

SECTION

2

Water Resources Status  
in the Aral Sea Basin

## 2.1. Water-Management Situation in the Amu Darya and Syr Darya River Basins

### Water Resources

In 2024, the total annual runoff in the Amu Darya and Syr Darya river basins amounted to 108.24 km<sup>3</sup>.

#### Amu Darya River Basin

The total annual runoff of rivers within the smaller Amu Darya basin (the Amu Darya tributaries: Vakhsh, Panj, Kafirnigan, and Surkhandarya) amounted to 66.25 km<sup>3</sup>, including 56.4 km<sup>3</sup> of natural (unregulated) flow of the Amu Darya at the “Nominal Kerki” gauging section located upstream of intake to the Gara-gumderya Canal. The Amu Darya flow at the “Nominal Kerki” totaled 5.05 km<sup>3</sup> in the first quarter, 43.28 km<sup>3</sup> during the growing season, and 8.07 km<sup>3</sup> in October-December.

As of January 1, 2024, the combined water storage in the Nurek and Tuyamuyun reservoirs amounted to 13.26 km<sup>3</sup>.

#### Syr Darya River Basin

For the Syr Darya River basin, the total annual runoff, including the Naryn, Karadarya, and Chirchik rivers, as well as smaller rivers, amounted to 41.99 km<sup>3</sup>, of which 24.22 km<sup>3</sup> was the total inflow to three reservoirs, such as Toktogul, Andijan, and Charvak.

By January 1, 2024, the total storage of reservoirs within the basin was 17.55 km<sup>3</sup>, including 12.28 km<sup>3</sup> in the major reservoirs of the flow formation zone (Toktogul, Andijan, and Charvak reservoirs).

### Operation of Reservoir Hydrosystems

The annual inflow to the Nurek Reservoir from the Vakhsh River amounted to 20.67 km<sup>3</sup>, including 16.4 km<sup>3</sup> during the growing season, which corresponds to 79% of the annual inflow. Annual water releases from the reservoir totaled 20.5 km<sup>3</sup>, including 12.63 km<sup>3</sup> during the growing season.

The annual inflow to the Tuyamuyun Hydrosystem amounted to 21.95 km<sup>3</sup>, exceeding the forecast by 1.77 km<sup>3</sup>; inflow during the growing season totaled 15.86 km<sup>3</sup>. Annual water releases from the reservoir reached 21.12 km<sup>3</sup>, fitting the BWO Amu Darya's schedule, including 14.83 km<sup>3</sup> during the growing season or 104% of the schedule.

The annual inflow to the Toktogul Reservoir from the Naryn River amounted to 14.2 km<sup>3</sup>, including 10.7 km<sup>3</sup> during the growing season, or 75% of the annual inflow. Annual water releases from the reservoir totaled 13.45 km<sup>3</sup>, including 4.99 km<sup>3</sup> during the growing season, which represents 37% of the annual water releases. The Toktogul Reservoir was filled by

0.76 km<sup>3</sup>, and its storage reached 11.19 km<sup>3</sup> by the end of the year.

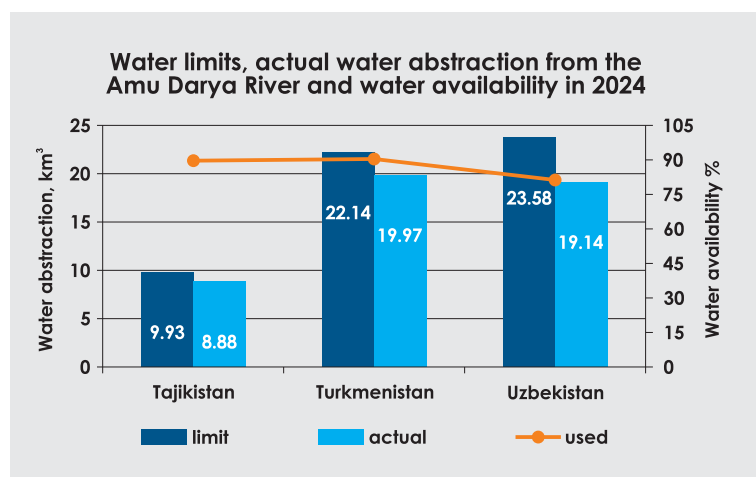
### Water Allocation and Water Shortage

The allocation of water resources in the Amu Darya and Syr Darya river basins among the Central Asian countries is carried out by the ICWC on the basis of limits/quotas established for the hydrological year (October-September). Below we show an analysis of water allocation on a calendar-year basis (January-December).

