ISSUES OF LIMITING TRANSBOUNDARY WATER IN CENTRAL ASIA

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annotation
The new geopolitical situation in Central Asia has changed the status of water bodies and their waters. They now appear to be transboundary and, therefore, their economic use should be regulated according to the norms of international law. But the standards arising from it, obviously, are designed to be based on taking into account the peculiarities of the formation and distribution of water resources and, no less important, centuries-old traditions and the legal custom of water use and water consumption that has developed on the subcontinent.
The current water generation and use situation in the subcontinent is uncertain for a number of reasons. Elimination of uncertainties, first of all, requires clarifying the regime of water generation in the context of global warming and streamlining the use of water resources. In connection with this issue, apparently, the problem of quotas for transboundary waters should also be discussed. This will somehow, probably, contribute to overcoming the accumulated collisions of water use and water consumption.
The given data and judgments made it possible to propose a scheme for the distribution of transboundary waters for the expected "norm" of runoff in the future. However, the formation of runoff, as a rule, proceeds cyclically, and this property will obviously manifest itself in the future. It is possible that the energy factors under the conditions of global warming will be more powerful, which, apparently, will affect the runoff formation and cause a larger range of its fluctuations.

Keywords: Aral Sea, hydrological regime, water resources, use of water resources, river flow regulation.

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Introduction

Having a significant water surface (over 69.8 thousand km ^{2}), the Aral Sea served until the mid-1960s as a climate-regulating reservoir and softened sharp fluctuations in the weather in the Central Asian region. The air masses that invaded the region from the west warmed up in winter, and cooled over the water area of the Aral Sea in summer. Thanks to this temperature regime, moisture carried by air currents fell in the form of precipitation over the Tien Shan and Pamir mountains in the autumn-winter period, replenishing snow reserves and the volume of glaciers.

The level of the water surface of the Aral Sea in natural conditions was almost 80 m above the level of the Caspian Sea. It was 428 km long and 234 km wide, with a maximum depth of 69 m and a volume of 1064 km ^{3}.

The Aral Sea zone was distinguished by a unique diversity of flora and fauna, only the number of saigas reached 1 million heads, the floristic composition was 638 species of higher plants.

Until 1960, the Aral was the largest fishery reservoir in Central Asia with an annual catch of up to 40 thousand tons of fish (carp, sturgeon). For comparison , all reservoirs in Uzbekistan (excluding fish ponds) produce about 8,000 tons of fish annually. Since 1980, the Big Aral has completely lost its fishery importance.

Methodology and objects of research

Available water resources and quota precedents

On the southern slope of the Aral Sea basin, river waters are formed and used in the basins of the large Amudarya and Syrdarya rivers [5, 21]. River waters in this part of the subcontinent have been and remain the main sources of water supply.

Table 1 presents data on the available primary resources of these transboundary rivers. These data are borrowed from [6, 7, 8, 11, 12] and compared with estimates [2, 5, 10, 13, 21], as well as with estimates [3, 14, 15, 16, 18]. In addition, the changes in the water content of rivers due to global warming, expected according to the given estimates [10], are “digitized”. This operation showed that in the near future, a shift in the “climatic norm” of runoff to approximately the level of the current water content of 90% is likely. This assessment, although very approximate, is oriented towards the preparation of "countermeasures". How effective they will be, if implemented, time will tell.

Table 1.

Available water resources r.r. Amudarya and Syrdarya (for the year 50% security or norm) according to the characteristic stages of their development and expected

by the beginning of the II quarter of the XXI century, (km ^{3} / year)

No. p / p	characteristic alignment	In the 50s of the XX century	By the 1950s	Beginning of the 21st century	Beginning of the II quarter of the XXI century
1	2	3	four	five	6
1.	Total for the Amudarya basin, including:		66.5 [8] - 67.9 [7]	69.8 [10] -	
1.1	upstream, of them:		67.9 [7] -	69.8 [10] -	52.4 ± 5.8
1 1.a	Afghanistan and Iran *)			19.9 [10]	

