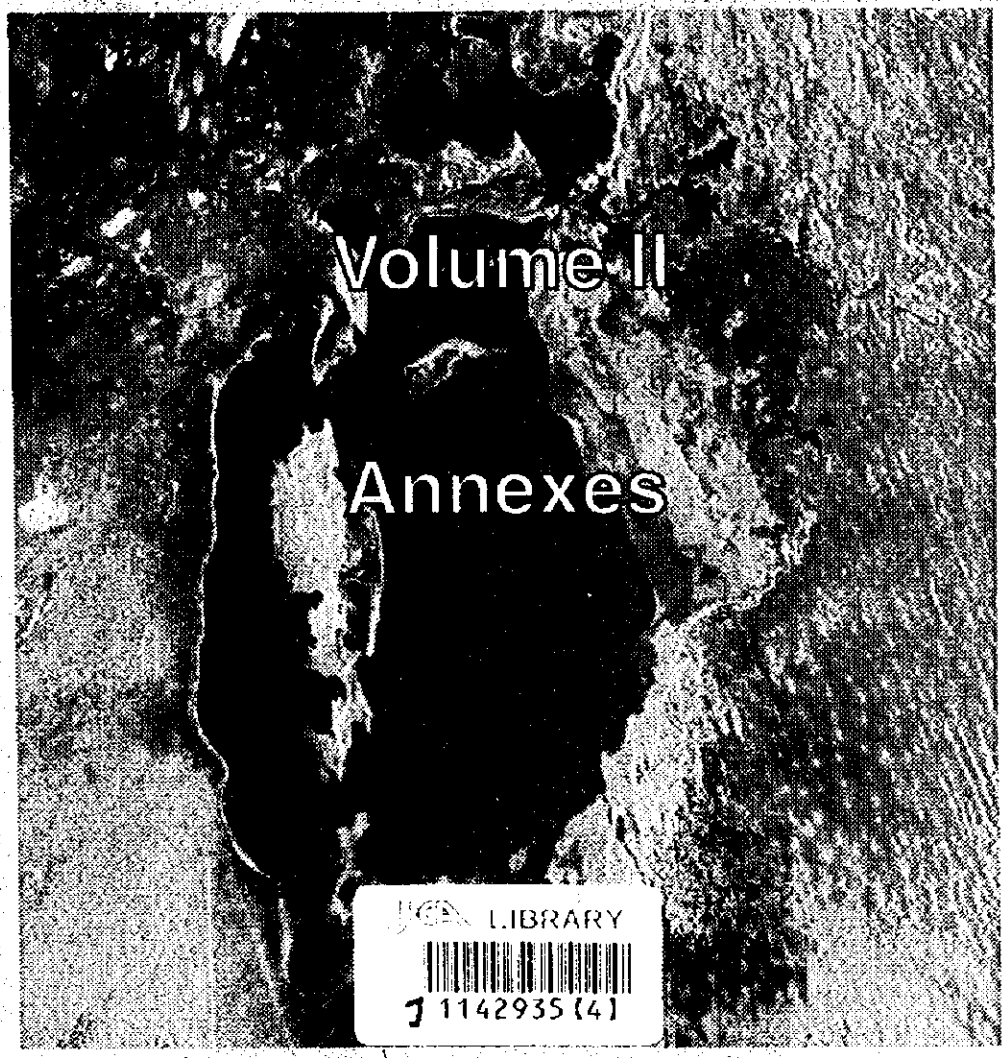
Japan International Cooperation Agency (JICA)

Ministry of Agriculture
Government of Kazakstan

THE STUDY
ON
KZYL-ORDA IRRIGATION/DRAINAGE AND WATER MANAGEMENT PROJECT
IN
THE REPUBLIC OF KAZAKSTAN



March 1998

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Sanyu Consultants Inc.
Aero Asahi Corporation

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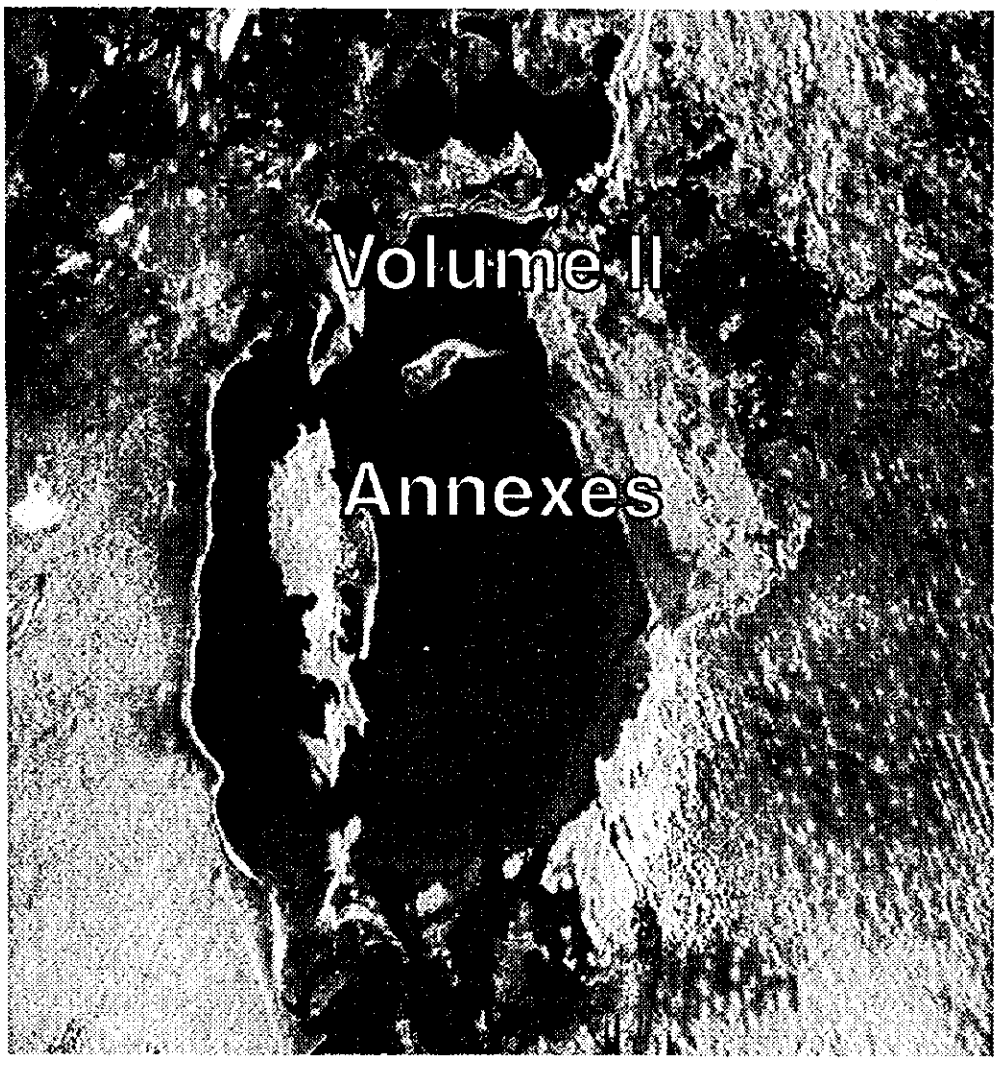

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Exchange Rate

US$ 1 = T. 68.0 = J. Yen 110.0 (As of October 1996)
US$ 1 = T. 75.0 = J. Yen 115.0 (As of August 1997)

ANNEX - A

METEOROLOGY AND HYDROLOGY

ANNEX - A

METEOROLOGY AND HYDROLOGY

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ANNEX - A METEOROLOGY AND HYDROLOGY

1. General

This Annex describes the results of meteo-hydrological study made during the Phase I and Phase II of JICA Study on the Kzyl-Orda Irrigation/Drainage and Water Management Project. Investigations and studies were carried out to clarify the natural conditions in the study area in order mainly to assess the availability of surface water resources for the Project and water saving for Aral sea. The main activities of the Study were:

(1) Collection of meteorological data for precipitation, air temperature, air relative humidity, wind speed, and sunshine records from several meteorological stations in and around the Study Area,

(2) Collection of river discharge data from 12 discharge gauging stations,

(3) Collection of sediment load data in the Syr Darya,

(4) Collection of data on annual river water use in Kzyl-Orda Oblast,

(5) Collection of data on annual water level of Aral sea,

(6) Collection of information on the water share of the Syr Darya for Kazakstan,

(7) Field survey to examine the working condition of meteorological and discharge gauging stations, and

(8) Analysis of collected data.