#### Amu Darya River Basin

In 2024, water abstraction from the Amu Darya River basin, against an established withdrawal limit of 55.65 km<sup>3</sup>, amounted to 47.99 km<sup>3</sup>, including 33.83 km<sup>3</sup> during the growing season. The annual limit was utilized by 86%, and by 85% during the growing season. By country, water abstraction was distributed as follows:

- Tajikistan – with a limit of 9.93 km<sup>3</sup>, actual abstraction amounted to 8.88 km<sup>3</sup>;
- Turkmenistan – with a limit of 22.14 km<sup>3</sup>, actual abstraction amounted to 19.97 km<sup>3</sup>;
- Uzbekistan – with a limit of 23.58 km<sup>3</sup>, actual abstraction amounted to 19.14 km<sup>3</sup>.



In the reach from the Nurek HPP to the Tuyamuyun Reservoir (Darganata gauging station), the water shortage amounted to 9% for Tajikistan, 2% for Turkmenistan, and 10% for Uzbekistan during the growing season. In the reach from the Darganata gauging station to the Samanbay gauging station, Turkmenistan and Uzbekistan received 26% and 29% less water, respectively, during the growing season than the required amount (limit).

### Syr Darya River Basin

The total water abstraction from the Syr Darya River basin (up to the inflow to the Shardara Reservoir) amounted to 13.44 km<sup>3</sup>, including 9.85 km<sup>3</sup> during the growing season, which corresponds to 83% of the canal withdrawal limit. Discharge from the Syr Darya River to the Arnasay Lake System totaled 704 million m<sup>3</sup> (500 million m<sup>3</sup> in 2023).

The BWO Syr Darya's plan for water abstraction from the Syr Darya River was fulfilled by 83%. In the reach from the Toktogul to the Shardara reservoirs, the water shortage amounted to 31% for Tajikistan, 10% for Kyrgyzstan, and 21% and 14% for Kazakhstan and Uzbekistan, respectively, during the growing season.

### Inflow to the Aral Sea Region

According to the Committee for Regulation, Protection and Use of Water Resources of the Kazakhstan's Ministry of Water Resources and Irrigation, the inflow into the Northern Aral Sea from the Syr Darya amounted to 2.6 km<sup>3</sup> in 2024.

1.22 km<sup>3</sup> of water was delivered to the South Aral region from the Amu Darya River (Samanbay gauging station); the total inflow, including river runoff, collector-drainage water, and canal discharges, amounted to 2.59 km<sup>3</sup>.

Based on research by SIC ICWC, the South Aral region shall receive 8 km<sup>3</sup> of water from the Amu Darya River in wet years and 3.5 km<sup>3</sup> in dry years. However actually, in 2024, 2.59 km<sup>3</sup> of water was delivered to the South Aral region.

### Meeting Water Demands

The Table below illustrates how water demands were met for the Central Asian states during the growing season.

CA republic	Meeting water demand by basin during the growing season, %	
	Amu Darya	Syr Darya
Kazakhstan	–	79
Kyrgyzstan	–	90
Tajikistan	91	69
Turkmenistan	90	–
Uzbekistan	79	86

