ANALYSIS OF HYDROLOGICAL CONDITIONS IN THE SYR DARYA AND AMU DARYA RIVER BASINS FOR THE NONGROWING SEASON 2023-2024

1 Syr Darya River Basin

The actual inflow to the upper reservoirs of the Syr Darya River basin (Toktogul, Andijan, Charvak) during the non-growing season (October 2023-March 2024) was 5.3 km^3 or 107% of the forecast.

Inflow to the Toktogul reservoir amounted to 3.11 km^3 or 113% of the forecast. Inflow to the Andijan reservoir was 15% lower than expected, while the actual inflow to the Charvak reservoir was 9% higher.

Total water releases from the three upper reservoirs amounted to 10.44 km^3 or 8% less than the forecast of BWO Syr Darya.

Total lateral inflow amounted to 9.94 km^3 in the reach from the Toktogul reservoir to the Shardara reservoir, including water discharge from the Karadarya and Chirchik Rivers – this was more than the total inflow to the upper reservoirs but 5% lower than the total water releases from these reservoirs.

By the end of the non-growing season, the water volume was 8.84 km^s in the reservoirs, including: Toktogul reservoir – 7.28 km^3 or 116% of the plan, Andijan reservoir – 0.96 km^3 or 119 % of the plan, Charvak reservoir – 0.61 km^3 or 119 % of the plan. The Toktogul reservoir was drawn down by 4.47 km^3, Charvak reservoir – by 0.92 km^3, and Andijan reservoir – by 0.18 km^3.

Inflow to the Bakhri Tojik reservoir was 10.75 km^3. This is by 0.26 km^3 less than in the forecast schedule accepted as a reference at the 85th ICWC meeting – 9.08 km^3 of water were discharged into the river. This is by 0.42 km^3 less than in BWO's schedule. The reservoir accumulated up to 3.32 km^3 of water.

The total water withdrawal from the Naryn and Syr Darya Rivers made up 3.87 km^3, including for the: Kyrgyz Republic – 0.01 km^3, Republic of Tajikistan – 0.04 km^3, Republic of Kazakhstan (through Dustlik canal) – 0.49 km^3, and Republic of Uzbekistan – 3.33 km^3 (Table 1.1).

The inflow to the Shardara reservoir amounted to 10.31 km^3 during the non-growing season 2023-2024. This is by 0.86 km^3 less than scheduled by BWO Syr Darya. By the end of the season, the reservoir was filled with water to 4.82 km^3 (93% of the plan). The discharge from the Shardara reservoir amounted to 4.9 km^3 (70% of the forecast), including: water discharge into the river – 4.22 km^3, water withdrawal to the Kyzylkum canal – 0.05 km^3, and water releases into Arnasay – 0.63 km^3.

The water use in the lower reaches of the Syr Darya (water withdrawal, losses) amounted to 2.94 km^3 (Table 1.2.). Inflow to the Aral Sea was 1.16 km^3 by the data of KazHydromet and 1.27 km^3 (79% of expected amount) by the data of the Committee for Water Resources of Kazakhstan.

Table 1.2 below shows the river water balance, while Table 1.3 gives the reservoir water balance.

Table 1.1

Water use by riparian countries of the Syr Darya River Basin
(in the reach up to Shardara reservoir), non-growing season 2023-2024

#	Water- user	Water volume, km^3		Water availability, %
		Limit/ schedule	Actual	Season
1	Total water withdrawal	4.25	3.87	91
2	by country:			
	Kyrgyz Republic	0.05	0.01	24
	Republic of Uzbekistan	3.35	3.33	99
	Republic of Tajikistan	0.37	0.04	11
	Republic of Kazakhstan	0.49	0.49	100
3	by river reach:			
3.1	Toktogul reservoir-Uchkurgan hydroscheme	1.38	1.38	100
	including:			
	Kyrgyz Republic	0.04	0.01	28
	Republic of Tajikistan	0.08	0.03	34
	Republic of Uzbekistan	1.25	1.34	107
3.2	Uchkurgan hydroscheme-Bakhri Tojik reservoir	0.25	0.22	87
	including:			
	Kyrgyz Republic	0.01	0.0002	3
	Republic of Tajikistan	0.07	0.0010	2
	Republic of Uzbekistan	0.17	0.21	125
3.3	Bakhri Tojik hydroscheme–Shardara reservoir	2.62	2.28	87
	including:			
	Republic of Kazakhstan	0.49	0.49	100
	Republic of Tajikistan	0.212	0.010	5
	Republic of Uzbekistan	1.92	1.78	92