2. Collected data

2.1 Meteorological Data

There are 12 meteorological service stations in and around the Study Area operated under the management of the Hydro-Meteorological Center. Their inventory and locations are shown in Table A.1 and Figure A.1, respectively. Periods of available meteorological data are shown in Table A.3 and Table A.4. Taking their location and recording periods into the consideration, the Kzyl-Orda station is selected to represent the study area. The Kzyl-Orda station is recording precipitation, air temperature, air relative humidity, and wind speed. The monthly data of these records from the year 1964 to 1995 at the station were obtained from the Kzyl-Orda Hydro-Meteorological Center. The sunshine records were not available at the station. Therefore, they were estimated from the nearest station of Chirikrabad. Average monthly climatic data at other stations in the Syr Darya basin were also collected. Precipitation intensity data were not available for the study in and around the study area. However, one-day maximum precipitation and three-day maximum precipitation data at the Kzyl-Orda Station were collected for the period from 1963 to 1996.

2.2 Hydrological Data

There are 12 discharge gauging stations in the Syr Darya river basin operated under the management of the Hydro-Meteorological Center. Their inventory and locations are shown in Table A.2 and Figure A.1 respectively. Monthly river discharge data were collected for 12 gauging stations, of which 9 stations scatter along the Syr Darya river course and 3 stations on its tributaries. Periods of available discharge data are shown in Table A.5. For the Kzyl-Orda gauging station, 10-day discharge data were also collected for last 20 years (1976-1995). The Syr Darya monthly inflow discharges into the Chardara reservoir are collected for the period from 1970 to 1996. The data on monthly drainage discharge of the Kuvandarya river were collected for last 6 years (1991-1996). The annual water stage levels at the Aral sea discharge gauging station near Aralsk city, were also collected from 1963 to 1996.

2.3 Sediment Data

The measurements of suspended sediment load in the Syr Darya are available at the Tomenariyk and Kergelmes gauging stations. Monthly suspended load data were collected at the Kergelmes station for the period from 1970 to 1995. The sediment load was measured at the several points in the irrigation and drainage canals and the Syr Darya during the Phase I of the Study.

3. Meteorology

The study area is located in the transition area of semi-desert and desert agro-climatic zone. It has a continental climate with hot and dry summers, and cold and snowy winters. The climate of the Study Area is represented by the Kzyl-Orda Meteorological Station (Latitude 44° 51' North, Longitude 65°30' East, and Altitude 128 m above Baltic mean sea level).

3.1 Precipitation

Monthly and annual precipitation at the Kzy-Orda Meteorological Station from the year 1963 to 1996 are shown in Table A.6. Annual precipitation varies from 80.7 mm to 310.6 mm during the 34 years period. Mean annual precipitation is estimated at 155 mm. Variation of monthly and annual precipitation are shown in Figure A.2 and Figure A.3, respectively. Rainy season is from November to May and about 80% of precipitation has been recorded during this period. The average precipitation during the cultivation period (April-September) is only 40 mm, or 25% of the annual precipitation. The precipitation during the crop growing period is in form of rainfall. During the winter season from November to February, the precipitation is mostly snowfall.

One-day maximum and 3-day maximum precipitation in the year from 1963 to 1996 are shown in Table A.7. The one-day maximum precipitation varies from 6.3 mm (1975) to 53.7 mm (1993) and three-day maximum precipitation varies from 7.7 mm (1975) to 61.0 mm (1993).

3.2 Precipitation Probability

For the irrigation and drainage planning of the Study Area, the precipitation probability is examined. Taking into the consideration the recording duration more than 30 years and its location in the Study Area, the Kzyl-Orda station was selected for this analysis.

The probability of annual precipitation was estimated by means of Gumbel method, which is considered to be best-fit, as shown in below table. The precipitation in a dry year is 114 mm and in a wet year 195 mm. The probabilities of one-day maximum and 3-day maximum precipitation are also shown in the following table.

Probable Annual Precipitation at the Kzyl-Orda Station

Year	Probability of Exceedance (%)	Annual Precipitation (mm)	One-Day Maximum Precipitation (mm)	3-Day Maximum Precipitation (mm)
Wet	20	195	21.7	29.4
Normal	50	149	15.5	19.6
Dry	80	114	10.7	13.1

Probable monthly precipitation at the Kzyl-Orda station is shown in the following table. The probable (dry year) precipitation 1 in 5 year return period during the cultivation period (May to August) is negligible.

Probable Monthly Precipitation at the Kzyl-Orda Station

Return	Month Precipitation (mm)											
period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1/10	4.39	2.38	3.88	0	0	0	0	0	0	0.0	2.55	3.53
1/5	7.96	6.15	6.88	3.01	1.56	0	0	0	0	1.78	5.78	7.49

3.3 Air Temperature

The monthly mean, monthly mean maximum, and monthly mean minimum air temperature are tabulated in Tables A.8 to A.10. The mean annual air temperature is 9.9 °C and mean annual maximum is 15.8 °C. From May to September is summer season, having a mean maximum air temperature over 25 °C. The highest temperature peak occurs in July, occasionally rises up to about 35 °C. April to September are warmer months, when the temperature is generally above 20°C. The mean monthly minimum varies from -11.0 °C in January to 20.7 °C in July, and mean annual minima is 4.3 °C. The coldest period is from December to February with average temperatures below 0°C, and that may decrease to at -8.2°C in January. Average duration of the period with average daily temperature above 0°C is about 220-250 days, and non-frost period is 175-185 days. Stable temperature above 12 °C is set in general from the middle of April, and this time is adopted as the beginning of rice sowing.

3.4 Relative Humidity

Table A.11 shows the average monthly air humidity at the Kzyl-Orda station. The average relative humidity is about 56% and varies from about 35% in the summer season to about 80% in the winter season as shown in Figure A.4.

3.5 Sunshine Hours

Sunshine duration data at the Kzyl-Orda station are not available. Therefore, sunshine duration was estimated from the nearest station of Chirikrabad. The monthly sunshine duration at the Chirikrabad station is shown in Table A.12 and illustrated in Figure A.4. During the year sunny weather prevails. Sunny months are from May to September, with duration, generally, from 10 to 12 hours/days; whereas in winter season sunshine duration decreases to around 5 to 6 hours/day. The annual mean sunshine hours is 8.6 hours. The mean monthly sunshine hour varies from 4.6 hours in December to 12.4 hours in July.

3.6 Wind Speed

The monthly mean wind speed data from year 1963 to 1995 are tabulated in Table A.13 and average monthly wind speed illustrated in Figure A.4. During the year there are mostly north-east winds with velocity of 3-4 m/sec. The mean wind speed at the Kzyl-Orda Meteorological station is 3.4 m/sec, varying from 2.8 m/sec in November to 4.2 m/sec in April. Usually the strong winds take place in spring and at the beginning of summer. At the Kzyl-Orda Station, wind speed is measured at the height of 11 m above the ground surface.

3.7 Evaporation

The mean monthly evaporation at the Chardara and Aral sea stations are shown in the following table. The annual evaporation from Aral sea is 995 mm and from the Chardara reservoir 1114 mm. The evaporation usually varies from day by day under the influence of air temperature, relative humidity and rainfall, etc. The mean monthly evaporation at Aral sea varies from 9 to 182 mm.