1 1.b	Kyrgyzstan *)			1.6 [10]	
1 1.c	Tajikistan *)			45.3 [10]	
1 1.в	Uzbekistan *)			3.0 [10]	
1.2	middle current, of them:	63.6 [21] -	63.6 [7] ~ 50.9 [7]		46±5
1 2.a	Turkmenistan *)		~ 21.0		
1.2.b	Uzbekistan **)		~ 11.0		
1.3	downstream, of them:	47.9 [21] * **)	31.6 [13] 24.0 [13]		
1.3.a	Turkmenistan **)		7.0 / 5.0		
1 3.b	Uzbekistan **)		17.3 / 16.0		
1.3.c	Flow to the Aral Sea - expenses for the Kyzyldzhar GP	38.0 [21] -	6.1 [13]		?
2.	Total for the Syrdarya basin, including:	37.8 [21]	33.4 [7]	37.2 [10]	27.2 ± 3.1
2 1.a	Kyrgyzstan *)			23.9	
2 1.b	Tajikistan *)			1.0 [10]	
2.1.c	Uzbekistan *)			3.7	
2.2	Middle current, oh) of them:	23.9 [17] + 6.9 and small rivers)	14.0	21.5	5.3 ± 0.6 oo)
2.2.a	Kyrgyzstan *)		3.7	3.7 [20]	
2 2.b	Kazakhstan *)		2.4	2.4 [10]	
2.2.c	Tajikistan *)		0.6		
2 2.d	Uzbekistan *)		2.5	2.5	
2.3	Downstream, Kazakhstan		11.0 / 7.5	10.8 / 7.5	1.8±0.2

2.3.a	Flow to the Aral Sea - expenses for the GP Kazalinsk	14.5 [21]		2.0(?)	
3	Total on the southern slope of the Aral Sea basin		99.9	106.4	79.6 ± 8.9

Notes: *) assessment of water generation; **) assessment of seizures; ***) at the latitude of the city of Nukus, excluding water intake for Karakalpakstan, Khorezm and Dashtkhauz for the year 90% security; o) from the Farkhad hydroelectric complex, agricultural lands are irrigated on the right bank and left bank of the middle reaches; oo) plus a tributary along the trunk of the Syrdarya river.

Table 2 shows the main provisions of the pre-project water allocation carried out in the past [11, 12]. This water division was carried out taking into account the Rules for the Use of Waters of International Rivers (Helsinki, 1966), but to ensure development, mainly irrigation, which is still a precedent that satisfies or does not satisfy the post-Soviet interests of the basin states.

Table 2 summarizes the data on the limitation of primary water resources (column 4), but, as noted, in the middle and lower reaches of the rivers, water intake was also provided by return and “twice or more return” waters. Thus, the requirements of water consumers are satisfied, and the available water resources are spent on sunk costs and losses. This testifies to the depletion of water resources and leads to the conclusion that high water consumption of water management complexes is unacceptable for arid countries.

Assimilation potential of water bodies and water quality

The assimilation potential of a water body is its inherent ability to maintain water quality and other characteristics within acceptable and acceptable limits for the life of the original population of aquatic organisms under various kinds of impacts.

Functionally, the assimilation potential of large rivers and their tributaries also characterizes the quality of the only natural sources of drinking water for Homo sapiens (a) societies. The presence and functioning of such sources from time immemorial favored the specific settlement of ethnic groups on the subcontinent and the formation of their original ecological niches.

However, the depletion of water resources, described above, is quite fully reflected in the state of the assimilation potential of water bodies - it is also exhausted in the lower and partly in the middle reaches of large and in part of medium and small rivers. At least in the controlled sections of these rivers, the quality of water does not meet the standards of the World Health Organization (WHO) for drinking water. Such, if not year-round, then in the low-water phases of the hydrological regime manifests itself. This is mainly due to return waters [6, 7, 8], since they are essentially agricultural wastewater. This kind of wastewater is also saturated with pollutants from industrial and household sources. Discharges of agricultural effluents should have been banned long ago or, which is preferable, limits on water withdrawals and discharges should have been determined taking into account the assimilation potential of water bodies and thus regulate the quality of river waters. For this, it is necessary to modernize the hydrotechnical structure of irrigated areas and, in general, the organization of water management systems.

Table 2.

