ANALYSIS OF HYDROLOGICAL CONDITIONS IN THE SYR DARYA AND AMU DARYA RIVER BASINS FOR THE GROWING SEASON 2023

1. Syr Darya River Basin

The inflow to the upstream reservoirs in the Syr Darya basin (Toktogul, Andijan, Charvak) was 15.5 km³ or 87% of the forecast. This is 84% of the norm and by 2.6 km^3 lower than during the growing season 2022. The total lateral inflow to the Naryn and the Syr Darya Rivers (in the reaches before the Shardara reservoir) was 6.5 km^3 (this is by 2 km^3 lower than during the growing season 2022), including from the Karadarya River (Uchtepa g/s) - 0.98 km^3, the Chirchik River (Chinaz-Chirchik g/s) - 0.46 km^3, and from the collector drainage network/CDN (return flow) and small rivers - 5.05 km^3.

At the beginning of the growing season, the upper reservoirs (Toktogul, Andijan, Charvak) accumulated 9.49 km^3. By the end of the growing season, full water storage was 14.05 km^3 in the upstream reservoirs, i.e. the accumulation was 4.57 km^3.

Inflow to the Toktogul reservoir from the Narin River was 9.18 km^3, which is less by 0.63 km^3 than forecasted (94% of the norm). Water releases from the reservoirs amounted to 5.35 km^3, as scheduled by BWO Syr Darya. The total water withdrawal from the Narin River to the reservoir amounted to 3.83 km^3, which is 15% less than in the BWO Syr Darya schedule.

The amount of water in the Bakhri Tojik reservoir was 3.45 km^3 at the beginning of the growing season and 1.69 km^3 by the end of the growing season. Inflow to the Bakhri Tojik reservoir was 4.56 km^3 during the growing season and discharge into the river was 5.42 km^3. The analysis of the Bakri Tojik reservoir operation shows that the inflow to the reservoir was 0.65 km^3 lower than planned by BWO schedule and, consequently, water releases from the reservoir into the river were less by 0.77 km^3 than in the BWO schedule.

The total water withdrawal from the Narin and Syr Darya Rivers in the reaches up to the Shardara reservoir reach amounted to 9.81 km^3 or 82 % of the established limit/quota. For the growing season 2023, the water withdrawal was 2.09 km^3 lower than planned according to the established water limits/quotas by ICWC.

The water withdrawal by republic was as follows: 0.7 km^3 – Republic of Kazakhstan (through the Dustlik canal); 0.19 km^3 – Republic of Kyrgyzstan; 1.44 км^3 – Republic of Tajikistan; and, 7.48 km^3 – Republic of Uzbekistan.

The water storage in the Shardara reservoir was 5.0 km^3 by the beginning of the growing season and 1.01 km^3 by the end of the growing season. Inflow to the Shardara reservoir was 2.52 km^3 or 60% of the forecast, while 4.51 km^3 of water was discharged from the reservoir, including 3.9 km^3 into the river; no water flew from the Shardara hydroscheme into Arnasay reservoir.

Water supply to the Aral Sea and the Aral Sea region (Karateren g/s) amounted to 0.34 km^3 according to the Committee for Water Resources of the Republic of Kazakhstan.

The amount of flow used in the lower reaches of the Syr Darya (including water withdrawal plus water losses and minus lateral inflow) are estimated at 4.17 km^3.

Table 1.1

Indicators of water supply of the countries in the Syr Darya River basin, growing season 2023