Monthly and Annual Evaporation

Station	Evaporation (mm)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Chardara	8	15	21	55	119	191	245	208	130	78	32	12	1114
Aral Sea	20	9	18	40	98	144	169	182	142	91	47	36	995

3.8 Potential Evapotranspiration

Monthly potential evapotranspiration (ET_o) is estimated for 5 stations in the river basin using monthly climatic data as shown in Table A.14. The Modified Penman method was used for the calculation of ET_o. The estimated monthly and annual ET_o at 5 stations is shown in Table A.15. ET_o varies from 0.46 mm/day in December to 8.68 mm/day in July at the Kzyl-Orda station. Annual ET_o in the Study area (Kzyl-Orda) is estimated at 1557 mm.

3.9 Recommendations

At present, the Kzyl-Orda Meteorological station does not have sunshine recorder, and pan evaporation recorder. The installation of these instruments are recommended for the Kzyl-Orda station.

4 Hydrology

4.1 National Water Resources

There are 8 major river basins in Kazakstan. Total annual water resources in Kazakstan averaged 100.9 BCM (Billion Cubic Meter), of which only 56 BCM originate within boundaries of Kazakstan. The remaining water resources come from neighboring countries. After accounting for water committed for the release to Russia, domestic and ecological water supply requirements, reservoir dead storage and conveyance losses, the remaining flows available for irrigation are limited to 46.2 BCM per year. Due to the highly irregular flow of most of rivers, their development for economic uses is only possible through stream flow regulation by storage reservoir. Many rivers, especially the larger ones, have been provided with long-term and seasonal regulation by reservoirs and storage ponds. At present, Kazakstan has 204 reservoirs, with a total capacity of 95.5 BCM and a total area in excess of 10,000 km^2. Of the total, 23 have capacities of more than 100 MCM (Million Cubic Meter) and 41 have capacities more than 10 MCM. Potential annual yield of usable ground water is estimated at 15 BCM, mostly in southeast, of which 2.5 BCM has been developed. In Kazakstan, total regular irrigation is practiced on 2.38 million hectares, of which 95.6% are irrigated with surface water, 3.6% with groundwater and 0.8% with sewage water.

4.2 Syr Darya River Basin

The Syr Darya river is a major surface water source in the Study Area. The Syr Darya originates from the Tian Shan mountains in Kyrgzstan, where the river is called Naryn, then it flows down through Uzbekistan joining right-side tributary called Chirchick and takes the name of the Syr Darya till Aral sea. The catchment area of the Syr Darya is 240,000 km^2. The natural discharges of the Syr Darya are regulated by the Chardara reservoir and other reservoirs located in the drainage basin upstream as shown below.

S.N.	Reservoir & Hydroplant	River Basin	Year of Operation	Live Storage (BCM)	Installed Capacity (MW)	Yearly Avg Evaporation (BCM)
1	Toktogul	Naryn	1974	14.07	1200	0.086
2	Chardara	Syr Darya	1965	4.24	100	0.719
3	Kayrakkum	Syr Darya	1956	2.57		0.333
4	Charvac	Chirchick	1970	1.60	600	0.024
5	Andghigian	Kara Darya	1980	1.60	100	0.035
6	Bugun	Bugun	1970	0.36		0.041
7	Chakir System	Chakir		2.08		0.038
	Total			26.52	2000	1.276

Remark : BCM= billion cubic meter, MW = mega watts

The Toktogul is the biggest reservoir in the drainage basin upstream, which regulates the river flow on a multi-annual basis. In the upstream part of the catchment, there are four main irrigation areas that are High Naryn, Fergana valley, Middle Syr Darya and Chakir which account for more than 2.7 million hectares. Shortly downstream of the inlet into the Kazak territory, the Syr Darya enters the Chardara reservoir from which its flows are regulated and released to feed a hydro power plant, an irrigation canal and downstream river course. Flow in excess is spilled from a separate outlet, controled by gates, into the Arnasai depression, in Uzbekh territory. In the territory of Kazakstan, it flows in South-Kazakstan and Kzyl-Orda Oblasts.

The river flows a length of 1650 km from the Chardara reservoir to Aral sea. The river is flowing through meanders from bed elevation 225 to 50 m asl. For 920 km till Kzyl-Orda town, the river bed is well confined in both banks and the irrigation area is developed mainly in the left side of the river. Downstream Kzyl-Orda till Zhusali (220 Km), river morphology becomes very flat on both sides and the Syr Darya river branches into Karaozek (right side). From Zhusali till Aklak (400 km), the river has narrowed. The Syr Darya river width varies from 150 to 200 m and depth from 2 to 5 m. The flow speed is 0.8 m/sec and high water lasts for 6 to 7 months (September to March). The river freezes in December and is open in February-March. Along the Syr Darya river, mainly downstream of Kzyl-Orda, during winter season, in presence of very low temperature, there are ice formation obstructing the hydraulic section and limiting the discharge capacity of the river.

The river bifurcates into two channels, namely the Syr Darya and Karaozek rivers, about 35 km downstream of Kzyl-Orda, and rejoins about 190 km downstream of the bifurcation point. Only two tributaries join the Syr Darya river from the right side; the Keles river, just before the Chardara reservoir inlet, and the Aris river, some 250 km downstream of the reservoir. The contribution of these rivers to the Syr Darya river is scarce, since their flows are mostly diverted for irrigation along their upstream reaches. The annual natural discharge of Aris river is 2.5 BCM and normally does not reach any more to the Syr Darya river, because they are used for irrigation and industrial needs in the region of Shimkent. For this reason, presently the Aris river forms a separate hydrological system and only marginally, during winter, it influences the discharge of the Syr Darya river.

The important permanent structures existing on the Syr Darya river are (i) Chardara multipurpose reservoir (ii) Kzyl-Orda headworks for irrigation diversion, and (iii) Kazalinsk headworks also for irrigation diversion. There are three temporary structures along the Syr Darya river for rising flows during the dry period. The temporary structures are Aitek diversion, Amanotkel and Aklak intakes in delta area of the Syr Darya river. All the temporary structures are located in the downstream of the Kzyl-Orda headworks.

4.3 Water Sharing of the Syr Darya

Monthly inflow to the Chardara reservoir is affected by the water uses in the upstream Republics (Kyrgyztan, Tajikistan, Uzbekistan) and the by the regulation of natural discharges operated by the upstream reservoirs. The Syr Darya river flow is used basically in accordance with the interstate agreement of the five Republics involved (Kyrgyztan, Tajikistan, Uzbekistan, Turkmenistan and Kazakstan). The interstate agreement between Republics of Kazakstan, Kyzgyzstan, Uzbekistan, Tajikistan and Turkmenistan for the use of the Syr Darya river water has been signed on February 18, 1992 at Almaty. According to this agreement, the annual share of Kazakstan is 10 BCM at 75% guarantee and 8.7 BCM at 95% guarantee. Average annual inflow to the Chardara reservoir was 13,668 MCM (1970-1996) that is higher than the internationally agreed volume. Figure A.5 shows the comparison between annual inflow to the Chardara reservoir and annual release from the reservoir into the Syr Darya river during 1970-1995.

The water share of the Chardara water release for the Kzyl-Orda and South Kazakstan Oblasts is according to the criteria shown in the following table.

Oblast	Annual Water Share (BCM)	
	75% guarantee	95% guarantee
Kzyl-Orda Oblast	7.2	6.05
South Kazakstan	2.8	2.75

Every year, a month before the irrigation period, the Oblast Water Resources Committee decides the share of each irrigation system.

