

# **WATER SITUATION ANALYSIS WITHIN THE AMUDARYA AND SYRDARYA RIVER BASINS FOR THE GROWING SEASON OF 2013**

## **1. Syrdarya River Basin**

The actual inflow to the upstream reservoirs of the Syrdarya River Basin (Toktogul, Andizhan and Charvak without considering the inflow from the Ugam River) for the growing season was 16.187 km<sup>3</sup>, or 101.6 % of the predicted inflow. Total 5.14 km<sup>3</sup> of water was diverted to the upstream reservoirs from the Naryn, Karadarya and Chirchik rivers, which is 0.49 km<sup>3</sup> less than planned. The actual release from the reservoirs made 11.05 km<sup>3</sup>, which is 7.3 % more than planned.

The total lateral inflow to the Naryn and Syrdarya rivers (at the river reaches up to the Shardara reservoir) found by the balance calculation (based on data of the BWO “Syrdarya”) made 8.55 km<sup>3</sup>.

By the end of the growing season, 17.99 km<sup>3</sup> of water, or 97.9 % of the planned volume, was accumulated in the upstream reservoirs, in particular: 15.92 km<sup>3</sup> - in the Toktogul reservoir, 1.51 km<sup>3</sup> - in the Charvak reservoir, and 0.56 km<sup>3</sup> - in the Andizhan reservoir.

The total water diversion from the Naryn and Syrdarya rivers reaches up to the Shardara reservoir made 10.15 km<sup>3</sup>, in particular: for the Kyrgyz Republic - 0.225 km<sup>3</sup>; for the Republic of Tajikistan - 1.449 km<sup>3</sup>; for the Republic of Uzbekistan – 7.935 km<sup>3</sup>; and for the Republic of Kazakhstan (through the Dustlik canal) - 0.541 km<sup>3</sup>.

Over the growing season of 2013, the diversion was 0.32 km<sup>3</sup> (3.5 %) less than planned according to the BWO “Syrdarya” schedule. Water supply was unequal for the riparian countries as well as for the river reaches (see Table 1.1).

In general, the water availability was satisfactory for Kyrgyzstan only, because all the other countries perceived dramatic deficit during some months, particularly unsustainable water supply was in the beginning of the growing season. Dramatic water deficit was within the river midstream, the Kayrakkum-Shardara reach in particular, where the water availability in Uzbekistan decreased below 80-70 % and practically kept at that level till the beginning of August (see Table 1.2). The deficit was less at the Toktogul-Kayrakkum reach but also reached to 77-79 % in Uzbekistan, to 70-84 % in Tajikistan during some ten-day periods. Kazakhstan supplied itself with water mainly due to water accumulated in the Shardara reservoir during the winter and water supplied with pumping stations from the Shardara reservoir and not considered by BWO.

The commitments on water supply to the Kayrakkum reservoir were fulfilled by 114%; the water inflow to the reservoir made 5.14 km<sup>3</sup> as compared with 4.51 km<sup>3</sup> as per the BWO “Syrdarya” schedule. However, the Kayrakkum reservoir operation mode caused water underdrawal by 183 mln m<sup>3</sup> of the total underdrawal of 241 mln m<sup>3</sup> here in Tajikistan in April-May, for no apparent cause from BWO. Meanwhile, the underdrawal in the midstream was partially compensated with more intensive water

diversion from small rivers. Tajikistan diverted 90 mln m<sup>3</sup> or 127 % out of the average annual (2008-2013) diversion from the Isfara in 2013. Uzbekistan diverted 13.7 mln m<sup>3</sup> in total or 70 % out of the average annual (2008-2013) diversion and 30 % against the maximal value in 2010 from the Isfara in 2013.

The water availability within the Syrdarya river midstream depends on releases from the Kayrakkum reservoir, which can limit water supply to the midstream canals even during average water periods, given it operates in a power generation mode.

During the growing season of 2013, the lowest water availability, estimated on the limits for 2013, was observed in Tajikistan during the second ten-day period of April – up to 11.6%; in Kazakhstan in July – up to 51.6%, in Uzbekistan in June – up to 68%. The total release from the Kayrakkum reservoir made 6.32 km<sup>3</sup>, including the release of 5.96 km<sup>3</sup> into the river.

The release from the Kayrakkum reservoir was 0.22 km<sup>3</sup> more than scheduled by the BWO “Syrdarya”. The ten-day analysis of releases from the Kayrakkum reservoir is given in Table 1.8. The following fact makes oneself conspicuous: the schedule of releases from the Kayrakkum reservoir was over-fulfilled, mainly, due to large releases in August and the first ten-day period of September when need for water decreased already. Use of those excessive releases in May and July could have provided increased water availability in Tajikistan and Uzbekistan during those months.

The water inflow to the Shardara reservoir amounted to 3.54 km<sup>3</sup>, or 15.3% less than scheduled by the BWO “Syrdarya”. It was found from the balance calculation that flow losses at the Toktogul-Shardara river reach were 0.02 km<sup>3</sup>, at the lateral inflow of 8.55 km<sup>3</sup>.

The water release from the Shardara reservoir made 5.54 km<sup>3</sup>, including 4.8 km<sup>3</sup> into the river and no water to the Arnasay reservoir.

Over the growing season of 2013, there was no water release from the Shardara reservoir into the Arnasay. During the growing season, significant releases to the Arnasay (from 100 mln m<sup>3</sup> and above) were observed earlier, more frequently in April, sometimes in May, June, July, except 2002 when releases were made during the whole growing season at significant inflows into the Shardara reservoir, which exceed 6-7 km<sup>3</sup> over the growing season. During the growing season of 2013, the inflow to the reservoir was just 3.5 km<sup>3</sup> (Table 1.6 and Fig. 1.1). Some tendency to decreased vegetative releases into the Arnasay is observed over 1993-2012. If in 1993-2003 the release into the Arnasay reached 12-16 % out of the inflow to the Shardara, then it has not exceeded 1-3 % over the recent 10 years.

The Syrdarya River channel water balance at the downstream (including accumulation and drawdown of the Koksaray reservoir) is given in Table 1.7. It provides data on water resources use (water diversion), and water losses from the river are shown. Losses were found by balance method, therefore they can include CDF releases (with the sign reversed) into the river and unconsidered water diversion.

As follows from the balance, the total water diversion from the Shardara reservoir and the Syrdarya River downstream amounts to 5,117 mln m<sup>3</sup> during the

growing season, and the water losses – 2653 mln m<sup>3</sup> (or 55 % out of the releases from the Shardara). The total use of the flow (water diversion plus losses) downstream is estimated as 7770 mln m<sup>3</sup>. At that, the total resources of vegetative flow of the Syrdarya River within the Shardara (including the release from the Koksaray and along the Arys River) up to the Karateren gauging station decreased from 8275 to 1243 mln m<sup>3</sup> due to water diversion and losses.