The main provisions of the pre-project water allocation along the r.r. Amu Darya [12] and Syr Darya [11], (km ^{3} /year)

No. p / p	characteristic alignment	Stock by year 90% supply	water fence from the rivers	Return water (to the rivers)	Sunk costs and losses
1	2	3	four	five	6
1	The upper course of the Amu Darya - Pyandzha	59.5 *)	20.1	6.5	13.6
	Including:				
1.1.a	Tajikistan + Afghanistan	55.0	14.8	4.6	10.2
1.1.b	Uzbekistan	3.5	4.9	1.8	3.1
1.1.c	Kyrgyzstan	1.0	0.4	0.1	0.3
1.2	middle course	45.9	28.1	2.1	26.0
	Including:				
1.2.a	Uzbekistan		11.7	1.4	10.3
1 2.b	Turkmenistan		16.4	0.7	15.7
1.3	downstream	18.5	18.5	0.7	17.8
	Including:				
1.3.a	Uzbekistan,		14.3	0.7	13.6
	of them:				
1.3.a'	Tuyamuyun		5.3		5.3
1.3.a"	Takhiatash		9.0	0.7	8.3
1. 3.b	Turkmenistan,		4.2		4.2

	of them:				
1.3.b'	Tuyamuyun		2.6		2.6
1.3.b"	Takhiatash		1.6		1.6
1. 3.c	Drain into the Aral Sea			2.1	
1.4	Total along the Amudarya river	59.5	66.7	9.3	57.4
1.4.1	Kyrgyzstan	1.0	0.4	0.1	0.3
1.4.2	Tajikistan (+ Afghanistan)	55.0	14.8	4.6	10.2
1.4.3	Turkmenistan	-	20.6	0.7	19.9
1.4.4	Uzbekistan	3.5	30.9	3.9	27.0
2	The upper reaches of the Syr Darya - Naryn,	23.0 *)	19.0	9.4	9.6
	Including:				
2. 1.a	Kyrgyzstan		5.0	2.5	2.5
2. 1.b	Tajikistan		2.0	1.0	1.0
2. 1.c	Uzbekistan		12.0	5.9	6.1
2.2	Middle course and CHAKIR,	20.6 **) (13.4 + 7.2)	16.5	7.2	9.3
	Including:				
2. 2.a	Kyrgyzstan	3.7	0.2	0.1	0.1
2. 2.b	Kazakhstan	0.7	2.5	0.7	1.8
2. 2.c	Tajikistan		1.2	0.4	0.8
2. 2.d	Uzbekistan	2.8	12.6	6.0	6.6
2.3	downstream,	13.8	13.8		11.8
	Including:				
2. 3.a	Kazakhstan (below Chardara)	11.3			
2. 3.b	Arys + Bugun	2.5			
2. 3.c	Drain into the Aral Sea			2	

2.4	Total along the Syrdarya river	32.7	49.3	18.6	30.7
	Including:				
2.4.1	Kyrgyzstan	26.7	5.2	2.6	2.6
2.4.2	Tajikistan		3.2	1.4	1.8
2.4.3	Uzbekistan	2.8	24.6	11.9	12.7
2.4.4	Kazakhstan	3.2	16.3	2.7	13.6
3	Total for the Southern Slope of the Aral Sea Basin	92.2	116.0	27.9	88.1
	Including:				
3.1	Afghanistan	+12	16.6	3.5(+3)	10.1
3.2	Kazakhstan	3.2	16.3	2.7	13.6
3.3	Kyrgyzstan	27.6	5.6	2.7	2.9
3.4	Tajikistan	38.4	12.4	6.0	6.4
3.5	Turkmenistan	-	20.6	0.7	19.6
3.6	Uzbekistan	6.3	55.5	15.8	39.7
3.7	Discharge into the Aral Sea			4.1	

Notes: *) with a control coefficient of ~ 0.9; **) including the inflow along the river bed. Syr Darya - 13.4 km ^{3}

Forms of transboundary impacts

Intersectoral, interregional and temporary externalities (external effects, impacts) that took place on the subcontinent, with the achievement of independence and sovereignty by the basin states, were transformed into transboundary impacts of various levels of organization.