Table 1.2

Water balance of the Syr Darya River for the non-growing season, 2023-2024

#	Balance item	Water volume, km^3		
		Forecast/ plan	Actual	Deviation (actual - plan)
1	Inflow to the Toktogul reservoir	2.75	3.11	0.36
2	Lateral inflow in the Toktogul reservoir - Shardara reservoir reach (+)	9.24	9.94	0.70
	including:			
2.1	*Discharge from the Karadarya river*	1.34	1.75	0.41
2.2	*Discharge from the Chirchik river*	1.21	1.16	-0.05
2.3	*Lateral inflow from CDN and small rivers*	6.69	7.03	0.34
3	Flow regulation by reservoir: recharge (+) or diversion of flow (-)	3.61	2.79	-0.81
	including:			
3.1	*Toktogul reservoir*	5.47	4.46	-1.00
3.2	*Bakhri Tojik reservoir*	-1.86	-1.67	0.19
4	Regulated flow (1+2+3)	15.59	15.84	0.25
5	Water diversion in the Toktogul – Shardara reach (-)	-4.25	-3.87	0.37
6	Inflow to Shardara reservoir	11.17	10.31	-0.86
7	Water releases from Shardara reservoir into the river	6.99	4.22	-2.77
8	Water use at Shardara – Aral reach*	5.37	2.94	-2.42
9	Water supply to the Aral sea (Karateren g/s)**	1.62	1.27	-0.35

*Water withdrawal plus river water losses and minus lateral inflow
** Based on the data of the Committee for Water Resources of the Republic of Kazakhstan

Table 1.3

Reservoir water balance in the Syr Darya River basin
for the non-growing season, 2023-2024

#	Balance item	Water volume, km^3		
		Forecast/ plan	Actual	Deviation (actual - plan)
1	**Toktogul reservoir**			
1.1	Inflow to the reservoir	2.75	3.11	0.36
1.2	Water volume in reservoir:			
	- beginning of the season (1 October 2023)	11.75	11.75	0.00
	- end of the season (1 April 2024)	6.28	7.28	1.00
1.3	Water releases from the reservoir	8.21	7.57	-0.64
1.4	Flow regulation: recharge (+) or diversion of flow (-)	5.47	4.46	-1.00
2	**Andijan reservoir**			
2.1	Inflow to the reservoir	0.85	0.72	-0.13
2.2	Water volume in the reservoir:			
	- beginning of the season (1 October 2023)	0.77	0.77	0.00
	- end of the season (1 April 2024)	0.81	0.96	0.15
2.3	Water releases from the reservoir	0.82	0.52	-0.30
2.4	Flow regulation: recharge (+) or diversion of flow (-)	-0.03	-0.20	-0.17
3	**Charvak reservoir**			
3.1	Inflow to the reservoir	1.35	1.48	0.13
3.2	Water volume in reservoir:			
	- beginning of the season (1 October 2023)	1.53	1.53	0.00
	- end of the season (1 April 2024)	0.51	0.61	0.10
3.3	Water releases from the reservoir	2.36	2.34	-0.02
3.4	Flow regulation: recharge (+) or diversion of flow (-)	1.02	0.87	-0.15
4	**Bakhri Tojik reservoir**			
4.1	Inflow to the reservoir from the river	11.01	10.75	-0.26
4.2	Lateral inflow	0.352	0.184	-0.17
4.3	Water volume in reservoir:			
	- beginning of the season (1 October 2023)	1.69	1.69	0.00
	- end of the season (1 April 2024)	3.44	3.32	-0.13
4.4	Water released from the reservoir	9.61	9.10	-0.51
	including:			

#	Balance item	Water volume, km^3		
		Forecast/ plan	Actual	Deviation (actual - plan)
	- releases into the river	9.50	9.08	-0.42
	- water intake from the reservoir	0.11	0.028	-0.08
4.5	Flow regulation: recharge (+) or diversion of flow (-)	-1.86	-1.67	0.19
5	**Shardara reservoir**			
5.1	Inflow to the reservoir	11.17	10.31	-0.86
5.2	Lateral inflow	0.0	0.0	0.00
5.3	Water volume in reservoir:			
	- beginning of the season (1 October 2023)	1.01	1.01	0.00
	- end of the season (1 April 2024)	5.19	4.82	-0.36
5.4	Water releases from the reservoir	6.99	4.90	-2.09
	including:			
	- discharge into Arnasay	0.00	0.63	0.630
	- water releases into the river	6.99	4.22	-2.77
	- water intake from the reservoir	0.00	0.05	0.05
5.5	Flow regulation: recharge (+) or diversion of flow (-)	-4.18	-6.09	-1.91
	TOTAL flow regulation by reservoirs: recharge (+) or diversion of flow (-)	0.41	-2.63	-3.04

2 Amu Darya River basin

The actual water availability in the Amu Darya River at “nominal Kerki” g/s section (upstream of water intake to Garagumdarya) was 10.33 km^3 (90% of the forecast) which is by 1.23 km^3 less than the forecast (Table 2.1).

Inflow to the Nurek reservoir amounted to 3.81 km^3 (95% of the forecast), while water releases from the reservoir were 7.65 km^3 (98% of BWO Amu Darya’s schedule). Recharge of river flow through drawdown of the Nurek reservoir amounted to 3.84 km^3. By the end of the season, the reservoir was drawn down to 6.02 km^3.

The plan of water accumulation in the reservoirs of Tuyamuyun hydroscheme (TMHS) was fulfilled during the non-growing season. By April 1, the actual water volume was 0.09 km^3 more than planned and amounted to 2.97 $км^3$. The flow at the Darganata section was 5.19 km^3 (80% of the forecast). As a result of unrecorded inflow, water releases from TMHS were less than BWO’s schedule – 5.33 km^3 (84% of the forecast).