According to the of SIC ICWC assessment, average losses of vegetative flow within the Syrdarya downstream over 1990-2000 made 1.9 km<sup>3</sup> for a dry year (90 % of water availability), and for average water year – 2.4 km<sup>3</sup>. The losses were assessed based on the channel water balance and included losses of evaporation, transpiration, groundwater outflow and inflow, as well as losses of river overflow in the flood plain. Losses for the year of the 90% water availability coincide with the assessment of the Central Asia Design and Research Institute (Sredazgiprovodkhlopok) and data of D.Y. Ratkovich.

Thus, calculated downstream losses for the growing season of 2013 exceed previous assessment for dry year 1.4 times more.

According to the data from the Aral-Syrdarya BWA, over the growing season of 2013, the Koksaray reservoir was not filled, but the drawdown of earlier accumulated flow made in amount of 2960 mln m<sup>3</sup> (April-July).

The basin reservoir water balance analysis (Table 1.5) found the unconsidered inflow of 0.01 and 0.01 km<sup>3</sup> to the Toktogul and Charvak reservoirs, respectively. The total water losses in the Andizhan, Kayrakkum and Shardara reservoirs were identified in amount of 1.83 km<sup>3</sup>.

According to the data from the Kazakhstan Hydrometeorological Station (Karateren gauging station), the water supply to the Aral Sea and Priaralie made 1.474 km<sup>3</sup> over the growing season.

The ten-day analysis of releases from the Kayrakkum and Toktogul reservoirs and water availability for the republics is given in Tables 1.8 and 1.9 and Fig. 1.2 and 1.3.

Table 1.1

## Water availability in the Syrdarya River Basin countries for the growing season 2013

Water user	Water volume, km <sup>3</sup>		Water availability, %		Deficit (-), surplus (+), km <sup>3</sup>	
	Limit/Plan*	Actual	Season	Min ten-day **)	Season	Total of ten-day period ***)
1. Total water diversion	10.47	10.15	97.0	72.26	-0.32	-1.13
2. By countries:						
Kyrgyz Republic	0.207	0.225	108.8	80.33	0.02	0.00
Republic of Uzbekistan	7.921	7.935	100.2	72.49	0.01	-0.79
Republic of Tajikistan	1.717	1.449	84.4	37.27	-0.27	-0.33
Republic of Kazakhstan	0.624	0.541	86.7	51.57	-0.08	-0.14
3. By river reaches						
3.1 Toktogul reservoir-Uchkurgan hydroscheme	3.53	3.69	104.5	74.59	0.16	-0.20
<i>In particular:</i>						
<i>Kyrgyz Republic</i>	0.128	0.167	130.0	103.97	0.04	0.00
<i>Republic of Tajikistan</i>	0.213	0.073	34.2	11.11	-0.14	-0.12
<i>Republic of Uzbekistan</i>	3.193	3.453	108.1	75.68	0.26	-0.16
3.2 Uchkurgan hydroscheme – Kayrakkum hydroscheme	0.98	1.11	113.6	76.87	0.13	-0.03
<i>In particular:</i>						
<i>Kyrgyz Republic</i>	0.079	0.058	74.2	51.37	-0.02	-0.02
<i>Republic of Tajikistan</i>	0.406	0.519	127.8	89.63	0.11	0.00
<i>Republic of Uzbekistan</i>	0.490	0.530	108.1	69.99	0.04	-0.04
3.3 Kayrakkum hydroscheme – Shardara reservoir	5.96	5.35	89.8	67.62	-0.61	-1.15
<i>In particular:</i>						
<i>Republic of Kazakhstan</i>	0.624	0.541	86.7	51.57	-0.08	-0.14
<i>Republic of Tajikistan</i>	1.098	0.857	78.1	11.59	-0.24	-0.29
<i>Republic of Uzbekistan</i>	4.237	3.951	93.2	68.54	-0.29	-0.79
4. In addition:						
Inflow to the Shardara reservoir	4.18	3.54	84.7	42.2	-0.64	-0.85
Release to the Arnasay	0.00	0.00	0.00	0.00	0.00	0.00
Water supply to the Aral Sea and Priaralie	2.42	1.47	60.9			

\*) Limits for the growing season of 2013

\*\*) Minimum value recorded for the ten-day period

\*\*\*) Total water deficit recorded for ten-day periods.

Table 1.2

## Water availability of the states for May-June of 2013

River reach	States	May			June			July		
		I	II	III	I	II	III	I	II	III
Toktogul-Kayrakkum	Kyrgyzstan	129	112	125	112	96	101	94	97	97
	Tajikistan	86	97	92	84	86	88	70	86	104
	Uzbekistan	127	121	106	110	100	88	79	77	88
Kayrakkum-Shardra	Kazakhstan		<b>66</b>	113	111	89	74	98	<b>52</b>	<b>52</b>
	Tajikistan	38	71	<b>69</b>	75	74	79	81	76	90
	Uzbekistan	81	72	81	72	<b>69</b>	78	79	<b>69</b>	75

Table 1.3

## Water diversions from the BFC for the republics

Source	Indicators	Unit	April	May	June	July	August	Sept	Total for the growing season
BFC	Limit	mln m <sup>3</sup>	291.34	364.13	391.64	515.14	406.64	235.68	2204.57
	Actual	mln m <sup>3</sup>	368.24	385.93	374.16	413.90	430.43	294.85	2267.51
	WA*	%	126	106	96	80	106	125	103
BFC+ FC UZ	Limit	mln m <sup>3</sup>	269.67	334.45	361.12	481.61	376.17	213.61	2036.63
	Actual	mln m <sup>3</sup>	360.74	376.46	358.63	400.32	412.24	293.28	2201.66
	WA	%	134	113	99	83	110	137	108
BFC+FC TJ	Limit	mln m <sup>3</sup>	21.00	28.15	27.99	28.93	28.07	21.00	155.13
	Actual	mln m <sup>3</sup>	6.95	8.14	13.11	9.21	14.65	0.65	52.69
	WA	%	33	29	47	32	52	3	34
BFC+FC KG	Limit	mln m <sup>3</sup>	0.67	1.53	2.53	4.60	2.40	1.08	12.82
	Actual	mln m <sup>3</sup>	0.56	1.34	2.44	4.37	3.55	0.92	13.18
	WA	%	83	88	96	95	148	86	103

