pollution of the Prikumskoye fresh groundwater field used for water supply in Budennovsk. It is envisaged that in 2018, materials will be collected for all observation wells in this area of potential pollution, and the risk of contamination of fresh water in the Prikumskoye field is assessed. In addition, in 2018 it is advisable to conduct surveys of several more potential environmental pollution facilities and surface aquifers, including sedimentation tanks of the oilfields in the Budennovsky and Levokumsky districts of the Stavropol Territory.

REFERENCES

[1] Pismennaya E.V., Loshakov A.V., Odinsov S.V., Stukalo V.A Improving model of territorial organization of agricultural land tenure. // Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2016. T. 7. № 6. p. 1783-1787.

[2] Pismennaya E.V., Loshakov A.V., Shevchenko D.A., Odincov S.V., Kipa L.V. Comprehensive approach for evaluating the potential of the Stavropol agricultural territory // International journal of economics and financial issues, Vol. 5, No 3S, Mersin (Turkey), 2015, pp. 113-120.

[3] Pelikhovich Y.V., Loshakov A.V., Shevchenko D.A., Perepelkina A.A. GEOCHEMICAL PECULIARITIES OF ELEMENT ACCUMULATION IN SOILS OF MOUNTAIN LANDSCAPES IN THE WEST CAUCASUSResearch Journal of Pharmaceutical, Biological and Chemical Sciences. 2016. T. 7. № 5. p. 1930-1935.

[4] Shevchenko D.A., Pelikhovich Y.V., Kipa L.V., Ivannikov D.I. THE IMPACT OF MELT- AND RAINWATER ON SOIL EROSION BY WATER IN THE NORTH-WESTERN PART OF STAVROPOL UPLAND Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2016. T. 7. № 6. p. 2446-2450.