Water user	Water volume, km^3	
	BWO schedule/limit	actual
1 Total water withdrawal up to Shardara reservoir	11.90	9.81
2 Water withdrawal by state:		
– *Kyrgyz Republic*	0.27	0.19
– *Republic of Uzbekistan*	8.80	7.48
– *Republic of Tajikistan*	1.91	1.44
– *Republic of Kazakhstan*	0.92	0.70
3 Water withdrawal by river reach		
3.1 Toktogul reservoir – Uchkurgan hydroscheme	3.99	3.53
Including:		
– *Kyrgyz Republic*	0.21	0.10
– *Republic of Tajikistan*	0.24	0.04
– *Republic of Uzbekistan*	3.55	3.38
3.2 Uchkurgan hydroscheme – Bakhri Tojik reservoir	1.05	1.15
Including:		
– *Kyrgyz Republic*	0.06	0.08
– *Republic of Tajikistan*	0.45	0.53
– *Republic of Uzbekistan*	0.54	0.53
3.3 Bakhri Tojik – Shardara reservoir	6.85	5.13
Including:		
– *Republic of Kazakhstan*	0.92	0.70
– *Republic of Tajikistan*	1.22	0.86
– *Republic of Uzbekistan*	4.71	3.57
4 Additionally:		
– Inflow to the Shardara reservoir	4.22	2.52
– Discharge into Arnasay	0.00	0.00
– Water supply to the Aral Sea and Aral Sea region[1]	1.00	0.34

[1] Committee for Water Resources of the Republic of Kazakhstan

Table 1.2

Water balance of the Syr Darya River, growing season 2023

Balance item	Water volume, km^3		Deviation (actual-plan)	
	forecast / plan	actual	km^3	%
1 Inflow to Toktogul reservoir	9.81	9.18	-0.63	6
2 Lateral inflow (LI) in the reach of Toktogulk reservoir-Shardara reservoir (+)	8.89	6.49	-2.40	27
Including:				
– *Discharge from the Karadarya River (Uchtepa g/s)*	1.24	0.98	-0.26	21
– *Discharge from the Chirchik (Chinaz-Chirchik)*	0.59	0.46	-0.13	23
– *Lateral inflow from CDN and small rivers*	7.06	5.05	-2.01	28
3 Flow regulation by reservoirs: recharge (+) or diversion of flow (-)	-3.53	-2.97	0.56	16
Including:				
– *Toktogul reservoir*	-4.51	-3.83	0.68	15
– *Bakhri Tojik reservoir*	0.97	0.86	-0.11	12
4 Regulated flow (1+2+3)	15.16	12.70	-2.47	16
5 Water withdrawal in the Toktogul– Shardara reach(-)	-11.90	-9.81	2.09	18
6 Inflow to Shardara reservoir	4.22	2.52	-1.70	40
7 Water releases from Shardara reservoir (into the river and water withdrawal)	7.74	4.51	-3.24	42
8 Water use (-) downstream of the Shardara reservoir (water withdrawal –lateral inflow + river water losses)	-6.75	-4.17	2.58	38
9 Water supply to the Aral Sea and Aral Sea region	1.00	0.34	-0.66	66

Table 1.3

Reservoir water balance in the Syr Darya River basin, growing season 2023

Balance item	Water volume, km^3		Deviation (actual-plan)	
	forecast/ plan	actual	km^3	%
1.Toktogul reservoir				
1.1 Inflow to the reservoir	9.81	9.18	-0.63	6
1.2 Water volume in reservoir:				
– beginning of the season (April 1, 2023)	7.94	7.94	0.00	0
– end of the season (October 1, 2023)	12.44	11.75	-0.70	6
1.3 Water releases from the reservoir	5.30	5.35	0.05	1
1.4 **Flow regulation:** recharge (+) or diversion of flow (-)	-4.51	-3.83	0.68	15
2. Andijan reservoir				
2.1 Inflow to the reservoir	3.03	2.07	-0.96	32
2.2 Water volume in the reservoir:				
– beginning of the season (April 1, 2023)	0.90	0.90	0.00	0
– end of the season (October 1, 2023)	0.95	0.77	-0.18	18
2.3 Water releases from the reservoir	2.96	2.19	-0.77	26
2.4 **Flow regulation:** recharge (+) or diversion of flow (-)	-0.06	0.12	0.18	
3. Charvak reservoir				
3.1 Inflow to the reservoir	5.00	4.21	-0.79	16
3.2 Water volume in the reservoir				
– beginning of the season (April 1, 2023)	0.65	0.65	0.00	0
– end of the season (October 1, 2023)	1.67	1.53	-0.14	8
3.3 Water releases from the reservoir	4.00	4.01	0.01	0
3.4 **Flow regulation:** recharge (+) or diversion of flow (-)	-1.00	-0.20	0.80	80
4 Bakhri Tojik reservoir: recharge (+) or diversion of flow (-)				
4.1 Inflow to the reservoir	5.22	4.56	-0.65	13
4.2 Lateral inflow	0.28	0.133	-0.15	52
4.3 Water volume in the reservoir:				