\* Water availability

\*\*Feeder canal

Table 1.4

## Syrdarya River channel water balance for the growing season 2013

Item	Water volume, km <sup>3</sup>		Deviation (actual-planned)
	Predicted/ Planned	Actual	
1 Inflow to the Toktogul reservoir	7.92	8.83	0.90
2 Lateral inflow at the Toktogul reservoir-Shardara reservoir river reach (+)	2.17	8.55	6.38
<i>In particular:</i>			
<i>Release to the KaradaryaRriver</i>	1.60	1.64	0.04
<i>Release to the Chirchik River</i>	0.56	0.45	-0.11
<i>Lateral inflow by CDF<sup>1</sup> and small rivers</i>		6.45	6.45
3 Flow regulation in the reservoirs: accumulation (+) or drawdown (-)	-3.44	-3.71	-0.27
<i>In particular:</i>			
<i>Toktogul reservoir</i>	-4.87	-4.66	0.21
<i>Kayrakkum reservoir</i>	1.43	0.95	-0.48
4 Regulated flow (1+2+3)	6.65	13.67	7.02
5 Water diversion at the Toktogul-Shardara reach (-)	-10.47	-10.15	0.32
6 Flow losses (-) or unconsidered inflow to the channel (+) at the Toktogul-Shardara reach	8.00	0.02	-7.97
<i>Including in % of the regulated flow</i>	120.25	0.18	-120.07
7 Inflow to the Shardara reservoir	4.18	3.54	-0.64
8 Flow regulation in the Shardara reservoir: accumulation (+) or drawdown (-)	2.03	2.00	-0.04
9 Water release from the Shardara reservoir to the river	5.01	4.80	-0.21
10 Diversion to the Kzylkum canal (-)	-1.21	-0.74	0.47
11 Release to Arnasay (-)	0.00	0.00	0.00

<sup>1</sup> CDF stands for collector & drainage flow.

Item	Water volume, km <sup>3</sup>		Deviation (actual-planned)
	Predicted/ Planned	Actual	
12 Water supply to the Aral Sea and Priaralie	2.42	1.47	-0.95

Table 1.5

Water balance of the Syrdarya River basin reservoirs for the growing season 2013

Item	Water volume, km <sup>3</sup>		Deviation (actual-planned)
	Predicted/ Planned	Actual	
<b>1. Toktogul reservoir</b>			
1.1 Inflow to the reservoir	7.92	8.83	0.90
1.2 Water volume in the reservoir:			
- at the beginning of the season (April 1, 2013)	11.27	11.25	-0.02
- at the end of the season (October 1, 2013)	16.08	15.92	-0.16
1.3 Release from the reservoir	3.06	4.17	1.11
1.4 Unconsidered water inflow (+) or losses (-)	-0.05	0.01	0.07
<i>In % of the inflow to the reservoir</i>	-0.69	0.12	0.81
1.5 Flow regulation: accumulation (+) or drawdown (-)	-4.87	-4.66	0.21
<b>2. Andizhan reservoir</b>			
2.1 Inflow to the reservoir	2.85	2.46	-0.39
2.2 Water volume in the reservoir:			
- at the beginning of the season (April 1, 2013)	0.87	0.87	0.01
- at the end of the season (October 1, 2013)	0.90	0.56	-0.34
2.3 Release from the reservoir	2.80	2.77	-0.04
2.4 Unconsidered water inflow (+) or losses (-)	-0.01	-0.01	0.00
<i>In % of the inflow to the reservoir</i>	-0.38	-0.28	0.10
2.5 Flow regulation: accumulation (+) or drawdown (-)	-0.05	0.30	0.35
<b>3. Charvak reservoir</b>			
3.1 Inflow to the reservoir	5.15	4.90	-0.25
3.2 Water volume in the reservoir:			
- at the beginning of the season (April 1, 2013)	0.69	0.71	0.02
- at the end of the season (October 1, 2013)	1.38	1.51	0.12
3.3 Release from the reservoir	4.44	4.11	-0.33
3.4 Unconsidered water inflow (+) or losses (-)	-0.02	0.01	0.03
<i>In % of the inflow to the reservoir</i>	-0.34	0.29	0.63
3.5 Flow regulation: accumulation (+) or drawdown (-)	-0.71	-0.78	-0.07
<b>4. Kayrakkum reservoir</b>			
4.1 Inflow to the reservoir	4.51	5.14	0.64
4.2 Literal inflow	0.25	0.23	-0.02
4.3 Water volume in the reservoir:			
- at the beginning of the season (April 1, 2013)	3.42	3.33	-0.09
- at the end of the season (October 1, 2013)	1.54	1.51	-0.03
4.4 Release from the reservoir	6.19	6.32	0.14
<i>In particular:</i>			
- release to the river	5.75	5.96	0.22
- water diversion from the reservoir	0.44	0.36	-0.08
4.5 Unconsidered water inflow (+) or losses (-)	-0.45	-0.86	-0.41
<i>In % of the inflow to the reservoir</i>	-10.01	-16.78	-6.77
4.6 Flow regulation: accumulation (+) or drawdown (-)	1.43	0.95	-0.48
<b>5. Shardara reservoir</b>			
5.1 Inflow to the reservoir	4.18	3.54	-0.64

Item	Water volume, km <sup>3</sup>		Deviation (actual-planned)
	Predicted/ Planned	Actual	
5.2 Literal inflow	-	-	-
5.3 Water volume in the reservoir			
- at the beginning of the season (April 1, 2013)	3.93	3.95	0.02
- at the end of the season (October 1, 2013)	1.37	1.00	-0.37
5.4 Release from the reservoir	6.22	5.54	-0.67
<i>In particular:</i>			
- release to the Arnasay	0.00	0.00	0.00
- release to the river	5.01	4.80	-0.21
- water diversion from the reservoir	1.21	0.74	-0.47
5.5 Unconsidered water inflow (+) or losses (-)	<b>-0.53</b>	<b>-0.96</b>	-0.43
<i>In % of the inflow to the reservoir</i>	-12.63	-26.98	-14.34
5.6 Flow regulation: accumulation (+) or drawdown (-)	2.03	2.00	-0.04
<b>TOTAL</b> Flow regulation by reservoirs: accumulation (+) or drawdown (-)	-2.17	-2.19	-0.02
<b>TOTAL</b> Losses (-), unconsidered inflow (+)	-1.06	-1.80	-0.74

Table 1.6

Dynamics of water inflow to the Shardara reservoir and water releases to the Arnasay for the growing seasons of 1993-2013, mln m<sup>3</sup>