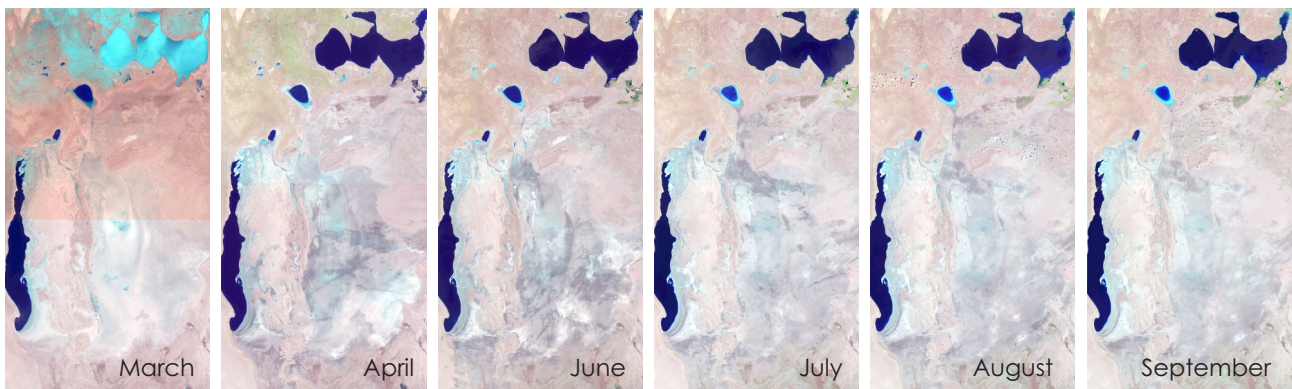
Source: SIC ICWC, based on the data of BWO Amu Darya and BWO Syr Darya

## 2.2. Large Aral Sea and the Amu Darya Delta

This section was prepared using data of the BWO Amu Darya, the Aral Sea Region Delta Authority, and the Uzbek Hydrometeorological Service (UzHydro-met). The RS-based data (Landsat 8 OLI images) on the Eastern and Western sub-basins of the Large Aral Sea (LAS) and the lake systems of the Amu Darya River delta ([http://cawater-info.net/aral/data/monitoring\\_amu.htm](http://cawater-info.net/aral/data/monitoring_amu.htm)) was also used. In the satellite imagery analysis, we utilized NDVI with the refined threshold values to identify **three surface categories**: (1) open water surface, (2) wetland, and (3) dryland. The satellite images of the Aral Sea are shown in Figure 1.

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Figure 1. Satellite images of Western and Eastern sub-basins of the Large Aral Sea Landsat 8 OLI (2024)