Balance item	Water volume, km^3		Deviation (actual-plan)	
	forecast/ plan	actual	km^3	%
– beginning of the season (April 1, 2023)	3.45	3.45	0.00	0
– end of the season (October 1, 2023)	1.63	1.69	0.07	4
4.4 Water releases from the reservoir	6.77	6.109	-0.66	10
Including*:*				
– *water releases into the river*	6.19	5.42	-0.77	12
– *water withdrawal from the reservoir*	0.58	0.69	0.11	19
4.5 **Flow regulation:** recharge (+) or diversion of flow (-)	0.97	0.86	-0.11	12
5 Shardara reservoir				
5.1 Inflow to the reservoir	4.22	2.52	-1.70	40
5.2 Lateral inflow	0.00	0.00	0.00	
5.3 Water volume in the reservoir:				
– beginning of the season (April 1, 2023)	4.99	4.99	0.00	0
– end of the season (October 1, 2023)	1.02	1.01	-0.01	1
5.4 Water releases from the reservoir	7.74	4.51	-3.24	42
Including:				
– *discharge into Arnasay*	0.00	0.00	0.00	
– *water releases into the river*	6.87	3.90	-2.96	43
– *water withdrawal from the reservoir*	0.87	0.60	-0.27	31
5.5 **Flow regulation:** recharge (+) or diversion of flow (-)	2.65	1.38	-1.27	48
TOTAL volume of flow regulation by reservoirs: recharge (+) or diversion of flow (-)	-1.95	-1.67	0.28	14

2 Amu Darya River Basin

The actual water availability in the Amu Darya River at nominal Kerki g/s (upstream of water intake to Garagumdarya) was 43.46 km^3 (94% of the norm), which is 0.36 km^3 lower than forecasted by BWO Amu Darya (Table 2.2). For comparison, in the growing season 2022, the river's water availability was 41.23 km^3.

Inflow to the Nurek reservoir amounted to 16.79 km^3 and was above the projected flow by 1.0 km^3, while water releases from the reservoir were 13.28 km^3 or 1.21 km^3 more than the forecast by BWO Amu Darya. 3.51 km^3 of river water was diverted through accumulation of water in the Nurek reservoir (Table 2.3)

According to the data from Darganata gauging station, the inflow to Tuyamuyun hydroscheme (TMHS) amounted to 16.27 km^3, which is less by 4.48 km^3 of the forecast. In spite of this, the planned amount of water of 3.5 km^3 was accumulated in TMHS reservoirs during the growing season. Water releases from TMHS were 13.31 km^3 or 4.46 km^3 less than planned.

Under the current situation in water, the established water withdrawal limit for canals in the Amu Darya River basin was met by 84% (Table 2.1). The total water withdrawal was 33.2 km^3, including 25.55 km^3 diverted downstream of Kerki g/s (starting from the water intake to Garagumdarya). In the growing season, the average water availability was 98% in the Republic of Tajikistan, 91% in Turkmenistan, and 73% in Uzbekistan. As to the lower reaches, the water availability was 70% in Turkmenistan, 63% in Uzbekistan, including 72% in Syrhankdarya province.

The water supply to the Aral Sea region and the Aral Sea was 1.19 km^3 (flow of the Amu Darya River at Samanbay g/s plus discharge from CDN) or 57% of BWO schedule.

Table 2.1

Indicators of water supply of the countries in the Amu Darya River Basin, growing season 2023