Year	Indicator	Apr	May	Jun	Jul	Aug	Sep	Growing season	% of inflow
1993	Inflow to Shardara	1823	3241	3064	1043	645	870	<b>10686</b>	
	Release to Arnasay	242	0	1018	0	0	0	<b>1260</b>	12
1994	Inflow to Shardara	3185	2945	1993	1163	623	874	<b>10782</b>	
	Release to Arnasay	980	156	0	0	0	0	<b>1136</b>	11
1998	Inflow to Shardara	2042	2888	3482	1377	683	605	<b>11077</b>	
	Release to Arnasay	178	0	850	0	0	0	<b>1028</b>	9
2002	Inflow to Shardara	2685	2598	1981	1227	495	582	<b>9569</b>	
	Release to Arnasay	651	200	60	24	297	17	<b>1249</b>	13
2003	Inflow to Shardara	4464	2327	2187	1009	481	882	<b>11351</b>	
	Release to Arnasay	1464	388	0	0	0	0	<b>1852</b>	16
2004	Inflow to Shardara	2290	1305	827	580	533	1038	<b>6574</b>	
	Release to Arnasay	472	0	0	0	0	0	<b>472</b>	7
2007	Inflow to Shardara	3165	1603	1131	535	358	499	<b>7291</b>	
	Release to Arnasay	244	0	0	0	0	0	<b>244</b>	3
2010	Inflow to Shardara	2710	3013	2854	1103	656	1251	<b>11587</b>	
	Release to Arnasay			67	61			<b>129</b>	1
2013	Inflow to Shardara	1359	626	511	316	323	409	<b>3543</b>	
	Release to Arnasay	0	0	0	0	0	0	<b>0</b>	

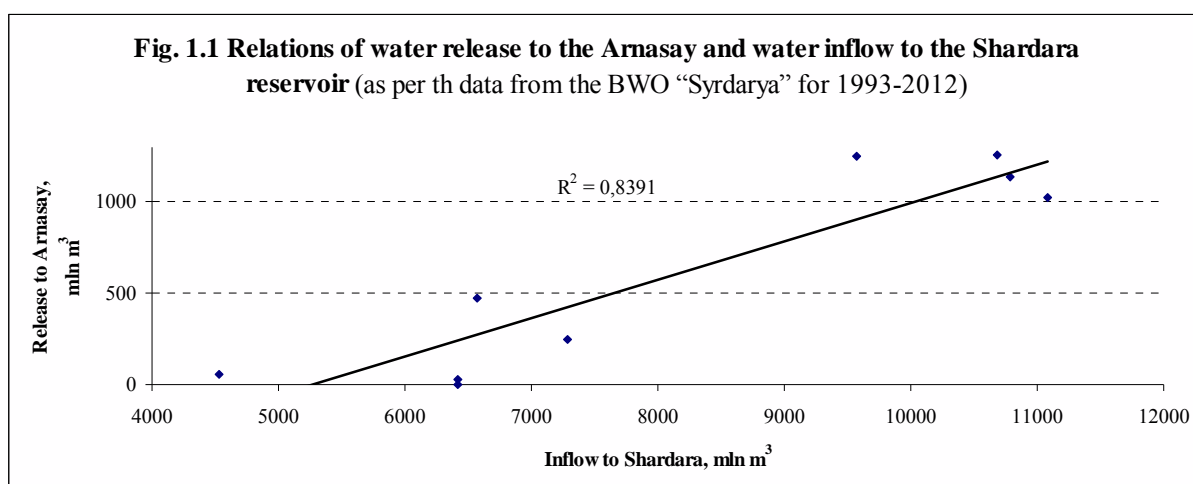


Table 1.7

The Syrdarya River water balance downstream for the growing season of 2013 (mln m<sup>3</sup>)

Channel balance item	April	May	June	July	August	September	Growing season
Release from the Shardara (BWO “Syrdarya” data)	1102	721	491	1228	959	303	4804
Water diversion to the Kyzalkum canal	89	88	130	280	132	19	738
Syrdarya River flow: gauging station downstream of the Shardara (Aral-Syrdarya BWA)	1136	782	521	1210	1112	328	5089
Imbalance - release from the Shardara - gauging station downstream of the Shardara: (+) losses, (-) unconsidered inflow	-34	-61	-30	18	-153	-25	-285
Water diversion to the Koksaray	0	0	0	0	0	0	0
Release from the Koksaray	183	1048	1168	561	0	0	2960
Release along the Arys River	130	49	22	13	3	9	226
Losses at the gauging station reach downstream of the Shardara – gauging station Koktyube	0	272	156	124	0	0	552
Syrdarya River flow: gauging station Koktyube	1449	1607	1555	1660	1115	337	7723
Water diversion at the g/s Koktyube – g/s Tasbuget reach	217	858	884	892	455	37	3343
Water diversion at the g/s Tasbuget – g/s Kazaly reach	80	237	226	230	118	145	1036
Losses at the g/s Koktyube – g/s Kazalinsk reach	511	269	338	514	469	0	2101
Syrdarya River flow: g/s Karateren	641	243	107	24	73	155	1243
<b>TOTAL FOR LOWER REACHES:</b>							
Water diversion	386	1183	1240	1402	704	201	5117
Losses	511	541	494	638	469	0	2653



Table 1.8

Ten-day analysis of releases from the Kayrakkum reservoir and water availability (W/A) at the Kayrakkum-Shardara reach

Republic	Indicator	April			May			June			July			August			September			For the growing season, mln m <sup>3</sup>
		I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	
Release from the Kayrakkum reservoir	Plan, m <sup>3</sup> /sec	450	450	450	350	350	350	380	380	380	400	400	400	350	350	350	250	250	250	5745.6
	Actual, m <sup>3</sup> /sec	467	401	352	351	266	319	364	377	433	438	388	449	512	518	380	340	239	193	5962.44
	Actual/Plan, %	104	89	78	100	76	91	96	99	114	110	97	112	146	148	109	136	96	77	104
UZ	Limit, m <sup>3</sup> /sec	217	226	240	242	245	266	356	402	402	405	405	405	333	261	189	107	71	49	4237
	Actual, m <sup>3</sup> /sec	155	238	200	195	176	215	257	275	315	320	280	304	326	335	269	248	207	180	3951
	W/A, %	71	105	83	81	72	81	72	69	78	79	69	75	98	128	142	233	291	370	93
TJ	Limit, m <sup>3</sup> /sec	9	54	73	74	74	80	83	86	86	86	86	86	86	86	74	54	36	32	1098
	Actual, m <sup>3</sup> /sec	4	6	9	28	53	55	62	64	68	70	65	78	84	77	78	75	59	37	857
	W/A, %	41	12	12	38	71	69	75	74	79	81	76	90	98	89	106	139	164	116	78
KZ	Limit, m <sup>3</sup> /sec	0	0	0	14	18	23	36	45	54	63	81	99	99	90	81	0	0	0	624
	Actual, m <sup>3</sup> /sec	8	9	5	13	12	25	40	40	40	62	42	52	77	93	60	32	3	0	541
	W/A, %				93	66	113	111	89	74	98	52	52	78	104	75				87

Table 1.9

Ten-day analysis of releases from the Toktogul reservoir and water availability (W/A) at the Toktogul-Uchkurgan reach

