ANALYSIS OF WATER MANAGEMENT SITUATION IN THE SYRDARYA AND AMUDARYA RIVER BASINS OVER THE GROWING SEASON 2015

1. Syrdarya River Basin

The actual inflow to upstream reservoirs in the Syrdarya basin (Toktogul, Andizhan, and Charvak reservoirs) was 18.53 km³ or 100% of the forecast during the growing season. The total lateral inflow to the Naryn and Syrdarya rivers (in reaches up to Shardara reservoir) was 9.32 km³. By the end of the growing season, 15.93 km³ or 103% of BWO Syrdarya's scheduled amount was accumulated in the upstream reservoirs, including 13.01 km³ in the Toktogul reservoir. Water releases from the Toktogul reservoir amounted to 3.81 km³ or 94% of BWO Syrdarya's schedule.

The total water withdrawal from the Naryn and Syrdarya rivers in the reaches up to Shardara reservoir was 9.15 km³ or 78 % of the quota. During the growing season 2.59 km³ less water was diverted against the schedule of BWO Syrdarya. Water shortage (against the quota) was 217 Mm³ for the Republic of Kazakhstan (Dustlik canal), 76 Mm³ for Kyrgyz Republic, 403 Mm³ for the Republic of Tajikistan, and 1,892 Mm³ for the Republic of Uzbekistan. There was uneven supply of water among the states and in the river reaches (Table 1.1). This shortage was particularly acute in the river's midstream in the reach Kayrakkum Hydroscheme-Shardara reservoir and amounted to on average 28 % during the growing season. In summer ten-day periods minimum water availability was recorded as follows:

- Republic of Uzbekistan – 43% in the reach Kayrakkum-Shardara in the first ten-day of June
- Republic of Kazakhstan – 50 % in the reach Kayrakkum-Shardara in the third ten-day of June
- Republic of Tajikistan – 66 % in the reach Toktogul-Kayrakkum in the first ten-day of June
- Kyrgyz Republic– 62 % in the reach Toktogul-Kayrakkum in the second ten-day of August

Inflow to the Kayrakkum reservoir was 5.6 km³ (against BWO Syrdarya schedule – 5.18 km³) and water releases were 6.42 km³ during the growing season. The comparison of actual data with BWO schedule's data on water releases from the Kayrakkum reservoir during ten-day periods has revealed the following exceeding of BWO schedule's data over the actual values:

Month	**May**	**June**			**July**	**August**		**September**		
Ten-day period	**1**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**
Exceeding of BWO schedule's data over the actual values , %	8	33	12	2	4	2	26	2	35	40

Inflow to the Shardara reservoir was 3.73 km³, while water releases from the reservoir were 5.64 km³, including 4.82 km³ released into the river; water did not reach the Arnasay reservoir from the Shardara hydroscheme. According to Aralo-Syrdarya Basin Water Administration's data, the Koksaroy reservoir accumulated water only in April (66 Mm³) and released the earlier accumulated flow in the amount of 2,561 Mm³ in other months.

The analysis of reservoirs' water balances (Table 1.3) indicated to unrecorded inflow to the Charvak reservoir in the amount of 0.28 km³. Losses identified for Kayrakkum and Shardara reservoirs amounted to 1.63 km³ in total.

Water supply to the Aral Sea and Priaralie (at the Karateren gauging station) amounted to 1.23 km³ during the growing season.

Table 1.1

Indicators of water availability in the Syrdarya River basin countries for the growing season 2015

Water user	Water volume, km³		Water availability, %	Deficit (-), surplus (+) km³
	BWO schedule / quota	actual	season	season
1 Total water withdrawal up to the Shardara reservoir	**11.74**	**9.15**	**78**	**-2.59**
2 By state:				
– *Kyrgyz Republic*	0.25	0.17	69	-0.08
– *Republic of Uzbekistan*	8.80	6.91	78	-1.89
– *Republic of Tajikistan*	1.91	1.50	79	-0.40
– *Republic of Kazakhstan*	0.79	0.57	72	-0.22
3 By river reach				
3.1 Toktogul reservoir – Uchkurgan hydroscheme	**3.95**	**3.17**	**80**	**-0.77**
of which:				
– *Kyrgyz Republic*	0.16	0.10	61	-0.06
– *Republic of Tajikistan*	0.24	0.06	25	-0.18
– *Republic of Uzbekistan*	3.55	3.02	85	-0.53
3.2 Uchkurgan hydroscheme – Kayrakkum hydroscheme	**1.08**	**1.12**	**104**	**0.05**
of which:				
– *Kyrgyz Republic*	0.08	0.07	85	-0.01
– *Republic of Tajikistan*	0.45	0.52	116	0.07
– *Republic of Uzbekistan*	0.54	0.53	97	-0.01
3.3 Kayrakkum hydroscheme – Shardara reservoir	**6.71**	**4.85**	**72**	**-1.86**
of which:				
– *Republic of Kazakhstan*	0.79	0.57	72	-0.22
– *Republic of Tajikistan*	1.22	0.92	76	-0.30
– *Republic of Uzbekistan*	4.71	3.36	71	-1.35
4 In addition:				
– Inflow to Shardara reservoir	4.18	3.73	89	-0.45
– Discharge into Arnasay	0	0		0
– Water supply to the Aral Sea and Priaralie	1,90	1,23	65	-0,67