4.4 Chardara Reservoir

The Chardara is a multipurpose reservoir; irrigation, hydropower and flood protection, is located at the boundary with Uzbekistan about 250 km south-west of Shimkent. The main purpose of the reservoir is to provide irrigation to South Kazakstan and Kzyl-Orda Oblasts. The reservoir capacity is 5.22 km^3, dead storage is 0.98 km^3 and the useful volume for reservoir operation is 4.24 km^3. The reservoir is formed by a 4.76 km long dam having average height of 12.5 m. It is a very shallow storage with the average depth of only 6.5 m, and has a surface area of 890 km^2. The dam crest is at 254.5 aBsl (above Baltic mean sea level) elevation and is 10-meter wide. The normal high water level of the reservoir is at 252 m aBsl and minimum water level is at 244 m aBsl.

The power house is located just at the dam toe in the Syr Darya river bed. The power house is installed with four units of generators with 25 MW (Mega Watts) each totaling 100 MW. The units can discharge an aggregate flow of 780 m^3/sec with a head of 15.8 m. The minimum maintenance flow through turbines is 100 m^3/sec. According to operating rule, yearly energy production should be 377 GWh (Giga Watts hour). The energy production during 1995 was 346 GWh and 453 GWh during 1996 . In each lateral side of the power house, there is a bottom outlet, each one controlled by two gates of 5 m wide and 6 m high; maximum discharge capacity of the two outlets is 920 m^3/sec at the normal high water level.

The overall discharge capacity of the Chardara complex is 3,975 m^3/sec (Turbine 780 m^3/sec, power house outlet gates 920 m^3/sec, 200 m^3/sec Kzylkumsk canal and Arnasay outlets 2,075 m^3/sec). The Study Area is located in the lower course of the Syr Darya river, about 920 km downstream of the Chardara reservoir.

The flow, needed the downstream reaches for irrigation, is released through the four turbines. During summer, the needs exceed the maximum capacity of the turbines (from 500 to 780 m^3/sec according to head), the lateral gates of the power house are opened till a

controlled release of around 1,200 m^3/sec that is the present maximum allowed discharge to the Syr Darya river.

Inflow to the Chardara consists of sanitary (maintenance) release from the Kaikakum reservoir, idle flow from the Chakir river and return flow from the middle stream of Chakir. river. From September to April, the Chardara reservoir is filling up along with water release for irrigation needs. In April, the reservoir should be filled up to full capacity. Then, it begins to release the stored water for the irrigation needs. At the time of the shallow critical period (less water season) when all water of useful volume used, the compensative flow from the Toktogul reservoir is foreseen in July-August. In order to release guaranteed outflow during the drought year, it is necessary to have 2.7 BCM of stored water in the reservoir at the beginning of critical period.

Monthly inflow to the Chardara reservoir is shown in Table A.17. The average annual inflow to the reservoir during 1970-1996 was 13,668 MCM, while the annual inflow during 1974-1977 was less than 8,000 MCM as the Syr Darya river water was used in the upstream for filling the dead storage of the Toktogul reservoir which started operation in 1974. The inflow during the summer season decreases due to water intakes for the upstream irrigation systems.

During 1969-70 to 1972-73, there was spilled water of 22,116 MCM in total from the Chardara reservoir to the Arnasai depression. During the period from 1973-74 to 1991-92, there was no spill to Arnasai depression. In last five year from 1992-93 to 1996-97, there was again spill to Arnasai depression totaling 17,922 MCM. Since 1992, the Toktogul reservoir operation rule has been changed to more power oriented operation. The Toktogul reservoir has been operated mainly for irrigation till 1987, producing in winter only 20-25% of the annual energy. Since 1992 the reservoir operation has been more power oriented producing more than 45% of the total annual energy during winter.

4.5 Kzyl-Orda Headworks

The Kzyl-Orda Headworks is located about 920 km downstream of the Chardara. It has been built for diverting water for the irrigation of both crops and pastures. The construction was started in 1941, but stopped during the world war. The construction work was resumed and completed in 1956. The weir is composed of a concrete ogee divided into 5 sluice ways with 16 m width. Each one presently surmounted by 6-m high radial gate. The overall dimensions are 170-m wide, 125-m long and 12-m high.

The normal high water level is set at 129 m asl; 6-m above the bottom of the approach channel at 123 m asl. The crest of the weir is at elevation 133.8 m asl. In normal condition, the weir can discharge 1200 m^3/sec and it was designed for a return flood of 100 years corresponding to 1900 m^3/sec. There are two irrigation intakes, one in each side of the weir. Both have front galleries to prevent bed load transportation to enter into the canals. The right bank intake has a capacity of 110 m^3/sec and it is controlled by three sliding gates with 5-m width and 3.8 m height. The total width of the intake is 22 m. The left bank intake has a capacity of 218 m^3/sec and it is controlled by six sliding gates with 5 m width and 3.8 m height. The total width of the intake is 41 m.

4.6 Aral Sea

Annual water level of the Aral sea is shown in Table A.16 and illustrated in Figure A.6. Figure shows that water level of the Aral sea has started lowering since the year 1960 and the sea was divided into two portion in the year 1990. At present the Aral sea is divided into two portions, namely: the Large Aral sea in the south, partially belonging to Uzbekh territory, and the Small Aral sea in the north. These two portions have separated since the beginning of the years 1990's by a natural edge of the sea bottom at around 40 m in elevation.

The small Aral sea, laying totally in Kazak territory, is fed by the Syr Darya, whereas the Large sea is fed by the Amu Darya, which flows in the Uzbekh territory.

The water level of the Aral sea was 52.63 m asl in 1963 and has dropped to the present level (end of 1996) of 36.5 m asl. Thus, the water level of the Aral sea has lowered for 16.13 m in 33 years. The water surface has been reduced by 50% (from 65,600 to 32,500 km^2) during the last 33 years. The characteristics of the small Aral sea are shown in Figure A.7. The small sea in the north part, most pertinent to the present study, is presently separated from southern portion. This part has lost 55% of its original surface (from 6,500 to 2,900 km^2) and 70% of its original volume (75 km^3 to 22 km^3).

The specific water inflow to the Small Aral sea is several times higher than that of the Big Aral sea, while the yearly evaporation is much higher in the latter. These factors have caused a sharp decrease of the water level in the Big Aral sea and the gap between the two portions, divided by the Berg strait, is presently around 3.0 m. Through the strait, the Small Aral sea is loosing a part of its incoming flows towards the Big Aral Sea declining further without improving the ecological balance of the latter. A dike (called Kokaral from the name of peninsula) built across the Berg strait could counter the declining regime of the Small Aral sea without causing any harm to the Big Aral sea and keep water level at 45 asl. A spillway releasing the excess flows to the Big Aral sea is foreseen in the west-south part of the Shevochenko Gulf providing periodic flushing operation to control the mineralisation of the waters.

4.7 River Discharge

The monthly river discharge of 10 stations is shown in Table A.18 to A.27. The average annual and monthly river discharges at three stations i.e., Chardara, Kyzl-Orda and Kazalinsk, are illustrated in Figure A.8 and A.9, respectively. The annual release from the reservoir was below 8,000 MCM during the period from 1974 to 1977 due to water use in the upstream for filling the dead storage of the Toktogul reservoir as discussed earlier. The river flows released from the Chardara reservoir are concentrated during the growing season from April to August, with about 70% of the annual total. The annual river flows released from the Chardara reservoir during the 26-year period (1970-1995), were 12,272 MCM (388 m^3/sec) on an average, varying from 5,266 MCM (166 m^3/sec) in 1975 to 21,453 MCM (678 m^3/sec) in 1993. The annual river flows at the Kazalinsk station during the 26-year period (1970-1995), were 3,795 MCM (120 m^3/sec) on an average, varying from 480 MCM (15.2 m^3/sec) in 1977 to 10,048 MCM (371 m^3/sec) in 1994. The discharge during the cultivation period in some years reduced below 25 m^3/sec. The average monthly and annual river discharge at the various stations in the Syr Darya river are summarized in Table A.28.

