

**ANALYSIS OF HYDROLOGICAL CONDITIONS IN THE SYRDARYA AND AMUDARYA  
RIVER BASINS OVER THE NON-GROWING SEASON  
2016-2017**

**1 Syrdarya River basin**

The actual inflow to the upstream reservoirs in the Syrdarya basin (Toktogul, Andizhan, and Charvak reservoirs) was 6.64 km<sup>3</sup> or 127% of the forecast during the non-growing season. The actual water releases were 10.81 km<sup>3</sup> from the reservoirs.

The total lateral inflow in the reach from the Toktogul reservoir to the Shardara reservoir, including discharges along the Karadarya and Chirchik rivers, was 11.82 km<sup>3</sup>. This is 1.8 times more than the total inflow to the upstream reservoirs.

By the end of the non-growing season, 14.44 km<sup>3</sup> were accumulated in the upstream reservoirs, including 12.78 km<sup>3</sup> in the Toktogul reservoir or 102 % of the BWO Syrdarya's scheduled amount. The inflow to the Torktogul reservoir was 3.64 km<sup>3</sup>. The discharge from the reservoir was 8.35 km<sup>3</sup> or 0.58 km<sup>3</sup> more than the BWO Syrdarya's scheduled amount.

During the non-growing season, the inflow to the Bakhri Tochik reservoir amounted to 13.46 km<sup>3</sup>, which is 1.41 km<sup>3</sup> more than scheduled by the BWO Syrdarya (during the non-growing season 2015-2016 the inflow was 9.8 km<sup>3</sup>); the water releases were 12.39 km<sup>3</sup> from the reservoir (in 2015-2016 – 9.8 km<sup>3</sup>). The accumulation of water in the reservoir amounted to 2.27 km<sup>3</sup> to 3.33 km<sup>3</sup>. The actual water releases from the reservoir exceeded the BWO Syrdarya's scheduled amount from the first ten-day of February to the third ten-day of March. In the first and second ten-days of October and from the first ten-day of December to the third ten-day of January, the actual water releases were lower than the BWO's scheduled amount; it totally amounted to 356 mcm.

During the non-growing season, the total water diversion from the Naryn and Syrdarya rivers in the reach up to Shardara reservoir was 2.9 km<sup>3</sup>, of which: for the Kyrgyz Republic – 0.02 km<sup>3</sup>, the Republic of Tajikistan – 0.03 km<sup>3</sup>, the Republic of Kazakhstan (along the Dustlik canal) – 0.45 km<sup>3</sup>, and for the Republic of Uzbekistan – 2.4 km<sup>3</sup>. Water supply was uneven in space and time (Table 1.1).

The water losses amounted to 2.05 km<sup>3</sup> in the reach Toktogul-Shardara (estimated by the balance method). In comparison, these losses amounted to 1.95 km<sup>3</sup> in the same reach during the non-growing season 2015-2016.

During the non-growing season 2016-2017, the total inflow to the Shardara reservoir was 13.8 km<sup>3</sup> or 0.68 km<sup>3</sup> more than scheduled by the BWO Syrdarya. The amount of 9.88 km<sup>3</sup> was discharged into the river from the Shardara reservoir; the water diversion for the Kzylkum canal was 0.19 km<sup>3</sup>; water releases to Arnasay were 0.95 km<sup>3</sup>. According to UzHydromet's data, the actual water delivery to the Aral Sea was 2.9 km<sup>3</sup>.

Table 1.2 shows the Syrdarya River channel water balance, and Table 1.3 gives the water balance of the reservoirs.