Table 1.2

Syrdarya River water balance for the growing season 2015

Balance item	Water volume, km^3		Deviation (actual-plan)
	Forecast/plan	Actual	
1 Inflow to Toktogul reservoir	9.91	10.41	0.50
2 Lateral inflow in the reach Toktogul – Shardara reservoirs (+)	9.58	9.33	-0.25
of which:			
– *Inflow from the Karadarya river*	1.65	1.70	0.05
– *Inflow from the Chirchik river*	0.93	0.74	-0.20
– *Lateral inflow from CDF and small rivers*	7.00	6.89	-0.11
3 Flow regulation in the reservoirs: accumulation (+) or release (-)	-4.62	-5.68	-1.06
of which:			
– *Toktogul reservoir*	-5.85	-6.60	-0.,75
– *Kayrakkum reservoir*	1.23	0.92	-0.31
4 Regulated flow (1+2+3)	14.87	14.05	-0.,81
5 Water diversion in the reach Toktogul -Shardara reservoirs (-)	-11.74	-9.15	2.,59
6 Water losses (-) or unrecorded inflow to the channel (+) in the reach Toктogul-Shardara reservoirs	1.05	-1.17	-2.22
Including % of the regulated flow	7	8	1
7 Inflow into Shardara reservoir	4.18	3.73	-0.45
8 Flow regulation by Shardara reservoir: accumulation (+) or release (-)	2.33	1.91	-0.42
9 Water releases from Shardara reservoir into the river	5.30	4.82	-0.49
10 Water diversion into Kyzylkum canal (-)	-4.21	-0.82	0.38
11 Discharge into Arnasay (-)	0	0	0
12 Water supply to the Aral Sea and Priaralie	1,90	1,23	-0,67

Table 1.3

Water balance of the Syrdarya river basin reservoirs for the growing season 2015

Balance item	Water volume, km^3		Deviation (actual-plan)
	Forecast/plan	actual	
1. Toktogul reservoir			
1.1 Inflow to the reservoir	9.91	10.41	0.50
1.2 Water volume in the reservoir:			
– beginning of the season (April 1, 2015)	6.39	6.41	0.02
– end of the season (October 1, 2015)	12.19	13.01	0.82
1.3 Water releases from the reservoir	4.06	3.81	-0.25
1.4 Unrecorded inflow (+) or water losses (-)	-0.05	0.01	0.06
% of inflow to the reservoir	0	0	0
1.5 Flow regulation: accumulation (+) or releases (-)	-5.85	-6.60	-0.75
2. Andizhan reservoir			
2.1 Inflow to the reservoir	3.16	2.78	-0.39