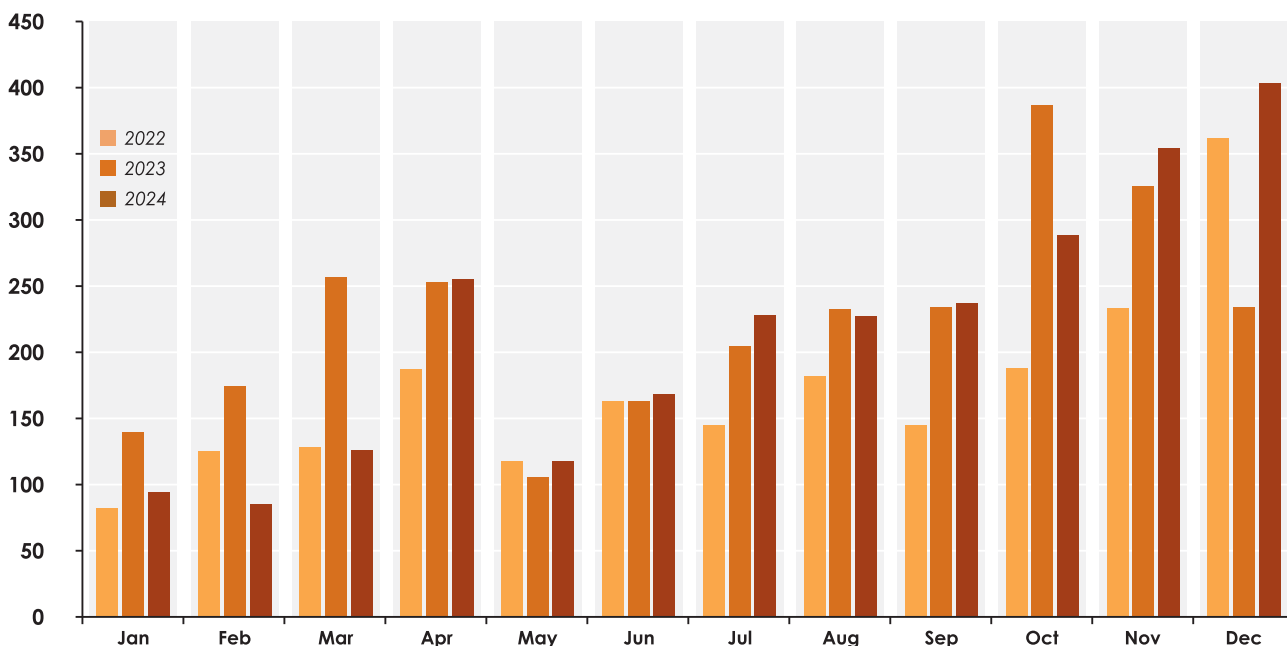


## 2.2.1. Water Supply to the Amu Darya Delta and the Large Aral Sea

### Water Supply to the Amu Darya Delta

According to BWO Amu Darya, in 2024, 2,588 Mm<sup>3</sup> of water (including river runoff and water discharged from canals and collecting drains) reached the Amu Darya Delta. This is 122 Mm<sup>3</sup> less than in 2023 but 533 Mm<sup>3</sup> more than in 2022. The monthly dynamics of water supply to the Amu Darya delta over 2022-2024 is shown in Figure 2.

Figure 2. Dynamics of water supply to the Amu Darya Delta over 2022-2024, Mm<sup>3</sup>



Source: BWO Amu Darya

### Flow from the Main South-Karakalpak collecting drain towards the exposed bed of the Large Aral Sea

Bypassing the Amu Darya Delta, 605.9 Mm<sup>3</sup> of collector-drainage water flowed towards the exposed bed of the Large Aral Sea from the Main South-Karakalpak (Right-bank) collecting drain (Table 1). This is 102.4 Mm<sup>3</sup> and 3.9 Mm<sup>3</sup> more than in 2022 and 2023, respectively.

Table 1. Flow from the Main South-Karakalpak collecting drain towards the exposed bed of the Large Aral Sea in 2022-2024, Mm<sup>3</sup>

Year	Jun	Feb	Mar	Apr	May	Lun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2022	23	25	31	51.5	54.5	52.5	43.5	42.5	48.5	50.5	45	36	503.5
2023	26	17	63	64	49	53	64	70	66	52	44	34	602.0
2024	28.1	31.3	62.5	65.6	54.3	52.1	68.1	79	61.6	49.1	30.9	23.3	605.9

Source: Aral Sea Region Delta Administration at the Ministry of Water Management of Karakalpakstan

### Total inflow into the Large Aral Sea

In 2024, water flowed to the Large Aral Sea (LAS) only from the Main South-Karakalpak collecting drain (SKCD) – 605.9 Mm<sup>3</sup>. The LAS has not got water from the Amu Darya River Delta and the Northern Aral Sea (NAS) (Table 2).

Table 2. Total inflow into LAS, Mm<sup>3</sup>

Year	North Aral Sea*		South Aral region		Total discharge into LAS
	Total inflow into NAS from the Syr Darya, Karateren site	Discharge from NAS into LAS	Total inflow into the Amu Darya Delta	Discharge from the Amu Darya Delta into LAS, including flow from SKCD**	
2022	816	0	2055	503.5	503.5
2023	2042	0	2710	602	602.0
2024	2555	0	2588	605.9	605.9

\* Committee for Regulation, Protection and Use of Water Resources of the Kazakhstan's Ministry of Water Resources and Irrigation;

\*\* Aral Region Delta Administration at the Ministry of Water Management of Karakalpakstan

## 2.2.2. Open Water Surface and Wetland Areas in Eastern and Western Sub-basins of the Large Aral Sea

Based on the results of processing of satellite images for January to September 2024, the area of open water surface decreased from 202.1 to 195.2 thousand ha in **Western sub-basin** of LAS and from 0.046 to 0.013 thousand ha in **Eastern sub-basin** of LAS (Table 3).