Table 1.1

Water availability in the Syrdarya River basin countries for the non-growing season 2016-2017

№	Water user	Water volume, km <sup>3</sup>		Water availability, %	Deficit (-), surplus (+), km <sup>3</sup>
		limit/schedule	actual	season	season
1	Total water diversion	3.41	2.90	85	-0.52
2	Water diversion by state:				
	Kyrgyz Republic	0.04	0.02	66	-0.01
	Republic of Uzbekistan	2.48	2.40	96	-0.09
	Republic of Tajikistan	0.37	0.03	7	-0.34
	Republic of Kazakhstan	0.53	0.45	85	-0.08
3	By river reach				
3.1	Toktogul reservoir – Uchkurgan hydroscheme	1.37	1.24	91	-0.12
	of which:				
	Kyrgyz Republic	0.030	0.024	82	-0.005
	Republic of Tajikistan	0.084	0.021	25	-0.063
	Republic of Uzbekistan	1.252	1.197	96	-0.055
3.2	Uchkugran hydroscheme – Bakhri Tochik hydroscheme	0.25	0.16	67	-0.082
	of which:				
	Kyrgyz Republic	0.007	0.000	0	-0.007
	Republic of Tajikistan	0.069	0.001	2	-0.067
	Republic of Uzbekistan	0.171	0.163	95	-0.008
3.3	Bakhri Tochik hydroscheme – Shardara reservoir	1.80	1.49	83	-0.31
	of which:				
	Kyrgyz Republic	0.527	0.450	85	-0.08
	Republic of Tajikistan	0.212	0.005	2	-0.21
	Republic of Uzbekistan	1.061	1.036	98	-0.02
4	Inflow to the Shardara reservoir	13.12	13.80	105	0.68
	Discharge into Arnasay	0.40	0.95	235	0.54
5	Water delivery to the Aral Sea (Karateren gauging station)	3.32	2.90	88	-0.41

Table 1.2

## Syrdarya River channel water balance for the non-growing season 2016-2017

№	Balance item	Water volume, km <sup>3</sup>		Deviation (actual - plan)
		Forecast/plan	Actual	
1	Inflow to the Toktogul reservoir	2.80	3.64	0.84
2	Lateral inflow at the river reach of Toktogul reservoir – Shardara reservoir (+)	10.93	11.82	0.89
	of which:			
2.1	<i>Water releases to the Karadarya river</i>	1.89	1.93	0.04
2.2	<i>Water releases to the Chirchik river</i>	2.08	1.56	-0.52
2.3	<i>Lateral inflow from CDF and small rivers</i>	6.97	8.34	1.37
3	Flow regulation in the reservoirs: inflow (+) or diversion (-)	3.76	3.27	-0.48
	of which:			
3.1	<i>Toktogul reservoir</i>	4.97	4.71	-0.26
3.2	<i>Bakhri Tochik reservoir</i>	-1.21	-1.43	-0.22
4	Regulated flow (1+2+3)	17.49	18.74	1.25
5	Water diversion at the reach Toktogul – Shardara (-)	-3.41	-2.90	0.52
6	Water losses (-) or unrecorded inflow to the channel (+) at the reach of Toktogul-Shardara	-0.96	-2.05	-1.09
6.1	Including % of the regulated flow	5	11	
7	Inflow to the Shardara reservoir	13.12	13.80	0.68
8	Flow regulation in the Shardara reservoir: inflow (+) or diversion (-)	-4.14	-2.78	1.36
9	Release from the Shardara reservoir to the river	8.50	9.88	1.38
10	Delivery to the Aral Sea (Karateren GS)	3.32	2.90	-0.41