The global externalities that are manifested in the subcontinent are due to the greenhouse effect, due to which the climate is changing. The consequences of climate change are expected [9, 10] to manifest themselves in a decrease in the water content of rivers. If these forecasts come true, the runoff rate will decrease. Such expectations are "digitized" in Table. 1 (column 6).

Interregional externalities, manifested in the subcontinent from ancient times to the present, are due to the withdrawal of river waters. If in the past this was typical for small and medium-sized rivers, now they cover large rivers. Evidence of this is the transformation of the Amu Darya into a "river with blind ends." Table 2 illustrates this situation.

Temporary externalities are determined by the levels of development of the productive forces of the basin states and their specialization. The criterion of impact power is the state of the Aral Sea. Before the Second World War and in the first decade after it, about 4 million hectares of agricultural land were developed on the subcontinent for irrigation, and the average river flow into the Aral was then about 52 ± 5 km ^{3}/year. The post-war development of new water and land resources ended (except for Turkmenistan) with an increase in the area of irrigated agricultural land up to 7 million hectares and the practical cessation of flow to the Aral. Turkmenistan, after achieving independence, brought the area of irrigated land to 1.7 million hectares [10]. And the subcontinent entered the 21st century with about 8 million hectares of irrigated farmland. Compared to rainfed agriculture, irrigated agriculture is much more productive, but the way it was cultivated is very resource-intensive, and therefore still extensive. The Asian "green revolution" bypassed the subcontinent and the introduction to intensive farming technologies, apparently, can be expected in the future.

Cross-sectoral externalities are driven by competition for resources. The most significant of these is the confrontation between irrigation and hydropower [20]. It manifested itself in the Soviet, and persists in the post-Soviet period. If in the Soviet period hydropower functioned under the dominance of irrigation, then in the post-Soviet period, upstream basin states prefer to meet their energy needs [10, 20]. In the absence of counter-regulatory structures, non-vegetation energy releases that exceed the low-water runoff, and the existing reservoirs were programmed for it alone, are lost for irrigation.

Hydropower, with its dominance in the upper reaches, fundamentally changes the intra-annual distribution of the runoff of developed rivers, both relative to the natural and irrigation regimes [20]. Therefore, the grassroots states incur losses in irrigated agriculture on the Amu Darya due to the Vakhsh cascade, while about 4-5 km ^{3} per vegetation, and in the Syr Darya - due to the Lower Naryn cascade - also about 4-5 km ^{3} . With the construction of the Dashtijum hydroelectric complex on the Pyanj, energy releases will increase by another 7-8 km ^{3} during the non-vegetation period.

But all the above estimates are based on traced hydrological events in the past climatic epoch. And in the new one, the situation, as noted above, is still uncertain. Therefore, the regulation and counter-regulation of river flow to meet water requirements remains an urgent problem. And this is clear despite the fact that the planning horizon in the current circumstances for the near and even more distant perspective is limited.

The externalities listed above proceed not only in isolation, but are grouped in space and time. Such integration causes something that complicates the flow state and transforms it into a non-linear flow regime. To a certain extent, this explains the transience and power of the negative consequences of the disorderly use of the water resources of the subcontinent. The "unexpected" increase in the water content of the rivers of the subcontinent in the last decade of the last century due to the melting of mountain glaciers not only did not alert, but rather delayed the timely adoption of a new regulation on water use and water consumption.

The discussion of the results

Optimization of water use and water consumption, development of the hydrographic network of the interfluve

The new regulation on water use and water consumption on the subcontinent, first of all, needs its scientific and technical justification. Such a justification should, apparently, begin with a critical analysis of more than a century of water management events, assess their positive and negative aspects, including "post-Soviet innovations."

The need for the rational use and protection of the waters of the subcontinent has been understood by the scientific and technical community since at least the last quarter of the nineteenth century. The first pre-project studies on river basins or their parts appeared in the first half of the last century, and they acquired the form of legislative guidelines after the Second World War. These results and the main provisions of the "scheme" studies are reflected in monographs [5] and approved in the prescribed manner the guiding documents of those years [11, 12].