The assigned limit on water withdrawal in the Amu Darya Basin was used by 89%. The total water withdrawal was 14.04 km^3, including 11.06 km^3 - downstream of Kerki g/s (starting from the water intake to Garagumdarya). Available water supply varied by states from 92% (Tajikistan) to 94% (Turkmenistan) and 83% Uzbekistan (Table 2.1). Water availability was 92% in the upper reaches (up to intake to Garagumdarya), 95% in the middle reaches (from “nominal Kerki” g/s to TMHS) and 75% in the lower reaches (78% in Turkmenistan and 73% in Uzbekistan).

The assigned limit of sanitary and environmental flow for canals in the lower reaches of the Amu Darya was used by 68%, and 0.55 km^3 of water were delivered. According to UzHydromet’s data, river and collector drainage water was delivered to the Aral Sea and the Aral Sea region, which amounted to 1.25 km^3 or 60% of the plan.

Tables 2.2 and 2.3 show the data on river water balance and reservoir water balance, respectively.

Table 2.1

Indicators of available water supply of the riparian countries in the Amu Darya River Basin, non-growing season 2023-2024

#	Water-user	Water volume, km^3		Water availability, %
		Limit / schedule	Actual	Season
1	Total water withdrawal	15.74	14.04	89
2	Breakdown by states:			
	Kyrgyz Republic	-	-	-
	Republic of Tajikistan	2.88	2.66	92
	Turkmenistan	6.50	6.10	94
	Republic of Uzbekistan	6.37	5.28	83
3	Downstream of “nominal Kerki” g/s	12.50	11.06	89
	Including:			
	Turkmenistan	6.50	6.10	94
	Republic of Uzbekistan	6.00	4,96	83
4	By river reach			
4.1	Upper reaches	3.25	2.98	92
	Including:			
	Kyrgyz Republic	-	-	-
	Republic of Tajikistan	2.88	2.66	92
	Republic of Uzbekistan, Syrkhandarya province	0.37	0.32	87
4.2	Middle reaches	8.34	7.95	95
	Including:			
	Turkmenistan	5.10	5.02	98
	Republic of Uzbekistan	3.25	2.94	91
4.3	Lower reaches	4.15	3.10	75
	Including:			
	Turkmenistan	1.40	1.09	78
	Republic of Uzbekistan	2.75	2.02	73
5	Sanitary-environmental flow to canals in the lower reaches	0.80	0.55	68
	Including:			
	Turkmenistan	0.15	0.14	92
	Republic of Uzbekistan	0.66	0.41	63
6	Water supply to the Aral Sea region and the Aral Sea	2.1	1.25	60

Table 2.2

Water balance of the Amu Darya River, non-growing season 2023-2024

Balance item	Water volume, km^3		
	Forecast/ plan	Actual	Deviation (actual-plan)
1. Water content in the Amu Darya River – unregulated flow at nominal Kerki section*	11.57	10.33	-1.232
2. Flow regulation by the Nurek reservoir: recharge (+) or diversion of flow (-)	3.76	3.84	0.08
3. Water withdrawal in the middle reaches (-)	-8.34	-7.95	0.39
4. Return flow in the middle reaches (+)	0.97	0.89	-0.08
5. River flow at Darganata g/s	6.50	5.19	-1.31
6. Water releases from TMHS (including water diversion from the reservoir)	6.38	5.33	-1.05
7. Water withdrawal in the lower reaches, including diversion from TMHS (-)	-4.15	-3.10	1.05
8. Sanitary-environmental flow to canals (-)	-0.80	-0.55	0.25
9. Flow of the Amu Darya River at Samanbai g/s	0.98	0.63	-0.35

* Excluding water withdrawal in the upper reaches (Tajikistan, Uzbekistan (Surkhandarya province))

Table 2.3

Reservoir water balance, Amu Darya River basin, non-growing season 2023-2024

Balance item	Water volume, km^3		
	Forecast/ plan	Actual	Deviation (actual-plan)
1 Nurek reservoir			
1.1. Inflow to the reservoir	4.03	3.81	-0.22
1.2. Water volume in the reservoir:			
– beginning of the season (1 October 2023)	10.51	10.51	0.00
– end of the season (1 April 2024)	6.39	6.02	-0.36
1.3. Water releases from the reservoir	7.79	7.65	-0.14
1.4. Flow regulation by the Nurek reservoir: recharge (+) or diversion of flow (-)	3.76	3.84	0.08
2 TMHS reservoirs			
2.1. River flow at Darganata g|s	6.50	5.19	-1.31
2.2. Water volume in the reservoirs:			
– beginning of the season (1 October 2023)	3.48	3.48	0.00
– end of the season (1 April 2024)	2.88	2.97	0.09
2.3. Water releases from hydroscheme	6.38	5.33	-1.05
including:			
– water releases into the river	4.50	3.84	-0.67
– water diversion	1.88	1.50	-0.38
2.4. Flow regulation: recharge (+) or diversion of flow (-)	-2.00	-1.36	0.64