4.8 Kuvandarya River

The Kuvandarya river is receiving drainage discharge from the Study Area. The two main drainage canals of the Project, the North Main Collector and South Main Collector, supply 297 MCM annually to the Kuvandarya river during the cultivation period (May-September). The annual discharge into the Kuvandarya river during the period from 1991 to 1996 is shown in Table A.29. The Kuvandarya river is receiving 61.4 MCM annually from the Zhanadarya river. The average annual drainage discharge from the Study Area (North and South Main Collectors) into the Kuvandarya is 297 MCM. The average annual discharge in the Kuvandarya river after the joining with the said collectors was 320 MCM during the period from 1991 to 1996. The monthly discharge in the Kuvandarya river at the downstream of the junction point with North and South Collectors is shown in Table A.30. It represents the drainage discharge from the Study Area, most of which comes during irrigation period. The annual water use of the Kuvandarya river is shown in Table A.31. The Kuvandarya water is mainly used for hay making and lake system. Table A.32 shows major lakes located in the Kuvandarya river basin.

4.9 Sediment Loads

The average annual suspended loads in the Syr Darya river was 153 mg/lit varying from 37 mg/lit in January to 390 mg/lit in May during the period from 1970 to 1989 at the Kergelmes gauging station located 85-km upstream of the Kzyl-Orda Headworks. The average monthly suspended load at the Tomenariyk and Kergelmes stations is shown in Table A.33 and A.34. In the present study, the measurements of suspended loads were conducted at the 3 points between Kzyl-Orda and Zhalagash during September-October, and the result showed that the average suspended loads at the three points was 104 mg/lit. In addition, the measurements were also conducted at 8 points in the irrigation canals and 8 points in the drainage canals at the end of irrigation period, which showed 91 mg/lit and 112 mg/lit of average sediment loads respectively.

4.10 Recommendations

The discharge gauging station in the upstream of the Kzyl-Orda headworks is damaged and not working. Therefore, repair of the station is recommended along with the installation of new automatic water stage recorder.

5 Availability of Water Resource

5.1 Available Water for the Study Area

The water flow at the Kzyl-Orda Headworks is diverted into the Left Main Canal (LMC) and Right Main Canal (RMC), and the remaining flows down and used for downstream irrigation areas and Aral sea. The LMC diverts river flow from the Kzyl-Orda Headworks into the Study Area. Therefore, water available for the Study Area is the amount of water which can be diverted into the LMC from the headworks, though the river flow is regulated by the Chardara reservoir and the amount of water for each canal is planned a month before irrigation starts.

The measured river discharge at the downstream of the Kzyl-Orda station is available. To determine the water availability for the Study Area, river discharge at the upstream of Kzyl-Orda Headworks is needed. Therefore, it was estimated using the discharge data of the Kzyl-Orda downstream station and inflow to the LMC and RMC. The discharge at the upstream of the Kzyl-Orda Headworks was estimated using following equation.

$$Q_{kzyl\text{-}up} = Q_{kzyl\text{-}down} + Q_{LMC} + Q_{RMC} + \text{Losses}$$

Where, $Q_{kzyl\text{-}down}$ is the discharge at the downstream of the Kzyl-Orda Headworks, Q_{LMC} is the discharge diverted into the LMC from the headworks, Q_{RMC} is the discharge diverted into the RMC from the headworks. Losses were neglected between two stations (upstream and downstream stations) as these stations are closely located each other..

The estimated discharge at the upstream of the Kzyl-Orda headworks is shown in Table A.35. The average annual discharge is 8,076 MCM (255 m^3/sec), of which 5,412 MCM (342 m^3/sec) is available during the cultivation period (April-September). The probable discharges were calculated in dry year (1 in 5 year return period) and normal year (1 in 2 year return period). The annual river discharge during the dry year (1 in 5 year return period) was estimated at 4,814 MCM, of which 3,481 MCM (72% of annual total) flows during the cultivation period. While the annual discharge during the normal year (1 in 2 year return period) was estimated at 7,760 MCM, of which 5,124 MCM (66% of annual) flows during the cultivation period. The monthly and seasonal discharges at the headworks are summarized in the following table.

Return Period	Drought Discharge (m^3/sec)												Discharge Volume (MCM)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Apr-Sep	Oct-Mar	Total
	Kyzl-Orda Headworks														
5 Year (Dry)	56.0	55.3	95.6	110.4	321.1	338.4	278.7	175.9	55.3	43.7	52.2	63.0	3481	1121	4814
2 Year (Normal)	148.5	155.7	206.3	250.3	429.3	437.8	376.6	289.6	155.5	117.4	131.6	154.7	5124	2488	7760
	Left Main Canal (Project Area)														
5 Year (Dry)	-	-	-	11.0	161.9	174.3	152.0	86.2	-	-	-	-	1632	-	1632
2 Year (Normal)	-	-	-	40.5	181.2	190.9	176.4	107.7	-	-	-	-	1852	-	1854

Remark : Dash (-) indicates no release of irrigation water from the headworks

The available water for the Study Area (LMC) was estimated based on the discharge at the upstream of headworks, water diverted into the RMC and discharge at the downstream of the Kzyl-Orda headworks. The water available for the Study Area (LMC) is shown in Table A.36. The average discharge during cultivation period is 1,858 MCM (119 m^3/sec). The water available for diversion for LMC was estimated at 1,632 MCM in the dry year and 1,854 MCM in the normal year. 10-day probable discharges available at the Kzyl-Orda Headworks and Left main canal are shown in Table A.37 and Table A.38.

5.2 Available water at the Chardara reservoir

The Chardara reservoir is the main water resource for irrigation system in the Kzyl-Orda and South Kazakstan Oblasts. The average inflow of the Syr Darya river to the Chardara reservoir was 13,668 MCM during 1975-1994. The annual inflow in dry year (1 in 5 years return period) was estimated at 9,100 MCM. The Chardara reservoir supplies water to the Kzylkumsk canal and the Syr Darya river. The Kzylkumsk canal intakes the water directly from the Chardara reservoir by separate facility. Its average annual intake from the reservoir was 1,412 MCM during the period from 1985 to 1995. Meanwhile, the annual release from the reservoir to the Syr Darya river was fixed to be 8,150 MCM at 90% guarantee according to operation criteria of the reservoir. However, the release from the Chardara reservoir was 12,272 MCM during 1985-1995. The available discharges volume at several points along the river course are shown in the following table:

S.N.	Station	Available Discharge Volume (MCM)					
		Average (1970-1995)			1 in 5 year return period		
		Apr to Sep	Oct to Mar	Annual	Apr to Sep	Oct to Mar	Annual
1	Inflow into Chardara			13668			9100
2	Chardara (Release to Syr Darya)	8998	3274	12272	6697	1275	7972
3	Kzyl-Orda Headworks (upstream)	5412	2664	8076	3481	1121	4814
4	Left Main Canal (from Headworks)	1905		1905	1632		1632
5	Kazalinsk	1720	2069	3795	262	686	948

6 Irrigation Area and Water Use

6.1 Irrigation Area and Water Use in the Study Area

The irrigation area and river water use in the irrigation schemes of the Syr Darya basin during the period 1985-1995 are shown in Table A.39. The average irrigation area during this period in the two Oblasts was 342,635 hectares, of which 254,662 hectares was in the Kzyl-Orda Oblast. The average irrigation area of the Study Area was 80,353 hectares, however, it is decreasing in the recent years. The average river water use in the two Oblasts was 6,801 MCM, of which is 1,920 MCM in the Study Area.

The irrigation schemes along the Syr Darya river are shown in Figure A.10. The irrigation area and irrigation water use in these irrigation schemes during the year 1995 are shown in Table A.40. About 5,893 MCM river water was used for irrigating 323,500 hectares in the two oblasts (South Kazakstan and Kzyl-Orda). Table A.41 shows irrigation area and water use during the year 1996 in irrigation system of the Syr Darya river basin. It

also includes the information on developed area, cropping area, design discharge, length of main canal and construction date.