Republic	Indicator	April			May			June			July			August			September			For the growing season, mln m <sup>3</sup>
		<i>I</i>	<i>II</i>	<i>III</i>	<i>I</i>	<i>II</i>	<i>III</i>	<i>I</i>	<i>II</i>	<i>III</i>	<i>I</i>	<i>II</i>	<i>III</i>	<i>I</i>	<i>II</i>	<i>III</i>	<i>I</i>	<i>II</i>	<i>III</i>	
Release from the Toktogul reservoir	Plan, m <sup>3</sup> /sec	200	200	200	180	180	180	200	200	200	200	200	200	180	180	180	200	200	200	1519
	Actual, m <sup>3</sup> /sec	386	306	300	262	245	209	202	222	197	203	220	322	422	366	219	222	221	225	2030
	Actual/Plan, %	193	153	150	146	136	116	101	111	98	101	110	161	234	203	122	111	111	113	134
UZ	Limit, m <sup>3</sup> /sec	135	158	178	201	190	190	201	218	242	270	287	283	260	231	193	151	121	119	3193
	Actual, m <sup>3</sup> /sec	195	230	237	250	234	192	224	221	213	217	217	254	255	257	211	188	165	172	3453
	W/A, %	144	145	133	125	123	101	111	101	88	80	76	90	98	112	109	124	136	144	108
TJ	Limit, m <sup>3</sup> /sec	10	12	13	14	14	14	15	15	15	15	15	15	15	15	14	12	10	8	213
	Actual, m <sup>3</sup> /sec	1	3	6	6	2	4	4	6	8	4	3	9	9	9	4	1	1	2	73
	W/A, %	11	26	49	41	15	26	26	40	53	23	20	61	59	60	27	8	13	31	34
KG	Limit, m <sup>3</sup> /sec	3	4	3	5	7	7	9	9	11	12	12	13	10	11	10	8	6	5	128
	Actual, m <sup>3</sup> /sec	3	6	6	8	9	11	11	10	13	14	14	15	15	14	14	11	9	7	167
	W/A, %	106	155	164	165	133	144	120	104	119	117	117	116	143	131	139	141	144	158	130

Fig. 1.2 Indicators of the ten-day analysis of releases from the Kayrakkum reservoir and water availability for the states at the Kayrakkum-Shardara reach over the growing season peak (June-August) of 2013