The purpose of such documents was to ensure the priority development of cotton growing, i.e. production of a product that was competitive at that time on world markets - cotton. It is no less significant in domestic production, etc. Therefore, in the norms of water allocation between the subjects of the union state, irrigation limits dominated , and the maximum irrigated area was taken as the main effect of planned designs. Up to 90-95% of available water resources were allocated for irrigation. For this, the flow was regulated, which guaranteed water supply and sustainability of irrigation. Return waters were included in the account of available water resources and participated in water supply. However, the hydropower resources of the rivers of the subcontinent were used as fully as possible, but according to the irrigation schedule.

Table 2 shows data on water withdrawals from rivers, returnable (discharged) and irretrievable costs and runoff losses that occurred during the implementation of past targets. Now, as it turns out, such a situation with water allocation, water use and water consumption does not meet the interests of the mountain basin states [3, 10].

Since 1992, the basin states, located in the belt of river flow formation and at the same time mastering the cascades of complex hydroelectric facilities with reservoirs, have changed their existing irrigation use to energy use. From this, they began to receive their benefits in the energy sector, and the grassroots states - belts of transit and dispersion of runoff, began to suffer direct damage from under-irrigation of already developed agricultural lands. At the same time, experts from upstream states attribute the costs and damages from hydropower to grassroots, as if flow regulation is carried out only in the interests of irrigation [1; 3, 32-35, 36-38]. And for services not rendered, they demanded payment and for the time being received it [10]. So the current situation with the use and protection of transboundary waters is hardly acceptable for the basin states. Especially, this is when the already limited resources of transboundary waters are predicted to decrease in the near future.

The decisive importance of the quality of river waters is no less obvious, since from time immemorial they have been sources of drinking water supply for the population. Therefore, the regulation of the quality of river waters is an urgent need for optimizing water use and water consumption. This is called for by the recent experience of the past, when, for example, the water intake from the Syrdarya-Naryn river and their tributaries reached the volumes of the formed runoff [6, 14], and the discharge of return water into them was not limited. Even then, at the exit from the upper reaches (the site of the Farkhad dam), the quality of the waters did not meet the current standards of GOST "Drinking Water". Consequently, the left-bank objects of the middle and entire lower reaches, with rare exceptions - the presence of deposits of fresh underground waters or fresh waters of small rivers, did not have good-quality drinking water.

From the foregoing, the goal of optimization is determined as the fullest possible use of the useful properties and purposes of the water runoff and minimization of the dangerous and harmful manifestations caused by it or genetically related to it, especially the deterioration of water quality, the destruction of water bodies, the degradation of irrigated lands and built-up areas, etc. [16, 17].

To achieve optimization goals, it is necessary to develop a hydrographic network, including water bodies. New reservoirs are needed to organize and ensure the counter-regulation of energy releases and, in general, the transformation of the hydrological regime to meet the requirements of irrigation and hydropower.

The problem of counter-regulation of the energy regime of the river runoff of the upper reaches into the irrigation regime of the middle and lower reaches of large rivers was considered and solved by the Hydroproject Institute in the 50-70s [5, 11, 12]. According to these developments in the Amu Darya, the tasks of counter-regulation are solved by the Verkhneamudarya complex hydroelectric complex with a reservoir with a useful capacity $^{\text{of about 11-12 km3}}$. But due to the large area of flooding (about 1100 km ^{2}), including parts of the Tigrovaya Balka nature reserve, the construction of this reservoir remains problematic.

A less capital-intensive and problematic option is the Kelif hydroelectric complex [5]. In terms of energy indicators, it is only 1/3 inferior to the Upper Amudarya, but it contributes to solving the problem of counter-regulation and modernization of water intakes in the middle reaches, makes them reliable and economical.

The Amubukhara gravity canal [5] can start from the hydroelectric complex, and the Karakum canal can receive regulated water intake. From this hydroelectric complex, Afghanistan may be able to develop irrigated agriculture in the northern border area.

^{3}) and Sultandag can also serve as regulating energy releases from Vakhsh tanks in this variant .

It will be necessary to implement the project of the Right-bank collector [2], with the diversion of not only the return waters of the Karshi and Bukhara oases, but also from the Zarafshan river basin.