Table A.42 shows the monthly balances of river flow between the Chardara and Kazalinsk stations during the cultivation period (April to September). These balances represent the water use including losses and gains of the Syr Darya water between the Chardara station and the Kazalinsk station. The average water use during the cultivation period is 7,172 MCM (459 m^3/sec).

The Syr-Darya water is also used in hay cultivation area and lake system. Table A.43 shows the hay area, number of lakes and volume of lakes in the LMC (Study area), RMC and Kzyl-Orda oblast during 1985-1996. Average hay cultivation area (1985-1996) in the Kzyl-Orda Oblast was 87,250 hectares of which 3,963 hectares (4.5%) was located in the Study Area.

The Syr Darya water use (plan and actual) during 1995 and 1996 for different sectors is shown in Table A.44 and Table A.45. The Syr Darya water use is divided into three categories: (i) industrial and domestic needs, (ii) fishing, and (iii) agricultural needs. The agricultural needs is further divided into irrigation needs, ecological needs (hay making and lake system), and losses in Canals (mainly Zhanadarya and LMC). The Chardara reservoir releases water into the Syr Darya river (downstream course) and into Kzyl-Kumsk canal (directly from the reservoir). Therefore, total water use from the Chardara is sum of the water use in the downstream Syr -Darya river course and in the Kzyl-Kumsk canal. Table A.45 shows water use only in the Kzyl-Orda Oblast .

6.2 Irrigation Area and Water Use in Priority Area

The priority area consists of two farms, Shagan and Ilyasov and these farms take water from the Left Main Canal. The irrigated area and water use in these two farms during the year 1985 to 1996 are shown Table A.46. The average irrigation area of two farms was 12,422 hectares during 1985-1996 period. The irrigation area in the two farms is sharply decreasing in recent years but irrigation water use does not show such trend. This may be due to poor operation and water management of the irrigation system. The average annual water use in the two farms is 240 MCM (from the Left Main Canal). The area of different crops grown in two farms is shown in Table A.47 and A.48.

7 Water Balance and Water Saving with the Project

7.1 Water Balance of the Study Area

The irrigation requirement in the Study Area "with Project" condition is estimated at 1,206 MCM for 87,000 hectares irrigation area, which is 714 MCM lower than the present irrigation requirement of 1,920 MCM during the period 1985-1995 for 80,350 hectares. Therefore, there is 37.2% water saving in the Study Area after implementation of the Project. The irrigation requirement in other irrigation systems of the river basin is estimated at 3,794 MCM assuming the similar conditions as the Study Area will be attained in future. Therefore, the total irrigation water requirement in two oblasts would amount to 5,000 MCM, of which 1,060 MCM is for the Kzylkumsk canal. After knowing these water requirements, the water balance study is made between the river discharge of the Syr Darya river and the water requirements, and its results are shown in the Table A.49. According to this table, the water release from the Chardara reservoir to the downstream reaches of the Syr Darya river can be increased by 352 MCM which can be saved in the Kzylkumsk canal under "with project" condition. The irrigation water demand in other irrigation areas in the Kzyl-Orda Oblast is estimated at 3,736 MCM, which is 1,449 MCM lower than present demand. The present irrigation water use is 38% of water release from the reservoir, which will decrease to 26.8% with the Project. The irrigation requirement and water saving "with project" condition in two Oblast are shown in the following table:

Oblast	Irrigation System	Irrigation Area (ha)	Water Use		Water Saving (MCM)
			Present (1985-1995) (MCM)	With Project (MCM)	
South Kazakstan	Kzylkumsk	66,500	1,412	1,060	352
	Others	21,500	204	204	0
	Sub Total	88,000	1,616	1,264	352
Kzyl-Orda	LMC	87,000	1,920	1,206	714
	Others	168,000	3,265	2,530	735
	Sub Total	255,000	5,185	3,736	1,449
Total		343,000	6,801	5,000	1,801

Remark : LMC = Left Main Canal (Study Area)

Under the "with project " condition, the annual irrigation water demand is estimated at 5,000 MCM for 343,000 hectares of irrigation area in the two oblasts, which is 1,801 MCM less than the present irrigation demand for the same irrigation area. Thus, there is 26.5% water saving for Aral sea under "with project " condition. The annual inflow into Aral sea will increase from 3,568 MCM to 5,369 MCM under "with project" condition applying to all projects of Kzyl-Orda and South Kazakstan Oblasts in the Syr Darya basin. The annual evaporation rate from Aral sea is estimated at 2,920 MCM for present water level (40.3 m) and 5,330 MCM at 50 m water level. As the estimated inflow to Aral sea under "with project" condition is more than present evaporation rate, the water level of Aral will rise in future. The annual inflow to Aral sea will increase 20% (714 MCM) under "with project" applying only to Study Area (LMC) as shown below.

Case	Present Water Use (1985-95) (MCM)	Future Water Use (MCM)	Water Saving (MCM)	Present Inflow into Aral Sea (MCM)	Future Inflow into Aral (MCM)	% Increase of Flow with Project Condition
With Project Condition LMC Only (Study area)	1,920	1,206	714	3,568	4,282	20
With Project Condition applying to all Projects of two oblasts	6,801	5,000	1,801	3,568	5,369	50

7.2 Water Balance of the Priority Area

The river discharge at the Kzyl-Orda Headworks is diverted into LMC and RMC, and the remaining flows down and is used for the downstream irrigation areas and Aral sea. LMC supplies irrigation water to whole Study Area of 87,000 hectares including the Priority Project Area of 13,690 hectares. The water available for the diversion to LMC is estimated at 1,632 MCM in dry year and 1,854 MCM in normal year. Since the future water demand for the Priority Project Area is estimated at 192.4 MCM, the available water is sufficient to irrigate the Priority Project Area.

The irrigation area and irrigation water use in the Priority Project Area during 1985-1996 is shown in the Table A.46. The irrigation water requirement in the Priority Project Area at the headworks under "with project" condition is estimated at 203 MCM for the irrigation area of 13,690 hectares, which is 80 MCM lower than the present irrigation water requirement of 282 MCM at the headworks during the period of 1985-1996 for 12,422 hectares. Therefore, about 28% water can be saved at the headworks for Priority Project Area after implementation of the Priority Project Area. The irrigation water requirement and water saving at the headworks with the implementation of Priority Project Area are shown in the following table.

Water Saving at the Headworks with Priority Project Condition

Farm	Irrigation Area	Irrigation Water Requirement at the Headworks for Priority Project Area		Water Saving
		Present	With Project	
	(ha)	(MCM)	(MCM)	(MCM)
Ilyasov	6,480	150	96	54.0
Shagan	7,210	133	107	26
Total	13,690	283	203	80

The water saving at the headworks will help increasing inflow into Aral sea. The annual inflow into Aral sea will increase from 3,568 MCM to 3,648 MCM under with project condition (priority area). Thus, there is 2.2% increase in flow into Aral sea with the implementation of Priority Project Area only. The inflow into Aral sea under "with project" condition is shown in the following table.