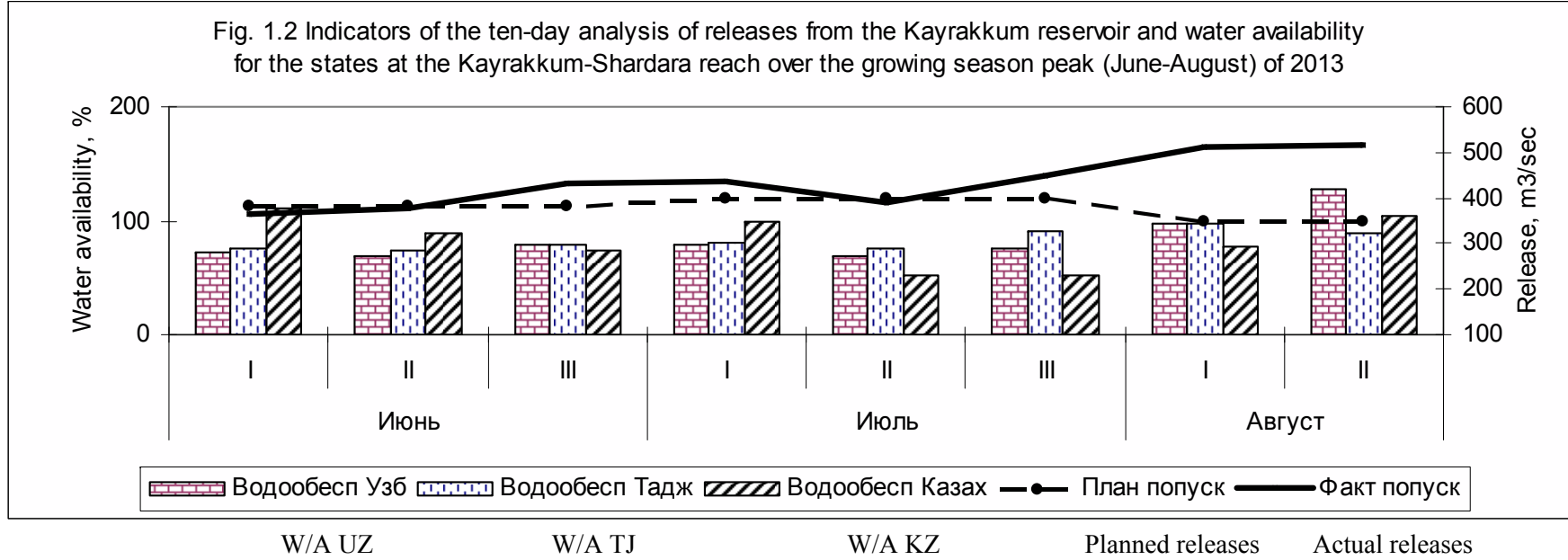
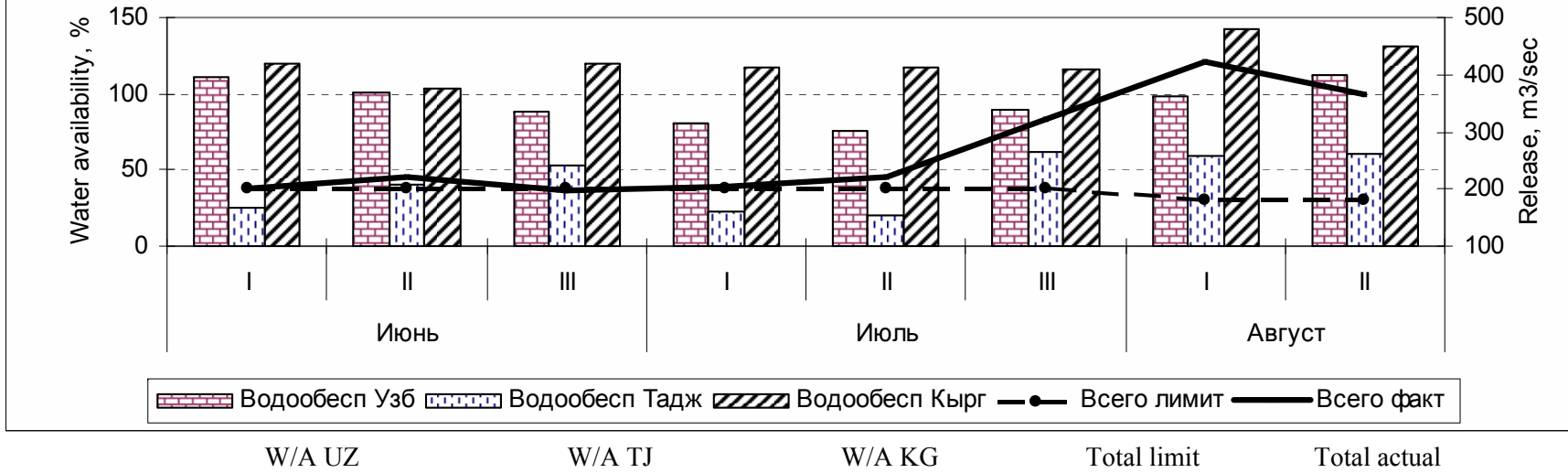
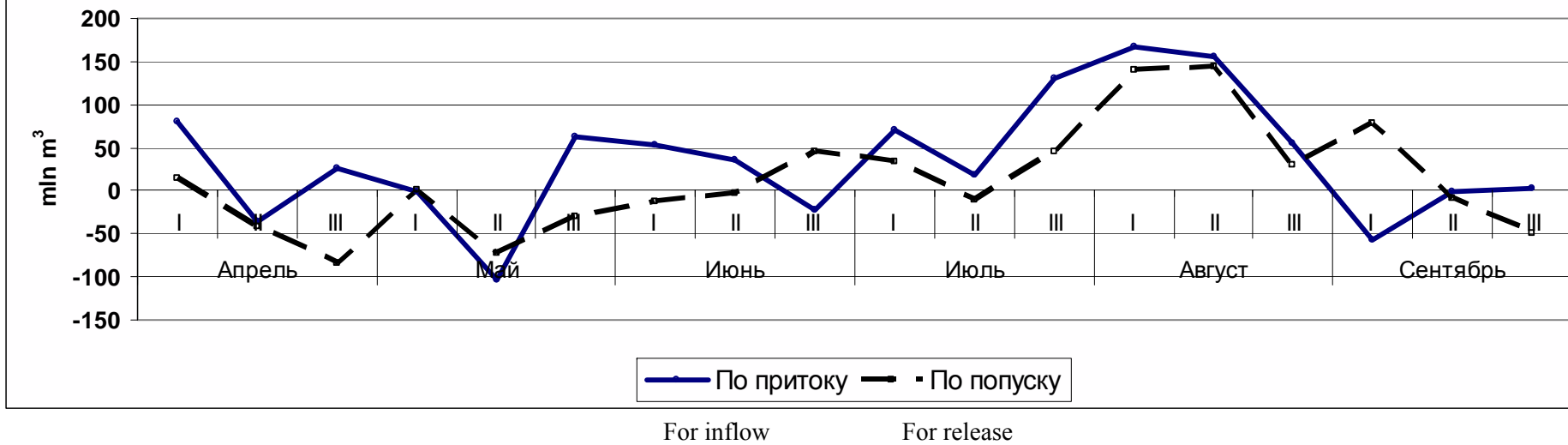
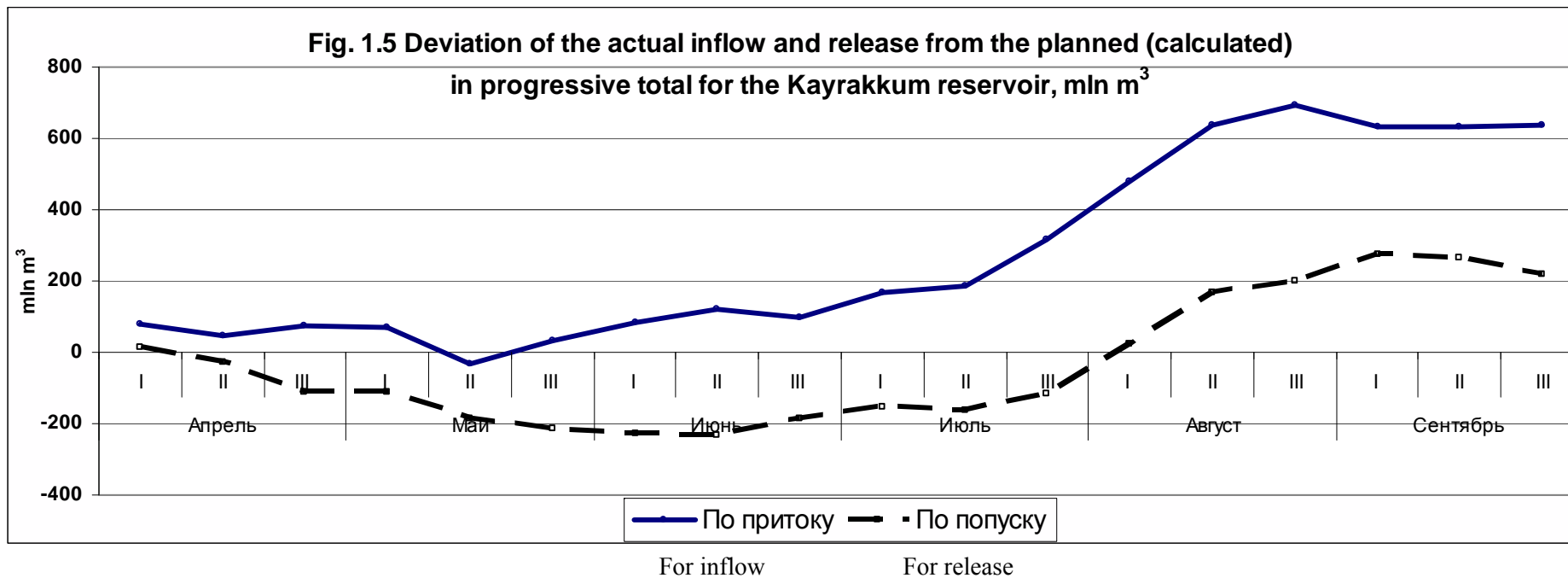


Fig. 1.3 Indicators of the ten-day analysis of releases from the Toktogul reservoir and water availability for the states at the Toktogul-Uchkurgan reach over the growing season peak (June-August) of 2013



**Fig. 1.4 Deviation of the actual inflow and release from the planned (calculated) from the Kayrakkum reservoir, mln m<sup>3</sup>**





Positive (+) values of deviation of actual inflow from planned (calculated) inflow indicate unconsidered inflow, negative (-) values indicate failure to perform commitments regarding inflow to reservoir and (or) unconsidered losses (water diversion).

Negative (-) values of deviation of actual release from reservoir from planned (calculated) release indicate failure to perform agreements on release (given that deviation for inflow is positive or negative but to a lesser extent than releases), see Fig. 2 and 3.

## 2 Amudarya River Basin

The actual water content of the Amudarya River at the Atamyrat gauging station (located at upstream of the water intake to Garagumdarya) was  $38.48 \text{ km}^3$ , which is  $7.92 \text{ km}^3$  less than expected, scheduled by the BWO “Amudarya” (Table 2.2). Meanwhile, the inflow to the Nurek HEPS was  $1.59 \text{ km}^3$  less than predicted, and therefore, the release from the reservoir made  $12.62 \text{ km}^3$ , or  $1.65 \text{ km}^3$  less than planned.