It is possible that in the middle reaches of the Syr Darya it will be impossible to assimilate energy releases. Then they will need to be diverted to the North Agitma reservoir and from it along the Daryasay to irrigate the lands of the Bukhara oasis, or the Tuprakkala massif, or the Turtkul oasis [19].

The right-bank main collector, as a receiver of marginal waters, is designed to improve the reclamation situation in the interfluve [2], in order to ensure their diversion to the regional runoff basis - the Aral Sea.

This is, in general, a sketch of the scheme for the development and modernization of the hydrographic network of the considered part of the subcontinent.

Quotas - the proposed scheme

The quota, as you know, is the share or norm of something permissible, while the limit is the maximum norm. Differences in these concepts, apparently, still exist. Therefore, let us agree that water quotas (water allocation) is the establishment by the subjects - users of the shares of water bodies' resources acceptable for water use and water consumption, taking into account the preservation of their assimilation potentials to an acceptable extent. The essence of this judgment is clearly characterized by the goals and methods of optimizing the management of water resources, their use and consumption [17]. Based on the logic of the above judgments and expectations, the first approximate version of quotas for transboundary waters was obtained (Table 3). It certainly needs to be revised by a team of experts in order to objectively weigh the "pros and cons" before being promoted to the level of a guiding pre-project document.

Table 3

The proposed scheme of water allocation in the transition period of the probable

dry epoch, (km ^{3} / year)

No. p / p	name of the watercourse, country	Probable in the near future quotas for		
		VP $^{o)}$ /VZ	reset $^{o)}$ VV in rivers	BVZP $^{o)}$
1	2	3	four	five
1	Amudarya river basin	52.4 / 58.4	11.4	47.0
	Including:			
1.1	upstream	52.4 / 16.3	5.4	10.9
1. 1.a	Panj	28.2 / 4.8	1.5	3.2
1. 1.b	Vakhsh	16.4 / 5.7	1.9	3.8
1. 1 c	Kafirnigan	4.2 / 1.3	0.4	0.8
1. 1.d	Surkhandarya	3.6 / 4.5	1.5	3.0

	Of them:			
1.1.1	Afghanistan	14.1 / 4.8	1.5	3.2
1.1.2	Tajikistan	33.8 / 6.8	2.3	4.5
1.1.3	Uzbekistan	3.6 / 4.5	1.5	3.0
1.1.4	Kyrgyzstan	0.9 / 0.2	0.1	0.1
1.2	middle course	41.5 / 20.7	2.5	18.2
	Including:			
1. 2.a	Karakum Canal	- / 10.3	-	10.3
1. 2.b	Karshi Canal	- / 3.5	(0.9 **)	2.6
1. 2.c	Amu-Bukhara Canal	- / 3.7	(0.9 **)	2.8
1. 2.d	Middle Amudarya water management system (Turkmenistan)	- / 3.2	0.7	2.5
	Of them:			
1.2.1	Turkmenistan	- / 13.5	0.7	12.8
1.2.2	Uzbekistan	- / 7.2	1.8 **)	5.4
1.3	downstream	11.0 / 21.4	3.5	17.9
	Including:			
1. 3.a	Tashdkhauz Canal	- / 7.2	-	7.2
1. 3.b	Khorezm	- / 3.6	0.9	2.7
1. 3.c	Southern Karakalpakstan	- / 1.8	0.4	1.4
1. 3.d	Right bank of northern Karakalpakstan	- / 4.4	1.1	3.3
1. 3.e	Left bank of northern Karakalpakstan	- / 4.7	1.1	3.3
1. 3.f	Discharge into the Aral Sea		2.2	
	Of them:			
1.3.1	Turkmenistan	- / 7.2	-	7.2