Balance item	Water volume, km^3		Deviation (actual-plan)
	Forecast/plan	actual	
2.2 Water volume in the reservoir:			
– beginning of the season (April 1, 2015)	0.92	0.95	0.04
– end of the season (October 1, 2015)	1.34	0.79	-0.55
2.3 Water releases from the reservoir	2.73	2.95	0.22
2.4 Unrecorded inflow (+) or water losses (-)	-0.01	0.01	0.02
% of inflow to the reservoir	0	0	0
2.5 Flow regulation: accumulation (+) or release (-)	-0.43	0.17	0.60
3. Charvak reservoir			
3.1 Inflow to the reservoir	5.46	5.35	-0.11
3.2 Water volume in the reservoir:			
– beginning of the season (April 1, 2015)	0.58	0.59	0.01
– end of the season (October 1, 2015)	1.48	1.59	0.11
3.3 Water releases from the reservoir	4.54	4.62	0.08
3.4 Unrecorded inflow (+) or water losses (-)	-0.02	0.28	0.30
% of inflow to the reservoir	0	5	5
3.5 Flow regulation: accumulation (+) or release (-)	-0.92	-0.73	0.19
4 Kayrakkum reservoir			
4.1 Inflow to the reservoir	5.18	5.60	0.42
4.2 Lateral inflow	0.30	0.27	-0.03
4.3 Water volume in the reservoir:			
– beginning of the season (April 1, 2015)	3.25	3.48	0.23
– end of the season (October 1, 2015)	1.59	1.75	0.15
4.4 Water releases from the reservoir	6.71	6.79	0.08
of which*:*			
– *water releases to the river*	6.23	6.42	0.19
– *water diversion from the reservoir*	0.48	0.37	-0.11
4.5 Unrecorded inflow (+) or water losses (-)	-0.42	-0.81	-0.39
% of inflow to the reservoir	8	14	6
4.6 Flow regulation: accumulation (+) or releases (-)	1.23	0.92	-0.31
5 Shardara reservoir			
5.1 Inflow to the reservoir	4.18	3.73	-0.45
5.2 Lateral inflow	0.00	0.00	0.00
5.3 Water volume in the reservoir:			
– beginning of the season (April 1, 2015)	4.09	3.91	-0.18
– end of the season (October 1, 2015)	1.23	1.22	-0.02
5.4 Water releases from the reservoir	6.51	5.64	-0.87
of which:			
– *Discharge into Arnasay*	0.00	0.00	0.00
– *Water releases to the river*	5.30	4.82	-0.49
– *Water diversion from the reservoir*	1.21	0.82	-0.38
5.5 Unrecorded inflow (+) or water losses (-)	-0.53	-0.79	-0.26
% of inflow to the reservoir	13	21	8
5.6 Flow regulation: accumulation (+) or releases (-)	2.33	1.91	-0.42
TOTAL flow regulation by reservoirs: accumulation (+) or releases (-)	-3.64	-4.33	-0.69
TOTAL water losses (-), unrecorded inflow (+)	-1.03	-1.30	-0.27

2 Amudarya River Basin

The actual water content along the Amudarya River in the Atamyrat gauging station (upstream of intake to Garagumdarya) was 50.83 km³ or 6.54 km³ more than expected in the BWO Amudarya schedule (Table 2.2). Inflow to Nurek HPP amounted to 19.34 km³ and turned to be higher of the forecast by 2.73 km³. Water releases from the reservoir were 15.64 km³ or 2.88 km³ more than planned amount. Withdrawal of the river flow at the expense of accumulation in the Nurek reservoir amounted to 3.7 km³.

Under such water-related conditions, the established quotas of water withdrawals into canals in the Amudarya River basin were 94% used; the total water withdrawal amounted to 37.25 km³, including 30.5 km³ downstream of Atamyrat gauging station (starting from intake to Garagumdarya). During the growing season the average water availability amounted to 85% in the Republic of Tajikistan, 94% in Turkmenistan and 97% in the Republic of Uzbekistan; in the lower reaches water availability amounted to 96% in Turkmenistan, 99% in the Republic of Uzbekistan and 69% in Surkhandarya province (Table 2.1)

Minimum water availability by ten-day period was recorded from May to August in:

- The Republic of Uzbekistan – 91 % in the reach Nurek-Tuyamuyun in the first ten-day of June
- Turkmenistan – 88 % in the reach Tuyamuyun-Samanbay in the second ten-day of August

Channel water losses, calculated by balance method, along the Amudarya River in the reach Atamyrat GS - Bir-Ata GS were 3.51 km³ or at about 7% of the flow in the Atamyrat GS, whereas losses in the reach Bir-Ata GS – Tuyamuyun GS were 4.39 km³. The analysis of actual channel losses during the operation period of TMHS and of SIC ICWC studies shows that water losses are no more than 2.3…2.5 km³ in the reach Bir-Ata GS (Darganata) – Tuyamuyun GS during the growing season. Whereas, in the growing season 2015 water losses were 1.9 km³ higher. Water losses from the inflow point to Tuyamuyun hydroscheme to the point of water delivery to the Aral Sea and Priaralie were 2.97 km^3 or 17% of water releases from the Tuyamuyun hydroscheme.

Water supply to the Aral Sea and Priaralie amounted to 5.73 km³ for the growing season (Amudarya river flow at the Samanbay GS plus collector-drainage water).

Table 2.1

Indicators of water availability in the Amudarya river basin countries for the growing season 2015

Water user	Water volume, km^3		Water availability, %	Deficit (-), surplus (+), km^3
	Quota/ Schedule	Actual	Season	Season
1. Total water withdrawal	**39.66**	**37.25**	**92**	**-2.41**
2. By state:				
Kyrgyz Republic	-	-	-	-