In the existing water situation, 84% of the fixed water diversion limit for the canals within the Amudarya River basin was used; the total water diversion amounted to  $33.27 \text{ km}^3$ , of which  $27.0 \text{ km}^3$  from downstream of the Atamyrat gauging station (starting from the water diversion to Garagumdarya). In general, at the water supply of 84%, all the republics received 80 to 87%, which is more equal than for the Syrdarya River (see Table 2.1).

By the end of the season, up to  $10.76 \text{ km}^3$  of water were accumulated in the Nurek reservoir, the volume of the Tuyamuyun Hydroscheme (TMHS) reservoir is up to  $2.51 \text{ km}^3$  (Table 2.3). The river flow diversion for accumulation in the Nurek made  $4.2 \text{ km}^3$ , and water inflow to the river flow from the Tuyamuyun reservoirs (including the water diversion from TMHS) made  $1.02 \text{ km}^3$ . Total river water diversion made  $3.37 \text{ km}^3$ .

The water situation for the Amudarya is very difficult – in May and June the water content was 10 % less than predicted, which as it was lower than average annual by 10 %. 20 days of July showed that the water content decreased to 20 % lower than predicted. In these conditions, all irrigated lands dramatically received their limits less, though they were decreased by 10 % compared with predicted.

From the view point of how much water was received by all the transboundary countries along the Amudarya, the picture looks rather strange – Tajikistan received  $11991 \text{ m}^3/\text{ha}$  per hectare within the basin, Turkmenistan -  $8577 \text{ m}^3/\text{ha}$ , and Uzbekistan –  $6271 \text{ m}^3/\text{ha}$ .

Comparison of the fact and the plan shows that drawdown of the Nurek was made during 1-2 ten-day periods of April from  $6.365$  to  $6.15 \text{ km}^3$  (total  $211.2 \text{ mln m}^3$ ), this volume was kept till the 2 ten-day period of May, and then filling of the Nurek started: by the beginning of June - to  $6.87 \text{ km}^3$ , by the beginning of July – to  $8.36 \text{ km}^3$ , by the beginning of August – to  $9.8 \text{ km}^3$ . According to the plan, Tajikistan should not have emptied the Nurek during the growing season (as well as during the growing seasons of 2010, 2011, 2012), and fill the Nurek by 2 ten-day period of May to  $6.4 \text{ km}^3$  (actual  $6.15$ ), by the beginning of June to  $7.17 \text{ km}^3$  (actual  $6.87 \text{ km}^3$ ), by the beginning of July to  $8.55 \text{ km}^3$  (actual  $8.36 \text{ km}^3$ ), by the beginning of August to  $9.79 \text{ km}^3$  (actual  $9.8 \text{ km}^3$ ).

Comparing the actual releases from the Nurek with planned, in April they were  $245 \text{ mln m}^3$  less than the BWO schedule, in May -  $300 \text{ mln m}^3$  less, in June -  $70 \text{ mln m}^3$  less, and in July -  $800 \text{ mln m}^3$  less!!! And only for the first ten-day period of August, the water was

released by 92 mln m<sup>3</sup> more than planned. In general, the situation can be partially explained with the decreased (compared with the BWO schedule) inflow to the Nurek over the growing season, although the actual inflow to the Nurek was more than the schedule for some ten-day periods (1 ten-day of April, 3 ten-day of May, 1 ten-day of August). Calculations also show that releases could have been increased in July (even if to the BWO schedule) by shifting the maximal filling time from the beginning of August to mid-September.

With the balance calculation, the water losses from the Amudarya River within the river reach from the Atamyrat gauging station to the TMHS inflow point made 6.24 km<sup>3</sup>, or 16.22% of the flow at the Atamyrat gauging station. The water losses at the river reach from the TMHS inflow point up to the point of water supply to the Aral Sea and Priaralie amounted to 2.63 km<sup>3</sup>, or 16.6% of the inflow to TMHS.

In general, water losses within the Amudarya River basin made 8.87 km<sup>3</sup>, or 23.1% of the river water content (Atamyrat gauging station), that is 0.34 km<sup>3</sup> (3.21%) less than calculated (planned by BWO “Amudarya”).

The literal inflow to the Nurek reservoir made 0.2 km<sup>3</sup>, and in the Tyuyamuyun reservoir there were no losses, the literal inflow was equal to zero as well.

0.92 km<sup>3</sup> were supplied to the Aral Sea and Priaralie, which is 2 times less than calculated, due to the flow to the Samanbay gauging station plus CDF releases.

Table 2.1

Water availability in the Amudarya River Basin countries for the growing season 2013

Water user	Water volume, km <sup>3</sup>		Water availability, %		Deficit (-), surplus (+), km <sup>3</sup>	
	Limit/Plan	Actual	Season	Min ten-day *)	Season	Total of ten-day period **)
1. Total water diversion	39.61	33.27	84.01	65.55	-6.33	-6.33
2. By countries:						
<i>Kyrgyz Republic</i>	-	-	-	-	-	-
<i>Republic of Tajikistan</i>	6.89	5.57	80.93	76.26	-1.31	-1.31
<i>Turkmenistan</i>	15.50	13.47	86.93	68.76	-2.03	-2.03
<i>Republic of Uzbekistan</i>	17.22	14.23	82.61	58.06	-2.99	-3.04
3. Downstream of Atamyrat g/s ***)	31.52	27.00	85.67	63.42	-4.52	-4.54
<i>In particular:</i>						
<i>Turkmenistan</i>	15.50	13.47	86.93	68.76	-2.03	-2.03
<i>Republic of Uzbekistan</i>	16.02	13.53	84.45	58.45	-2.49	-2.58
4. By river reaches:						
Upstream	8.09	6.27	77.53	70.93	-1.82	-1.82
<i>In particular:</i>						
<i>Kyrgyz Republic</i>	-	-	-	-	-	-
<i>Republic of Tajikistan</i>	6.89	5.57	80.93	76.26	-1.31	-1.31
<i>Surkhandarya province, Uzbekistan</i>	1.20	0.70	58.04	41.67	-0.50	-0.50
Midstream	16.21	14.72	90.85	76.98	-1.48	-1.51
<i>In particular:</i>						
<i>Turkmenistan</i>	10.47	9.24	88.25	70.57	-1.23	-1.25
<i>Republic of Uzbekistan</i>	5.73	5.48	95.60	88.88	-0.25	-0.33
Downstream	15.31	12.28	80.18	45.35	-3.03	-3.15
<i>In particular:</i>						
<i>Turkmenistan</i>	5.03	4.23	84.18	48.96	-0.80	-0.84