Table 1.3

## Water balance of the Syrdarya River basin reservoirs for the non-growing season 2016-2017

№	Balance item	Water volume, km <sup>3</sup>		Deviation (actual-plan)
		Forecast/Plan	Actual	
<b>1</b>	<b>Toktogul reservoir</b>			
1.1	Inflow to the reservoir	2.80	3.64	0.84
1.2	Water volume in the reservoir:			
	- beginning of the season (October 1, 2016)	17.49	17.487	0.00
	- end of the season (April 1, 2017)	12.51	12.78	0.27
1.3	Water releases from the reservoir	7.77	8.35	0.58
1.4	Unrecorded inflow (+) or losses (-)	-0.01	0.00	0.010
	Including % of inflow to the reservoir	0	0	0
1.5	Flow regulation: inflow (+) or diversion (-)	4.97	4.71	-0.26
<b>2</b>	<b>Andizhan reservoir</b>			
2.1	Inflow to the reservoir	0.95	1.12	0.18
2.2	Water volume in the reservoir:			
	- beginning of the season (October 1, 2016)	0.73	0.73	0.00
	- end of the season (April 1, 2017)	1.12	1.10	-0.02
2.3	Water releases from the reservoir	0.55	0.74	0.19
2.4	Unrecorded inflow (+) or losses (-)	0.00	-0.01	-0.01
	Including % of inflow to the reservoir	0	1	1
2.5	Flow regulation: inflow (+) or diversion(-)	-0.39	-0.38	0.01
<b>3</b>	<b>Charvak reservoir</b>			
3.1	Inflow to the reservoir	1.50	1.87	0.37
3.2	Water volume in the reservoir:			
	- beginning of the season (October 1, 2016)	1.68	1.68	0.00
	- end of the season (April 1, 2017)	0.85	0.56	-0.28
3.3	Water releases from the reservoir	2.32	2.75	0.43
	Unrecorded inflow (+) or losses (-)	-0.01	-0.24	-0.23
	Including % of inflow to the reservoir	1	13	12
3.5	Flow regulation: inflow (+) or diversion(-)	0.82	0.87	0.05
<b>4</b>	<b>Bakhri Tochik reservoir</b>			
4.1	Water inflow to the reservoir from the river	12.05	13.46	1.41
4.2	Lateral inflow	0.300	0.36	0.06
4.3	Water volume in the reservoir:			
	- beginning of the season (October 1, 2016)	2.27	2.27	0.00
	- end of the season (April 1, 2017)	3.47	3.33	-0.14
4.4	Water releases from the reservoir	11.14	12.39	1.25
	of which:			
	- releases to the river	11.07	12.39	1.32
	- diversion from the reservoir	0.07	0.00	-0.07
4.5	Unrecorded inflow (+) or losses (-)	-0.01	-0.37	-0.37
	Including % of inflow to the reservoir	0	3	3

№	Balance item	Water volume, km <sup>3</sup>		Deviation (actual-plan)
		Forecast/Plan	Actual	
4.6	Flow regulation: inflow (+) or diversion (-)	-1.21	-1.43	-0.22
<b>5</b>	<b>Shardara reservoir</b>			
5.1	Inflow to the reservoir	13.12	13.80	0.68
5.2	Lateral inflow	0.0	0.0	0.00
5.3	Water volume in the reservoir:			
	- beginning of the season (October 1, 2016)	1.08	1.08	0.00
	- end of the season (April 1, 2017)	5.13	4.633	-0.49
5.4	Water releases from the reservoir	8.98	11.02	2.03
	of which:			
	- Discharge into Arnasay	0.40	0.95	0.544
	- Water releases to the river	8.50	9.88	1.38
	- water diversion from the reservoir	0.08	0.19	0.11
5.5	Unrecorded inflow (+) or losses (-)	-0.09	0.78	0.87
	Including % of inflow to the reservoir	1	6	5
5.6	Flow regulation: inflow (+) or diversion(-)	-4.14	-2.78	1.36
	<b>Total</b> flow regulation by reservoirs: inflow (+) or diversion (-)	0.05	0.98	0.93
	<b>Total</b> unrecorded inflow (-), or losses (+)	-0.12	0.14	0.27

## 2 Amudarya River basin

The actual water availability in the Amudarya River at the Atamurat gauging station (upstream of the intake to Garagumdarya) was 8.98 km<sup>3</sup>, which is 31% less than expected by the BWO Amudarya schedule.