Water user	Water volume, km^3		Water availability, %	Shortage (-), surplus (+), km^3
	limit/ schedule	actual	season	season
1. Total water withdrawal	**39.45**	**33.19**	**84**	**-6.3**
2. By state:				
Kyrgyz Republic	-	-	-	-
Republic of Tajikistan	6.9	6.8	98	-0.1
Turkmenistan	15.4	14.0	91	-1.4
Republic of Uzbekistan	17.1	12.4	73	-4.7
3. Downstream of nominal Kerki g/s*	**31.339**	**25.55**	**82**	**-5.8**
Including:				
Turkmenistan	15.4	14.0	91	-1.4
Republic of Uzbekistan	15.9	11.6	73	-4.3
4. By river reach:				
Upper reaches	**8.111**	**7.64**	**94**	**-0.5**
Including:				
Kyrgyz Republic	-	-	-	-
Republic of Tajikistan	6.92	6.78	98	-0.1
Syrhandarya province, Uzbekistan	1.19	0.86	72	-0.3
Middle reaches	**16.121**	**15.62**	**97**	**-0.5**
Including:				
Turkmenistan	10.42	10.45	100	0.0
Republic of Uzbekistan	5.70	5.17	91	-0.5
Lower reaches	**15.218**	**9.93**	**65**	**-5.3**
Including:				
Turkmenistan	4.99	3.52	70	-1.5
Republic of Uzbekistan	10.223	6.42	63	-3.8
5. Additionally:				
Sanitary – environmental flow to canals in the lower reaches	0	0		

Water user	Water volume, km^3		Water availability, %	Shortage (-), surplus (+), km^3
	limit/ schedule	actual	season	season
Including:				
Turkmenistan	0	0		
Republic of Uzbekistan	0	0		
Water supply to the Aral Sea region and the Aral Sea**	2.10	1.19	57	-0.9

***)** nominal Kerki section - section in the Amu Darya River upstream of the water intake to Garagumdarya

**) including discharge from CDN

Table 2.2

Water balance of the Amu Darya River, growing season 2023

Balance item	Water volume, km^3		Deviation (actual-plan)	
	forecast/ plan	actual	km^3	%
1. Water content in the Amu Darya - unregulated flow at nominal Kerki station*	43.82	43.46	-0.36	1
2. Flow regulation by the Nurek reservoir: recharge (-) or diversion of flow (-)	-3.72	-3.51	0.21	6
3. Water withdrawal in the middle reaches (-)	-16.12	-15.62	0.50	3
4. Return flow in the middle reaches (+)	1.03	0.94	-0.09	9
6. River flow at Darganata g/s	20.75	16.27	-4.48	22
7. Water releases from TMHS (including water diversion from reservoir)	17.76	13.31	-4.46	25
8. Water withdrawal in the lower reaches, including diversion from TMHS (-)	-15.22	-9.93	5.28	35
9 Return flow in the lower reaches (+)	0.00	0.00	0.00	
10 Sanitary-environmental flow to canals (-)	0.00	0.00	0.00	
11 Water supply to the Aral Sea region and the Aral Sea (Samanbay g/s)	0.67	0.44	-0.23	34

***** Amu Darya River flow upstream of the water intake to Garagumdarya, natural flow at Nurek HPP (excluding flow regulation of the Vakhsh River).

Table 2.3

Reservoir water balance of the Amu Darya River, growing season 2023

Balance item	Water volume, km^3		Deviation (actual-plan)	
	forecast/ plan	actual	km^3	%
1 Nurek reservoir				
1.1. Inflow to the reservoir	15.79	16.79	0.99	6
1.2. Water volume in the reservoir:				
– beginning of the season (April 1, 2023)	6.38	6.38	0.00	0
– end of the season (October 1, 2023)	10.57	10.51	-0.06	1
1.3. Water releases from the reservoir	12.07	13.28	1.21	10
1.4. **Flow regulation:** recharge (+) or diversion of flow (-)	-3.72	-3.51	0.21	6
2 TMHS reservoirs				
2.1 River flow at Darganata g/s	20.75	16.27	-4.48	22
2.2 Water volume in reservoirs:				
– beginning of the season (April 1, 2023)	2.70	2.70	0.00	0
– end of the season (October 1, 2023)	3.53	3.48	-0.05	2
2.3 Water releases from hydroscheme	17.76	13.31	-4.46	25
Including:				
– water releases into the river	12.77	9.98	-2.79	22
– water withdrawal	4.87	3.33	-1.55	32
2.4 **Flow regulation:** recharge (+) or diversion of flow (-)	-7.98	-6.29	1.69	21
TOTAL flow regulation by reservoirs: recharge (+) or diversion of flow (-)	-11.70	-9.80	1.90	16