1.3.2	Uzbekistan	11.0(?) / 14.2	4.0(+1.8)	12.0
2	Basin of the Syrdarya river	27.2 *) / 39.3	14.8	24.5
	Including:			
2.1	upstream	(20.1) / 14.1	6.9	7.2
2. 1.a	Naryn	11.2 / 3.8		
1. 2.b	Karadarya	3.2 / 2.8		
1. 2.c	Small (and medium) rivers of Fergana	8.6 / 7.5		
	Of them:			
2.1.1	Kyrgyzstan	(20.1) / 3.8	1.9	1.9
2.1.2	Tajikistan	(12.9) / 1.5	0.7	0.8
2.1.3	Uzbekistan	(12.9) / 8.8	4.3	1.5
2.2	Middle course and CHAKIR	(18.2) / 12.2	5.2	7.0
2. 2.a	Inflow along the Syr Darya	(12.9)		
2. 2.b	Stoke CHAKIR	5.3		
	Of them:			
2.2.1	Kazakhstan	0.5 / 1.8	0.5	1.3
2.2.2	Kyrgyzstan	2.7 / 0.2	0.1	0.1
2.2.3	Tajikistan	- / 1.0	0.2	0.8
2.2.4	Uzbekistan	2.1 / 9.2	4.4	4.8
2.3	downstream	(13.0) / 13.0	2.7	10.3
2. 3.a	Inflow along the Syr Darya	11.2 / 11.2	2.7	8.5
2. 3.b	Small rivers Karatau	1.8 / 1.8	-	1.8
2. 3.c	Discharge into the Aral Sea	-	2.7	-
	Of them:			
2.3.1	Kazakhstan	13.0 / 13.0	2.7	10.3

3	Total on the southern slope of the Aral Sea basin	79.6 *) / 97.7	26.2	71.5
3.1	Afghanistan	14.1 / 4.8	1.5	3.2
3.2	Kazakhstan	13.5 / 14.8	3.2	11.6
3.3	Kyrgyzstan	22.8 / 4.2	2.1	2.1
3.4	Tajikistan	33.8 / 9.3	3.2	6.1
3.5	Turkmenistan	20.7 / 20.7	0.7	20.0
3.6	Uzbekistan	25.0 / 43.9	15.5	28.4
3.7	Discharge into the Aral Sea		6.7 **)	

Notes: *- probable river runoff; **) incl. discharge along the Pravoberezhny collector 1.8 km ^{3} from the middle course; °) WP - water use; VZ - water intake; WW - return water; SVZP - sunk costs and losses

Conclusion

The above data and judgments made it possible to propose a scheme for the distribution of transboundary waters according to the expected “norm” of runoff in the future. However, the formation of runoff, as a rule, proceeds cyclically, and this property will obviously manifest itself in the future. It is possible that the energy factors under the conditions of global warming will be more powerful, which, apparently, will affect the runoff formation and cause a larger range of its fluctuations.

Presumably, in the future, in the years of 90% and 10% supply, the volume of runoff will be 42.2 and 68.2 km ^{3} on the Amu Darya , and 19.3 and 33.2 km ^{3} , respectively. In general, in these basins the range of runoff fluctuations will apparently be in the range of 61.5-101.4 km ^{3} /year.

Pre-calculated runoff values lead to the conclusion that the probability of severe low water with a reduction in its volume by almost 2 times compared with the "norm" calculated over a more than 100-year cycle of observations, it can manifest itself. Such a lack of water will affect all sectors of the water management complexes of the basin states, both water users (hydropower, recreation, etc.) and water consumers (irrigated agriculture, thermal power engineering, etc.). Then the drinking water supply of the population will acquire special significance, although even now its condition is of concern in a number of territories.

The expected water management situation urgently requires overcoming the existing conflicts in the use of transboundary waters. This, however, is achievable on the basis of a reasonable and fair application of the legal customs that have developed over the centuries in the subcontinent and the developed norms of international law. All this is achievable only at the new technological level of the water management complexes of the basin states - water-saving. The introduction of water-saving technologies in all sectors of water management systems is an urgent need for arid countries. By the way, if the low water forecasts given in [10] do not come true, and the “countermeasures” are implemented and they will have an effect, then the released (saved) water resources will find their application in the development of the economies of the basin states and when they achieve environmental well-being.

It is unlikely that the sketch presented is "true in the last instance." But on the eve of the manifestation of the consequences of global warming, it clarified, apparently, schematically, the initial condition for overcoming the contradictions between the basin states - users and consumers of the transboundary waters of the subcontinent.