Case	Present Water Use (1985-95) (MCM)	Future Water Use (MCM)	Water Saving (MCM)	Present Inflow into Aral Sea (MCM)	Future Inflow into Aral (MCM)	% Increase of Flow with Project Condition
With Project Condition Priority area (13,690 ha) Only	283	203	80	3,568	3,648	2.2
With Project Condition Whole Study area (87,000 ha)	1,920	1,206	714	3,568	4,282	20

Tables

Table A.1 List of Meteorological Stations in the Syr Darya River Basin

S.N.	Station	Latititude North	Longitude East	Altitute aBsl	Records Available						Working Since
					P	T	RH	Wind Speed	SS	E	
1	Chardara	41°20'	67°55'	271	√	√	√	√		√	1928
2	Turkestan	43°16'	68°13'	206	√	√	√	√	√		1886
3	Kzyl Orda	44°51'	65°30'	128	√	√	√	√			1883
4	Zhusali	45°31'	64°05'	101	√	√	√	√			1920
5	Kazalinsk	45°46'	62°07'	66	√	√	√	√	√		1882
6	Aralsk (Aral sea)	46°50'	61°41'	62	√	√	√	√	√	√	1907
7	Shimkent	42°18	69°36	606	√						1920
8	Blinkovo	42°14'	70°09'	1212	√						1909
9	Zlika	45°13'	66°52'	138	√						1951
10	Syngirtek	46°09'	67°00'	230	√						1976
11	Barsakelmes	45°36'	59°48	80	√						1950
12	Chirik Rabad	44°04	62°54'	88	√				√		1942

Remark : P=Precipitation, T= Temperature, SS=Sunshine and E=Evaporation

Table A.2 List of Hydrometrical Stations on the Syr Darya

S.N.	Name of Station	Rive/Lake	Distance from Mouth (Km)	Working Since
1	Chardara	Syr Darya	1633	1959
2	Koktube	Syr Darya	1281	1974
3	Tomen Ariyk	Syr Darya	996	1913
4	Kergelmes	Syr Darya	804	1962
5	Tasbuget/Kzyl-Orda	Syr Darya	718	1931
6	Karaozek	Syr Darya	684	1913
7	Zhusali	Syr Darya	494	1961
8	Kazalinsk	Syr Darya	181	1911
9	Karateren	Syr Darya	15	1993
10	Karaozek Flow	Karaozek Flow		
11	Keles Mouth	Keles		
12	Ariys Mouth	Ariys		

Table A.3 Periods of Available Precipitation Data

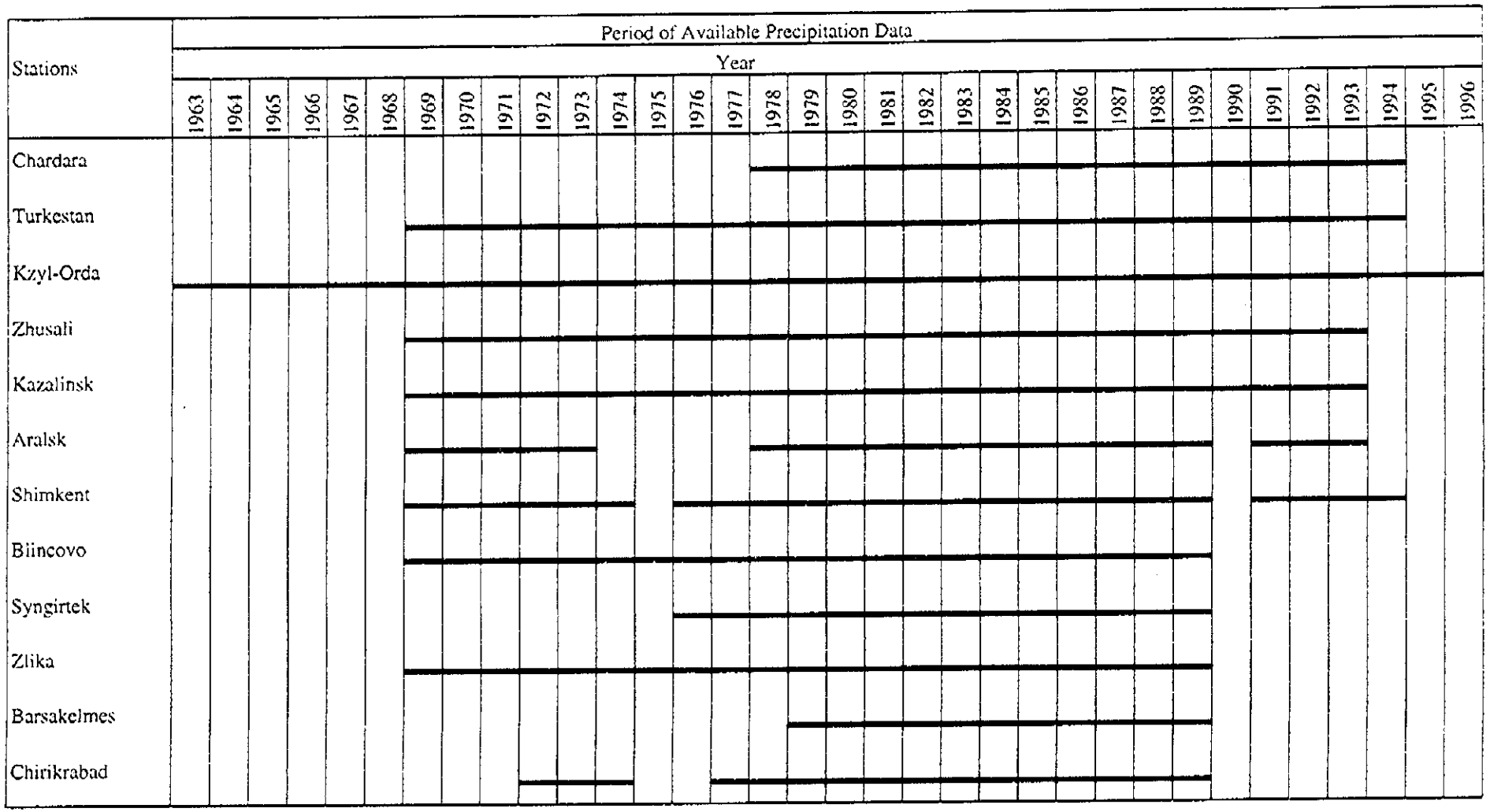

Table A.4 Periods of Available Meteorological Data

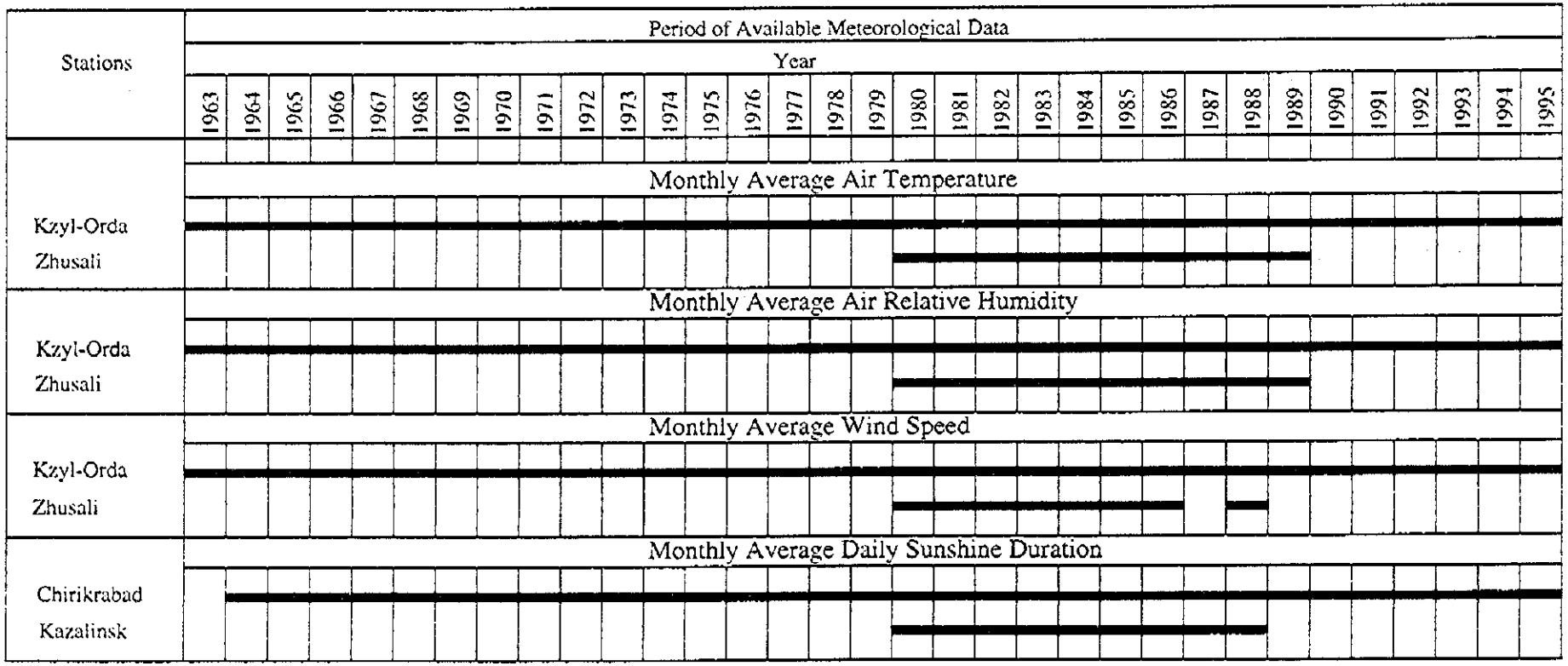

Table A.5 Periods of Available Discharge Data of the Syr Darya and Its Tributaries