Water user	Water volume, km <sup>3</sup>		Water availability, %		Deficit (-), surplus (+), km <sup>3</sup>	
	Limit/Plan	Actual	Season	Min ten-day *)	Season	Total of ten-day period **)
<i>Republic of Uzbekistan</i>	10.29	8.05	78.23	39.35	-2.24	-2.33
5. In addition:						
Emergency and environmental releases to canals within lower reaches	0.00	0.00				
<i>In particular:</i>						
<i>Turkmenistan</i>	0.00	0.00				
<i>Republic of Uzbekistan</i>	0.00	0.00				
Water supply to the Aral Sea and Priaralie ****)	2.10	0.92	44.0			

\*) Minimum value recorded for the ten-day period

\*\*\*) Total water deficit recorded for the ten-day periods

\*\*\*\*) Atamyrat gauging station – located at the Amudarya upstream of the water intake to Garagumdarya

\*\*\*\*\*) taking into account CDF flow

Table 2.2

The Amudarya River channel water balance for the growing season 2013

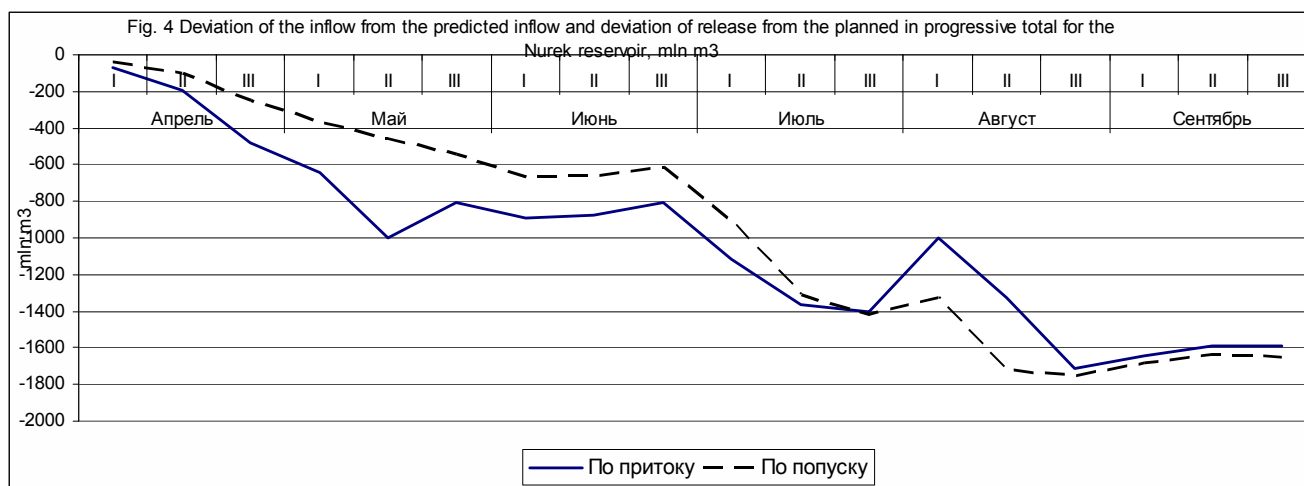
Item	Water volume, km <sup>3</sup>		Deviation (actual-planned)
	Predicted/Planned	Actual	
1 Water content in the Amudarya River - unregulated flow at the Atamyrat g/s *	46.41	38.48	-7.92
2 Flow regulation in the Nurek reservoir: accumulation (+) or drawdown (-)	-4.14	-4.20	-0.06
3 Water diversion in the midstream (-)	-16.21	-14.72	1.48
4 Midstream return CDF (+)	1.31	1.49	0.17
5 Water losses (-) or unconsidered inflow to the channel (+)	-6.34	-6.24	0.10
<i>In % of the flow at the Atamyrat g/s</i>	-13.67	-16.22	-2.55
6 Inflow to the TMHS (Bir-Ata g/s)	21.04	14.81	-6.23
7 Flow regulation at TMHS: accumulation (+) or drawdown (-)	-0.50	1.02	1.52
8 Losses (-) in the TMHS reservoirs, lateral inflow (+)	0.26	0.00	-0.26
<i>In % of inflow</i>	1.23	0.00	-1.23
9 Releases from TMHS (including water diversion from the reservoir)	20.54	15.83	-4.71
10 Downstream water diversion, including diversion from TMHS (-)	-15.31	-12.28	3.03
11 Downstream return CDF (+)	0.00	0.00	0.00
12 Emergency and environmental water releases to canals (-)	0.00	0.00	0.00
13 Runoff losses (-) or unconsidered inflow to the channel (+)	-3.13	-2.63	0.50
<i>In % of the flow at the Tuyamuyun downstream pool</i>	-15.2	-16.6	-1.40
14 Water supply to the Priaralie and Aral Sea	2.10	0.92	-1.18
<b>TOTAL losses</b>	-9.21	-8.87	0.34
<i>In % of the water content in the river</i>	-19.85	-23.1	-3.21

\* Water content is calculated as the sum total of flow at the Kerki gauging station, water diversion upstream of the Kerki g/s (without Tajikistan and Surkhandarya province of Uzbekistan) and accumulation in the Nurek reservoir

Table 2.3

Water balance of the Amudarya River Basin's reservoirs for the growing season 2013

Item	Water volume, km <sup>3</sup>		Deviation (actual-planned)
	Predicted/ Planned	Actual	
<b>1. Nurek reservoir</b>			
1.1 Inflow to the reservoir	18.41	16.82	-1.59
1.2 Water volume in the reservoir:			
- at the beginning of the season (April 1, 2013)	6.06	6.37	0.30
- at the end of the season (October 1, 2013)	10.50	10.56	0.06
1.3 Release from the reservoir	14.27	12.62	-1.65
1.4 Lateral inflow (+) or water losses (-)	0.30	0.20	-0.11
<i>In % of the inflow to the reservoir</i>	1.64	1.17	-0.47
1.5 Flow regulation: accumulation (+) or drawdown (-)	-4.14	-4.20	-0.06
<b>2. TMHS reservoir</b>			
2.1 Inflow to the TMHS	21.04	14.81	-6.23
2.2 Water volume in the reservoir:			
- at the beginning of the season (April 1, 2013)	3.28	3.54	0.26
- at the end of the season (October 1, 2013)	4.03	2.51	-1.52
2.3 Release from the TMHS	20.54	15.83	-4.71
In particular:			
- release to the river	14.92	11.23	-3.68
- water diversion	5.62	4.60	-1.02
2.4 Lateral inflow (+) or water losses (-)	0.26	0.00	-0.26
<i>In % of the inflow to the reservoir</i>	1.2	0.00	-1.2
2.5 Flow regulation: accumulation (+) or drawdown (-)	-0.50	1.02	1.52
<b>TOTAL</b> flow regulation by the reservoirs: accumulation (+), drawdown (-)	-4.63	-3.17	1.46
<b>TOTAL</b> losses (-), unconsidered inflow (+)	0.56	0.20	-0.36



For inflow    For release