# Monitoring of changes in the water surface and wetland area of the Aral Sea and the Aral Region

SIC specialists are constantly monitoring the state of the Southern Aral Sea and parts of the Greater Aral Sea by using the Landsat 8 and 9 OLI images. According to the image from September 20, 2022, the areas of wetlands and open water surface were determined

**Figure 1. Western and Eastern parts of the Aral Sea. Landsat 8, 20 September 2022.**

**Table 1**

**The area of wetlands, open water surfaces and dried ground* in the Western and Eastern parts of the Aral Sea**

| | **29.04.2022** | **23.05.2022** | **08.06.2022** | **18.07.2022** | **27.08.2022** | **20.09.2022** |
|---|---|---|---|---|---|---|
| ***Western part of the Aral Sea, ha*** | | | | | | |
| Wetland | 284 687 | 5877 | 15 446 | 8659 | 4644 | 9834 |
| Water surface | 220 020 | 219 193 | 218 914 | 216 255 | 214 563 | 211 891 |
| Dried ground* | 56 642 | 342 097 | 326 990 | 336 435 | 342 143 | 339 625 |
| ***Eastern part of the Aral Sea, ha*** | | | | | | |
| Wetland | 1 292 357 | Облачно | Облачно | 5173 | 3845 | 6180 |
| Water surface | 1 624 | | | 25,38 | 145 | 46,17 |
| Dried ground * | 202 841 | | | 1 496 626 | 1 492 835 | 1 490 671 |
| | April | May | June | July | August | September |
| Water quota | 180 | 336 | 391 | 480 | 391 | 319 |
| Inflow to the Aral Region, $Mm^3$/month | 188 | 189 | 162 | 144 | 181 | 145 |

* bare soil, dense or rare vegetation

**Table 2**

**Areas of wetlands in the Aral Region, ha**

| Water body | 29.04.2022 | 23.05.2022 | 24.06.2022 | 18.07.2022 | 27.08.2022 | 20.09.2022 |
|---|---|---|---|---|---|---|
| Sudoche | 2105.35 | 228.69 | 17801.2 | 706.3 | 335.16 | 865.98 |
| Mejdureche | 2768.67 | 30 | 330.9 | 21.87 | 21.9 | 47.88 |
| Rybache | 509.04 | 0.81 | 631.3 | 0.18 | 0 | 0 |
| Muynak | 1514.34 | 3.15 | 101.6 | 1.08 | 0.45 | 2.88 |
| Djiltyrbas dam-terminated | 7184.43 | 42659.3 | 6048.45 | 102.96 | 32.22 | 21.69 |
| Djiltyrbas (together with former right and left streams) | 1715.4 | 98856.77 | 0 | 2.52 | 26.55 | 95.22 |
| Dumalak | 2012.31 | 0 | 64.44 | 0 | 0 | 0 |
| Makpalkul | 1157.13 | 34.65 | 188.82 | 126 | 0 | 0 |
| Mashan Karadjar | 1988.19 | 17.37 | 498.9 | 3.42 | 24.03 | 20.43 |
| Water surface southward of Muynak | 301.86 | 9605 | 48.42 | 0 | 0 | 0.27 |
| Water surface along Kazakhdarya river channel | 192.69 | 4751.5 | 0 | 0 | 0 | 0 |
| Zakirkol | 36.09 | 2790.04 | 0 | 0 | 0 | 0 |
| ***Total:*** | **21 485.5** | **158 977.3** | **25 714.03** | **964.33** | **440.31** | **1054.35** |