Table 3. The area of wetlands and open water surface in the Western and Eastern parts of LAS, 2024

Date	Mar 1	Apr 18	Jun 6	Jul 31	Aug 24	Sep 9
<b>Western part of the Large Aral Sea, thousand ha</b>						
<b>Total area</b>	<b>561.3**</b>					
<b>Wetland</b>	302.1	309.0	319.9	321.6	311.8	303.9
<b>Water surface</b>	202.1	199.2	199.1	196.9	195.4	195.2
<b>Dryland*</b>	57.1	53.1	42.3	42.8	54.1	62.2
<b>Eastern part of the Large Aral Sea, thousand ha</b>						
<b>Total area</b>	<b>1,496.8**</b>					
<b>Wetland</b>	1,316.3	1,461.3	1,432.4	1,449.8	1,434.4	1,432.5
<b>Water surface</b>	0.046	0.01	0.047	0.02	0.04	0.013
<b>Dryland*</b>	180.5	35.5	64.4	47.0	62.4	64.3

\* bare soil, rare or dense vegetation

\*\* taken as control as of 2016 (Monograph "Aral Sea and the Aral Sea Region". UNESCO, "Complex Print", Tashkent 2020, <http://cawater-info.net/library/rus/aral-sic-icwc-2020.pdf>)

Source: SIC ICWC using GIS data derived from Landsat 8 OLI images, [http://cawater-info.net/aral/data/monitoring\\_amu.htm](http://cawater-info.net/aral/data/monitoring_amu.htm)

## 2.2.3. Lake Systems in the Amu Darya Delta

Lake systems in the Amu Darya delta are represented by small local water bodies of the South Aral region. Since March to December 2024, the open water surface area of the lake systems remained virtually unchanged: 51.8 to 51.7 thousand ha (Table 4). A water supply of 2,588 Mm<sup>3</sup> to the Amu Darya delta is not enough for fisheries or for sustaining the ecosystems of Lakes Sudoche, Rybache, Muynak, and Dzhylytyrbas<sup>10</sup>.

In 2024, the inflow of collector–drainage water into local water bodies of the South Aral region (Table 5) increased compared to 2022, rising from 1,067.16 to 1,635.29 Mm<sup>3</sup>. This increase is associated with higher water deliveries to the Amu Darya delta during the growing season (Figure 2).

<sup>10</sup> SIC ICWC, based on its research, recommends delivering not less than 8 km<sup>3</sup> in average and wet years and 3.5 km<sup>3</sup> in dry years to the South Aral region, <http://cawater-info.net/biblio/Publicationview.php?KodItem=1179>

**Table 4. The area of open water surface, wetlands and dryland within the lake systems of South Aral region in 2024<sup>11</sup>, thousand ha**