The established limit of water withdrawal in the basin was 93 % used; the total water withdrawal was 14.58 km<sup>3</sup>, including 12.1 km<sup>3</sup> downstream of Atamurat gauging station (starting from the intake to Garagumdarya).

Water availability was uneven in the states and river reaches (Table 2.1). The water deficit was 7% in general. It amounted to 26% in the Republic of Tajikistan, 1% - in the Republic of Uzbekistan, and 5 % - in Turkmenistan.

By the end of the growing season, 6.73 km<sup>3</sup> of water was managed to be kept in the Nurek reservoir and 2.58 km<sup>3</sup> - in the TMHS reservoirs. The inflow to the Nurek reservoir was 3.8 km<sup>3</sup>; the water releases amounted to 7.66 km<sup>3</sup>. The surplus to the river flow due to the drawdown of the Nurek reservoir was 3.86 km<sup>3</sup>. In October-December, the water releases from the Nurek reservoir were 0.37 km<sup>3</sup> less than planned. From the second ten-day of January to March, it was 0.57 km<sup>3</sup> more than planned.

In the TMHS reservoirs, the water accumulation plan has not been achieved – by the 1<sup>st</sup> of April the actual water volume was less than the scheduled one by 0.4 km<sup>3</sup>. The failure to implement the water accumulation plan is explained by the limited inflow to the in-stream reservoir as expected.

The established limits for environmental water releases to the Amudarya downstream canals were 91% used; the water supply was 0.72 km<sup>3</sup>. According to the Hydromet's data, 1.51 km<sup>3</sup> were supplied to Prearalie and the Aral Sea.

Table 2.2 provides data on the river channel balance, and Table 2.3 gives the water balance of the reservoirs.

In the Atamurat-Bir-Ata section, water losses were not recorded; unrecorded inflow was 0.19 km<sup>3</sup>. In the Tuyamuyun-Samanbay section, flow losses were 1.32 km<sup>3</sup>.

Table 2.1

## Water availability in the Amudarya River basin countries for the non-growing season 2016-2017

№	Water user	Water volume, km <sup>3</sup>		Water availability, %	Deficit (-), surplus (+), km <sup>3</sup>
		limit / schedule	actual	season	season
1	Total water withdrawal	15.73	14.58	93	-1.15
2	Water withdrawal by state:				
	<i>Kyrgyz Republic</i>	-	-	-	-
	<i>Republic of Tajikistan</i>	2.88	2.11	73	-0.77
	<i>Turkmenistan</i>	6.50	6.24	96	-0.26
	<i>Republic of Uzbekistan</i>	6.35	6.23	98	-0.12
3	Downstream of the Atamurat section	12.48	12.10	97	-0.38
	<i>of which:</i>				
	<i>Turkmenistan</i>	6.50	6.24	96	-0.26
	<i>Republic of Uzbekistan</i>	5.98	5.86	98	-0.12
4	By river reaches				
	Upper reaches	3.25	2.48	76	-0.77
	<i>of which:</i>				
	<i>Kyrgyz Republic</i>	-	-	-	-
	<i>Republic of Tajikistan</i>	2.88	2.11	73	-0.77
	<i>Republic of Uzbekistan, Surkhandarya</i>	0.3700	0.3679	99	0.00
	Middle reaches	8.66	8.61	100	-0.04
	<i>of which:</i>				
	<i>Turkmenistan</i>	5.10	5.06	99	-0.04
	<i>Republic of Uzbekistan</i>	3.56	3.56	100	0.00
	Lower reaches	3.83	3.49	91	-0.34
	<i>of which:</i>				
	<i>Turkmenistan</i>	1.40	1.18	85	-0.22
	<i>Republic of Uzbekistan</i>	2.43	2.30	95	-0.12
5	Sanitary and environmental releases to canals within lower reaches	0.80	0.72	91	-0.07
	<i>Including:</i>				
	<i>Turkmenistan</i>	0.15	0.15	100	0.00
	<i>Republic of Uzbekistan</i>	0.65	0.57	89	-0.07
6	Supply to Prearalie and the Aral Sea	2.1	1.51	72	-0.60