**Figure 2 The Aral Region. Landsat 8, 27 August 2022.**

**Table 3**

**The area of open water surface in the Aral region, ha**

| Water body | 29.04.2021 | 23.05.2022 | 24.06.2022 | 18.07.2022 | 27.08.2022 | 20.09.2022 |
|---|---|---|---|---|---|---|
| Sudoche | 9580.95 | 9009.99 | 6374.5 | 4270.9 | 1756.7 | 3239.37 |
| Mejdureche | 1788.48 | 1389 | 898.9 | 596.97 | 1501.2 | 1784.61 |
| Rybache | 789.48 | 628.92 | 44.19 | 0 | 0 | 0.36 |
| Muynak | 36.27 | 23.76 | 7.2 | 2.7 | 2.52 | 5.31 |
| Djiltyrbas dam-terminated | 5948.1 | 4813.02 | 1617.9 | 1286.1 | 844.56 | 322.29 |
| Djiltyrbas (together with former right and left streams) | 196.29 | 94.23 | 0 | 8.19 | 6.84 | 7.38 |
| Dumalak | 0.09 | 0 | 0 | 0 | 0 | 0 |
| Makpalkul | 815.13 | 401.58 | 0 | 573.3 | 0 | 0.09 |
| Mashan Karadjar | 181.17 | 33.57 | 0.36 | 7.65 | 63 | 152.64 |
| Water surface southward of Muynak | 0.09 | 0 | 0 | 0 | 0 | 0 |
| Water surface along Kazakhdarya river channel | 0 | 0 | 0 | 0 | 0 | 0 |
| Zakirkol | 57.78 | 1.26 | 0 | 0 | 0 | 0 |
| ***Total*** | **19393.83** | **16 395.33** | **8 943.05** | **6 745.81** | **4 174.82** | **5 512.05** |

**Table 4**

**Dried ground area* in the Aral Region, ha**

| **Water body** | **29.04.2022** | **23.05.2022** | **24.06.2022** | **18.07.2022** | **27.08.2022** | **20.09.2022** |
|---|---|---|---|---|---|---|
| Sudoche | 61010.7 | 63458.32 | 48521.3 | 67719.8 | 70605.14 | 68591.65 |
| Mejdureche | 33226.85 | 36365 | 36554.2 | 37165.16 | 36260.9 | 35951.51 |
| Rybache | 10194.48 | 10863.27 | 10817.51 | 11492.82 | 11493 | 11492.64 |
| Muynak | 14613.39 | 16137.09 | 16055.2 | 16160.22 | 16161.03 | 16155.81 |
| Djiltyrbas dam-terminated | 34339.86 | 401.58 | 39806.04 | 46083.33 | 46595.61 | 47128.41 |
| Djiltyrbas (together with former right and left streams) | 97039.31 | 5.76 | 98951 | 98940.29 | 98917.61 | 98848.4 |
| Dumalak | 14037.6 | 16050 | 15985.56 | 16050 | 16050 | 16050 |
| Makpalkul | 6711.74 | 8247.77 | 8495.18 | 7984.7 | 8684 | 8683.91 |
| Mashan Karadjar | 25031.64 | 27150.06 | 26701.74 | 27189.93 | 27113.97 | 27027.93 |
| Water surface southward of Muynak | 9303.05 | 0 | 9556.58 | 9605 | 9605 | 9604.73 |
| Water surface along Kazakhdarya river channel | 4558.81 | 0 | 4751.5 | 4751.5 | 4751.5 | 4751.5 |
| Zakirkol | 2697.43 | 0.81 | 2791.3 | 2791.3 | 2791.3 | 2791.3 |
| ***Total*** | **312 764.8** | **178 679.6** | **318 987.1** | **345 934.0** | **349 029.0** | **347 077.7** |

* bare soil, dense or rare vegetation

**Notes:** From 2012 to 2019, to determine the area of the water surface and wetlands, satellite image data were digitized manually with a comparison of the NDVI index (Normalized Difference Vegetation Index/ Standardized Index of differences in vegetation Cover). Since 2019 SIC ICWC has started using the methodology of water surface and wetlands recognition based on a controlled AWEI pixel value classification (Automated Water Extraction Index). At the beginning of 2022, it was decided to return to the use of the NDVI index, but according to the specified threshold values. The main provisions of past and new approaches are presented below so that users can correctly interpret and compare data from different years.

Until 2022, the total area of the reservoir was defined as the sum of the area of open water surface and the area of wetlands. However, the question of the exact division of the wetlands area in order to distinguish it from the land (dry, degraded lands) remained open. Therefore, since 2022, the use of the NDVI index with refined threshold values has been started, which allow recognizing three categories of surfaces: 1) open water surface, 2) wetlands, 3) land. Their descriptions and threshold values for the NDVI index are given in the table below. In order to further classify water bodies based on the results of the study, NDVI thresholds were selected: < -0.001 for open water, -0.001-0.05 for wetland and > 0.05 for other Earth surface coverings. Currently, the materials (2021 and 2022) on the site have been updated according to an improved methodology. In this regard, there may be some discrepancies when compared with data from previous years.

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