Water body	TA*	Mar 1			Apr 18			Jun 6			Jul 31			Aug 24			Sep 9			Oct 3			Dec 22		
		WS	WL	DL	WS	WL	DL	WS	WL	DL	WS	WL	DL	WS	WL	DL	WS	WL	DL	WS	WL	DL	WS	WL	DL
Lake Sudoche	72.7	14.7	13.3	44.7	15.2	16.3	41.1	9.5	7.4	55.8	4.4	10.5	57.9	3.9	10.0	58.9	4.9	8.6	59.2	5.6	18.7	48.6	13.9	46.7	12.3
Mezhdureche res.	37.8	12.2	3.1	22.5	7.4	1.2	29.2	2.1	0.5	35.1	1.7	0.3	35.9	1.4	0.4	36.0	0.9	0.3	36.6	2.3	0.3	35.1	12.9	3.4	21.6
Lake Rybache	11.5	1.5	1.8	8.2	2.0	0.2	9.3	1.8	0.07	9.7	1.0	0.1	10.3	0.7	0.1	10.6	0.8	0.1	10.7	0.7	0.3	10.6	1.2	3.8	6.5
Lake Muynak	16.1	1.2	3.0	12.0	1.4	2.1	12.7	0.1	0.1	15.9	0.02	0.1	16.0	0.0	0.2	16.0	0.01	0.3	15.9	0.03	1.0	15.1	1.2	8.0	6.8
Dzhylyrbas dam-terminated	47.5	15.5	16.9	15.0	14.2	16.4	16.9	5.5	1.0	41.0	4.7	0.6	42.3	3.9	1.0	42.7	2.9	0.7	44.0	3.3	1.9	42.3	15.7	19.6	12.0
Lake Dzhylyrbas (together with former right and left streams)	98.9	1.2	16.7	81.1	1.8	10.2	86.9	0.05	0.7	98.2	0.03	0.8	98.0	0.01	0.8	98.1	0.01	0.8	98.1	0.03	4.2	94.8	0.7	52.0	46.3
Lake Dumalak	16.0	0.0	0.7	15.4	0.0	0.03	16.0	0.0	0.0	16.0	0.0	0.0	16.0	0.0	0.0	16.0	0.0	0.0	16.0	0.0	0.0	16.0	0.0	1.3	14.8
Lake Makpalkal	8.7	3.2	0.6	4.9	3.2	0.4	5.1	0.2	0.3	8.1	0.06	0.03	8.6	0.07	0.03	8.6	0.05	0.01	8.7	0.03	0.03	8.7	3.3	1.2	4.1
Lake Meshan-Karedjar	27.2	1.5	2.5	23.1	1.1	1.4	24.7	0.4	0.3	26.5	0.1	0.3	26.8	0.1	0.1	27.0	0.2	0.1	26.8	0.6	0.7	25.9	2.4	5.4	19.4
Water surface southward of Muynak	9.6	0.04	1.1	8.3	0.0	0.2	9.4	0.0	0.0	9.7	0.0	0.04	9.6	0.0	0.03	9.5	0.0	0.04	9.5	0.0	0.2	9.3	0.01	4.1	5.5
Water surface along Kazakhdarya river course	4.8	0.01	0.07	4.7	0.0	0.01	4.8	0.0	0.0	4.8	0.0	0.0	4.8	0.0	0.0	4.8	0.0	0.0	4.7	0.0	0.0	4.7	0.0	0.8	4.0
Lake Zakirkal	2.8	0.8	0.08	2.0	0.6	0.1	2.1	0.07	0.05	2.7	0.0	0.0	2.7	0.0	0.0	2.7	0.0	0.0	2.7	0.0	0.0	2.7	0.4	0.1	2.2
<b>Total:</b>	<b>353.6</b>	<b>51.85</b>	<b>59.85</b>	<b>241.90</b>	<b>46.90</b>	<b>48.54</b>	<b>258.20</b>	<b>19.72</b>	<b>10.42</b>	<b>323.50</b>	<b>12.01</b>	<b>12.77</b>	<b>328.90</b>	<b>10.08</b>	<b>12.66</b>	<b>330.90</b>	<b>9.77</b>	<b>10.95</b>	<b>332.90</b>	<b>12.5</b>	<b>27.3</b>	<b>313.80</b>	<b>51.71</b>	<b>146.40</b>	<b>155.50</b>

\* TA – Total area of water body within the boundaries of water surface (WS) and wetlands (WL) of 2016 as mentioned in the “Aral Sea and the Aral Region” monograph