Table 2.2

## The Amudarya River channel water balance for the non-growing season 2016-2017

Balance item	Water volume, km <sup>3</sup>		Deviation (actual-plan)
	forecast/ plan	actual	
1. Water content of the Amudarya river - non-regulated flow at the Atamurat GS *	12.93	8.98	-3.95
2. Flow regulation in the Nurek reservoir: accumulation (+) or diversion (-)	4.30	3.86	-0.44
3. Water diversion in the midstream (-)	-8.29	-8.61	-0.32
4. Midstream return CDF (+)	1.35	1.38	0.03
5. Water losses (-) or unrecorded inflow to the channel (+)	-2.33	0.19	2.52
<i>% of flow at the Atamyrat GS conditional</i>	13	2	-12
6. Flow at the Bir-Ata GS	7.96	5.81	-2.15
7. Flow regulation by TMHS: accumulation (+) or diversion (-)	-1.85	0.33	2.18
8. Water releases from TMHS (including water diversion from the reservoir)	6.79	6.14	-0.65
9. Downstream water diversion, including from TMHS (-)	-4.24	-3.49	0.76
10. Downstream return CDF (+)	0.00	0.00	0.00
11. Emergency and environmental water releases to canals (-)	-0.80	-0.72	0.07
12. Runoff losses (-) or unrecorded inflow to the channel (+)	-0.49	-1.32	-0.83
<i>% of flow at the Tuyamuyun GS section</i>	12	30	18
13. Supply to Prearalie and the Aral Sea (Samanbay GS)	0.58	0.61	0.02
<b>TOTAL losses:</b>	-2.81	-1.13	1.69
<i>% of water content</i>	16	9	-8

\* Minus upstream water diversions (Tajikistan and Surkhandarya province)

Table 2.3

Water balance of the reservoirs in the Amudarya River basin for the non-growing season  
2016-2017

Balance item	Water volume, km <sup>3</sup>		deviation (actual-plan)
	forecast/plan	actual	
<b>1 Nurek reservoir</b>			
2.1 Inflow to the reservoir	3.61	3.80	0.19
2.2 Water volume in the reservoir:			
– beginning of the season (April 1, 2016)	10.57	10.57	0.00
– end of September (October 1,2016)	6.29	6.73	0.44
2.3 Water releases from the reservoir	7.90	7.66	-0.24
2.4 Lateral inflow (+) or losses (-)	0.02	0.02	0.01
<i>% of the inflow to the reservoir</i>	0.42	0.55	0.14
2.5 Flow regulation: accumulation (+) or diversion (-)	4.30	3.86	-0.44
<b>2 TMHS reservoirs</b>			
2.1 River flow at Bir-Ata GS	7.96	5.81	-2.15
2.2 Water losses at Bir-Ata GS-Tuyamuyun GS section (-)	-1.85	0.33	2.18
2.3 Water volume in the reservoirs:			
– beginning of the season (April 1, 2016)	2.75	2.75	0.00
– end of September (October 1,2016)	2.98	2.58	-0.40
2.4 Water release from the hydroscheme	6.111	6.14	0.03
of which:			
– release to the river	4.037	4.45	0.41
– water diversion	2.074	1.69	-0.39
2.5 Unrecorded inflow (+) or water losses (-)	-1.62	0.17	1.78
<i>including %of inflow to the reservoir</i>	20	-3	-23.18
2.6 Flow regulation: accumulation (+) or diversion (-)	-1.85	0.33	2.18
<b>TOTAL</b> flow regulation by the reservoirs: accumulation (+) or diversion (-)	2.45	4.19	1.75
<b>TOTAL</b> losses (-), unrecorded inflow (+)	-1.60	0.19	1.79