Water user	Water volume, km^3		Water availability, %	Deficit (-), surplus (+), km^3
	Quota/ Schedule	Actual	Season	Season
Republic of Tajikistan	6.94	5.92	82	-1.02
Turkmenistan	15.50	14.56	94	-0.94
Republic of Uzbekistan	17.22	16.77	95	-0.45
3. Downstream of Atamyrat GS*)	**31.52**	**30.50**	**95**	**-1.02**
of which:				
Turkmenistan	15.50	14.56	94	-0.94
Republic of Uzbekistan	16.02	15.94	96	-0.08
4. By river reach:				
Upper reaches	**8.14**	**6.75**	**81**	**-1.39**
of which:				
Kyrgyz Republic	-	-	-	-
Republic of Tajikistan	6.94	5.92	82	-1.02
Surkhandarya province, Uzbekistan	1.20	0.83	78	-0.37
Middle reaches	**16.21**	**15.80**	**94**	**-0.41**
of which:				
Turkmenistan	10.47	10.09	96	-0.39
Republic of Uzbekistan	5.74	5.71	91	-0.02
Lower reaches	**15.31**	**14.70**	**96**	**-0.61**
of which:				
Turkmenistan	5.03	4.47	89	-0.56
Republic of Uzbekistan	10.28	10.23	99	-0.06
5. In addition:				
Emergency and environmental releases into canals in lower reaches	0	0		
of which:				
Turkmenistan	0	0		
Republic of Uzbekistan	0	0		
Inflow to the Aral Sea and Priaralie **	2.10	5.37	256	

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

**) Taking into account CDF

Table 2.2

The Amudarya River water balance for the growing season 2015

Balance item	Water volume, km^3		Deviation (actual-plan)
	Forecast/plan	Actual	
1. Water content of Amudarya River – non-regulated flow at Atamyrat GS*	44.28	50.83	6.54
2. Flow regulation by Nurek reservoir: accumulation (+) or releases (-)	-4.21	-3.70	0.51
3. Water diversion in the midstream (-)	-16.21	-15.80	0.41
4. Return CDF in the midstream (+)	1.43	1.98	0.55
5. Runoff losses (-) or unrecorded inflow to channel (+)	-3.74	-3.53	0.21
% of the flow at Atamyrat GS	8	7	-2
6. River flow at Bir-Ata GS	21.55	29.78	8.23
7. Losses in the reach Bir-Ata GS – Tuyamuyun GS (-)	-0.96	-4.39	-3.43
% of the flow at Bir-Ata GS	4	15	11
8. Flow regulation at TMHS: accumulation (+) or releases (-)	-1.17	-6.73	-5.56
9. Water releases from TMHS (including water diversion from the reservoir)	20.37	23.04	2.67
10. Downstream water diversion, including diversion form TMHS (-)	-15.31	-14.70	0.61
11. Downstream return CDF (+)	0.00	0.00	0.00
12. Emergency and environmental water releases into canals (-)	0.00	0.00	0.00
13. Runoff losses (-) or unrecorded inflow to the channel (+)	-2.96	-2.97	-0.01
% of the flow at Tuyamuyun GS	20	17	-3
14. Water supply to the Aral Sea and Priaralie	2.10	5.37	3.27
TOTAL losses:	-7.66	-10.89	-3.23
% of water content in the river	17	21	4

- Water content is calculated as the total of the flow at the Kerki section, water diversions upstream of the Kerki (excluding Tajikistan and Surkhandarya province) and the accumulation in the Nurek reservoir

Table 2.3

Water balance of the Amudarya river basin reservoirs for the growing season 2015

Balance item	Water volume, km^3		Deviation (actual-plan)
	Forecast/plan	Actual	
1 Nurek reservoir			
2.1 Inflow to the reservoir	16.97	19.34	2.37
2.2 Water volume in the reservoir:			
– beginning of the season (April 1, 2015)	6.00	6.78	0.78
– end of the season (October 1, 2015)	10.45	10.50	0.05
2.3 Water releases from the reservoir	12.76	15.64	2.88
2.4 Lateral inflow (+) or water losses (-)	0.24	0.02	-0.22
% of the inflow to the reservoir	1	0	-1
2.5 Flow regulation: accumulation (+) or releases (-)	-4.21	-3.7	0.51
2 TMHS reservoirs			
2.1 River flow at Bir-Ata GS	21.55	29.78	8.23
2.2 Water losses in the reach Bir-Ata GS – Tuyamuyun GS	-0.95	-4.39	-3.44
2.3 Water volume in the reservoirs:			
– beginning of the season (April 1, 2015)	2.66	3.10	0.44
– end of the season (October 1, 2015)	2.88	5.43	2.55
2.4 Water releases from the TMHS	20.38	23.04	2.66
of which:			
– water releases into the river	14.76	17.94	3.18
– water diversion	5.62	5.11	-0.51
2.5 Flow regulation: accumulation (+) or releases (-)	-1.17	-6.73	-5.56
TOTAL flow regulation by reservoirs: accumulation (+) or releases (-)	-5.38	-10.43	-5.05
TOTAL losses (-), unrecorded inflow (+)	-0.72	-4.38	-3.66