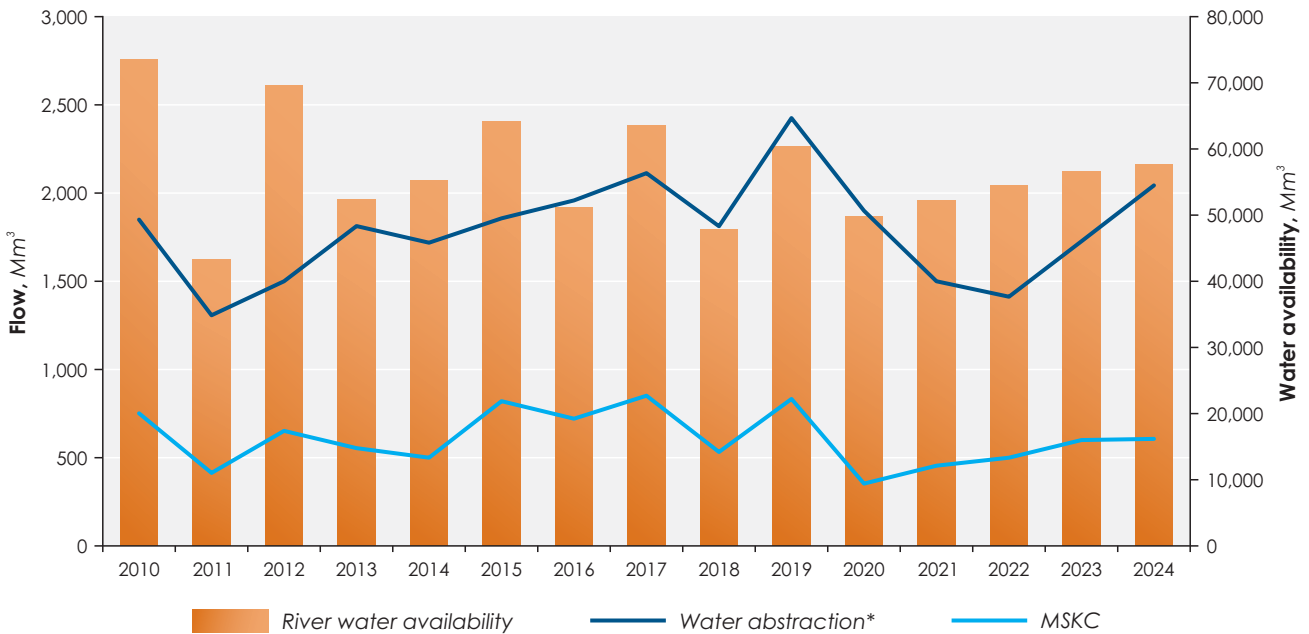
<sup>11</sup> Source: SIC ICWC using the GIS data derived from Landsat 8 OLI images, [http://cawater-info.net/aryl/data/monitoring\\_amu.htm](http://cawater-info.net/aryl/data/monitoring_amu.htm)

**Table 5. Inflow into local lakes in South Aral region over 2022-2024, Mm<sup>3</sup>**

Water body	Inflow by month												Total annual
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
<b>Sudoche</b>	13.85	14.61	22.61	29.59	27.09	30.62	26.02	31.13	34.96	30.88	21.23	19.95	<b>302.54</b>
<b>Mezhdureche</b>	28.04	46.19	60.87	25.36	12.49	22.16	10.42	45.42	24.34	25.84	98.08	122.1	<b>521.31</b>
<b>Dzhylyrbas</b>	5.32	8.53	10.25	14.90	16.10	22.69	26.46	22.48	28.18	38.27	22.93	27.20	<b>243.31</b>
<b>Sudoche</b>	17.77	22.80	41.76	45.64	31.85	34.63	39.48	47.56	54.77	53.55	32.94	19.24	<b>441.99</b>
<b>Mezhdureche</b>	76.88	68.86	45.45	11.85	8.56	20.19	49.46	38.01	33.06	99.18	143.70	64.39	<b>659.59</b>
<b>Dzhylyrbas</b>	20.16	21.15	42.19	36.09	20.59	30.91	39.02	53.99	68.60	94.63	65.61	8.54	<b>501.48</b>
<b>Sudoche</b>	18.35	16.72	38.95	48.17	31.34	31.89	41.67	54.48	54.47	72.59	33.68	20.14	<b>462.45</b>
<b>Mezhdureche</b>	26.43	24.47	12.32	12.22	13.34	24.69	21.22	4.98	33.22	42.21	96.69	165.83	<b>477.62</b>
<b>Dzhylyrbas</b>	6.36	3.83	27.37	33.01	33.60	44.34	86.42	93.16	50.64	82.74	123.99	109.76	<b>695.22</b>

Source: Aral Region Delta Administration at the Ministry of Water Management of Karakalpakstan

**Figure 3. Water delivery to the Amu Darya delta and ASB, depending on annual water availability, 2010-2024**



\* Total of RBC (Right-Bank Canal) and pumped water to Kipchak g/s (Tuyamuyun-Kipchak)

Source: BWO Amu Darya

### Conclusion

Despite lower quantity of water supplied to the Amu Darya delta compared to 2023, discharges from the Main South-Karakalpak collecting drain (SKCD) toward the Aral Sea Basin slightly increased in 2024.

This is related to annual flow conditions and, particularly, depends on the regulation of river flow at the Tuyamuyun Reservoir (Figure 3). Since the beginning of 2024, the water surface area of both the eastern and western parts of Aral Sea have decreased. Small local water bodies in the South Aral region continue facing challenges with water supply.