Delay in the adoption of "countermeasures" to overcome the consequences of the predicted low water, the symptoms of which are already somehow manifested, is unacceptable, since otherwise large-scale disasters or even catastrophes are possible. The impending dangers, apparently, can be significantly minimized in advance.

References

1. Asanbekov A.T. et al. Economic Mechanism of Transboundary Water Resources Management and Basic Provisions of the Interstate Water Distribution Strategy. Bishkek: International Institute of Mountains, 2000. - 48 p.
2. Water is a vital resource for the future of Uzbekistan. The team of authors. Tashkent: UNDP, 2007. - 127 p.
3. Water and sustainable development of Central Asia. Bishkek: Elita, 2001. - 178 p.
4. Global Environmental Conventions: Strategic Directions for Capacity Development. Tashkent: GEF, UNDP, 2006. - 84 p.
5. Irrigation in Uzbekistan. Tashkent: FAN, T.II. 1975. - 360 p., Vol. III. 1979. - 359 p.
6. Rubinova F.E. Changes in the flow of the Syrdarya River under the influence of water management construction in its basin. Moscow: Gidrometeoizdat, 1979. - 139 p.
7. Rubinova F.E. Changes in the flow of the Amudarya River under the influence of water reclamation in its basin. Moscow: Gidrometeoizdat, 1985. - 116 p.
8. Rubinova F.E. Influence of water reclamation on the runoff and hydrochemical regime of the rivers of the Aral Sea basin. Moscow: Gidrometeoizdat, 1987. - 161 p.
9. Collection of abstracts. International conference on regional cooperation in transboundary river basins. Dushanbe: UNDP, 2005.
10. Strengthening regional cooperation on the rational and efficient use of water and energy resources in Central Asia. New York: UN. 2003. - 125 p.
11. Refinement of the scheme for the integrated use and protection of water resources in the Syrdarya river basin: Corrective note. Tashkent: "Sredazgiprovodkhlopok", 1983. - 124 p.
12. Refinement of the scheme for the integrated use and protection of the water resources of the Amudarya River: a summary note. Tashkent: "Sredazgiprovodkhlopok", 1984. - 372 p.
13. Khamraev N.R., Sherfedinov L.Z. Water resources of Central Asia: estimates, scales of use, variability, significance for ecological safety and social and economic development

of Uzbekistan// In book. “Water problems of arid territories. Issue. 2. Tashkent: "Uzbekhydrogeology", 1994, - S. 3-18.

14. Khasanov A.S., Sherfedinov L.Z. Arid hydrogeological-reclamation process. Tashkent: Fan, 1987. - 151 p.
15. Khodjibaev N.N., Sherfedinov L.Z. The structure of the current use of groundwater resources in the basins of the Syrdarya, Amudarya rivers and its likely changes in the future. Reports at the meeting of the Section for the Use and Protection of Water Resources of Central Asia of the Scientific Council of the State Committee for Science and Technology of the Russian Federation. Tashkent: GIDROINGEO, 1978. - S. 119-140.
16. Khodjibaev N.N., Sherfedinov L.Z. Issues of hydrogeological forecasting in arid regions. Tashkent: Fan, 1982. - 180 p.
17. Sherfedinov L.Z. Ecological and economic aspects and principles of integrated management of water and salt flow / / In the book. "Water resources, the problem of the Aral Sea and the environment". Tashkent: University: 2000, - S. 164-178.
18. Sherfedinov L.Z., Davranova N.G. Water is a limiting strategic resource for the socio-economic and environmental security of Uzbekistan / / In the book. "Reservoirs, emergencies and the issue of sustainability". Tashkent: National University, 2004, pp. 123-133.
19. Sherfedinov L.Z., Makhmudov E.Zh., Yakubov M.A. Variant of counter-regulation of energy releases along the Syrdarya river. Ecological Bulletin of Uzbekistan, No. 7, 2007, - P. 19-20.
20. Sherfedinov L.Z., Pak E.L. Central Asia: Irrigation and Energy "Confrontation"// In the book: Reservoirs, Emergencies and Problems of Sustainability. Tashkent: National University, 2004, pp. 114-122.
21. Shults V.L. Hydrography of Central Asia. Tashkent: SAGU, 1958. - 117 p.