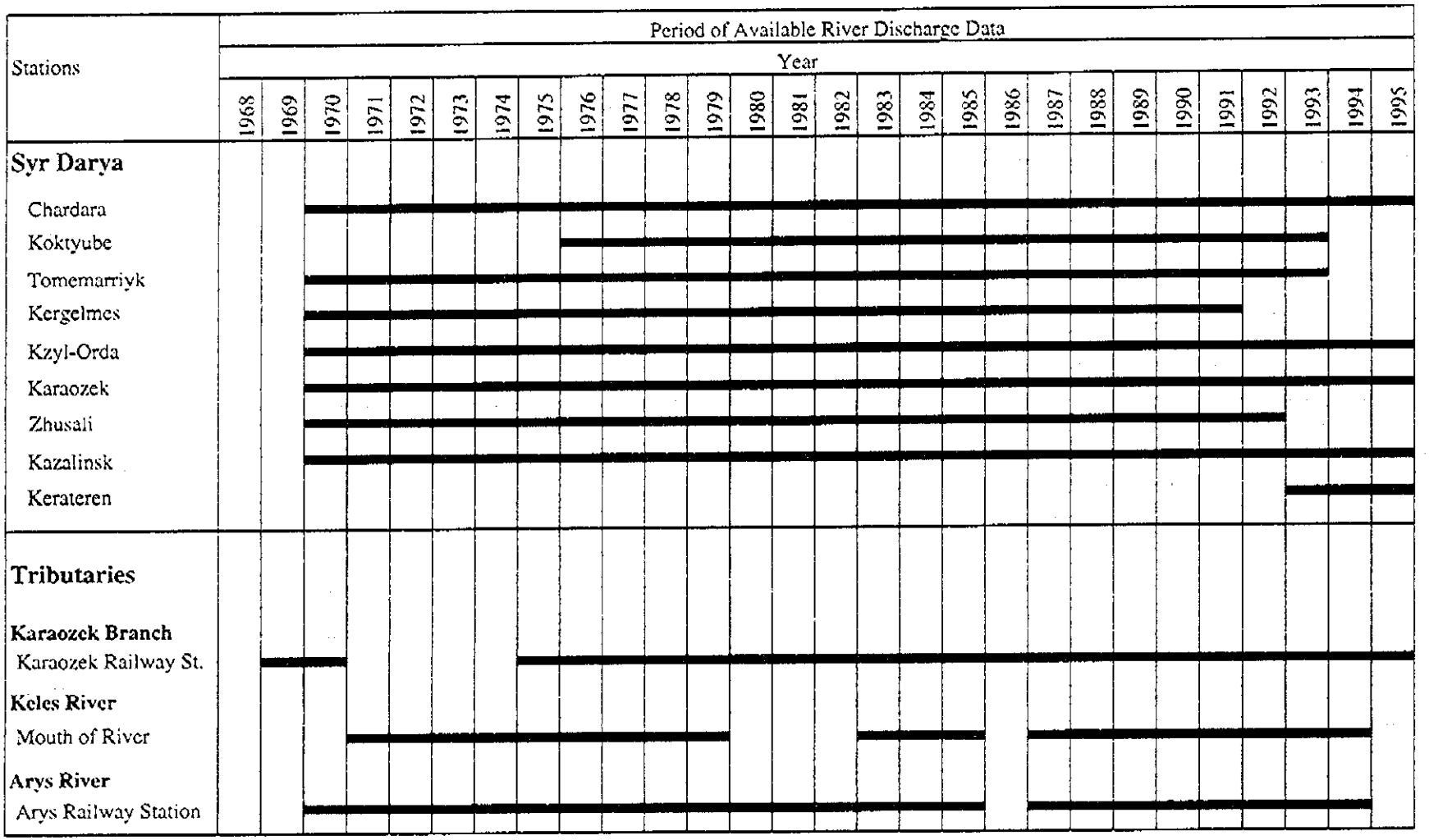

Table A.6 Precipitation - Monthly and Annual (mm)

Station: Kzyl-Orda (128 m aBsl)

	Precipitation (mm)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1963	10.0	2.0	7.0	5.7	33.2	11.8	11.5	0.0	0.0	1.3	7.0	11.0	101
1964	23.0	3.0	37.9	18.3	5.0	23.4	5.8	0.9	3.6	5.5	7.0	16.0	149
1965	6.5.0	9.0	13.7	4.8	0.7	0.1	0.2	0.7	1.7	23.5	16.0	1.0	86
1966	16.0	6.0	5.2	4.3	6.5	22.1	8.0	13.5	0.2	7.2	16.0	21.0	126
1967	13.0	18.0	8.6	33.9	6.6	6.5	3.9	0.0	0.9	26.8	25.0	11.0	153
1968	11.0	14.0	33.0	12.0	1.2	1.2	27.9	0.2	0.1	4.3	13.0	7.0	125
1969	0.0	3.0	52.5	52.5	3.4	2.8	8.2	6.2	1.7	42.9	4.0	11.0	188
1970	5.0	6.0	18.7	7.1	3.1	1.8	3.9	3.6	2.6	1.9	7.0	20.0	81
1971	2.0	5.0	3.5	8.0	2.9	5.0	0.0	0.7	0.0	11.9	5.0	48.0	92
1972	31.6	5.0	24.1	12.3	63.8	5.1	1.1	1.2	0.0	2.8	11.0	5.0	163
1973	18.0	23.0	6.3	41.3	8.9	0.0	0.0	0.0	11.7	25.3	8.0	7.0	150
1974	15.0	0.3	5.8	64.4	25.5	2.4	4.2	4.5	2.8	0.0	10.0	4.0	139
1975	14.0	26.0	17.2	1.2	0.0	0.4	1.8	0.0	0.0	3.4	14.0	17.0	95
1976	6.0	25.0	33.9	34.7	5.2	3.7	0.6	0.4	1.5	31.6	20.0	5.0	168
1977	15.0	10.0	20.1	0.7	0.0	3.2	1.9	4.8	6.1	11.3	11.0	12.0	96
1978	25.0	9.0	18.4	34.5	37.1	22.5	2.4	0.0	2.5	12.1	32.0	30.0	226
1979	3.0	24.0	3.6	23.2	12.6	2.1	0.0	1.9	2.9	13.3	2.0	26.0	115
1980	22.0	10.6	25.3	15.7	16.8	0.0	0.0	4.0	0.4	9.3	35.0	20.0	190
1981	10.0	20.6	36.7	51.5	54.8	69.4	0.6	10.1	9.5	0.0	22.0	25.0	318
1982	14.0	20.0	13.2	3.1	4.1	0.4	6.0	0.3	17.1	25.0	15.0	10.0	128
1983	28.0	23.0	18.9	12.7	22.6	8.8	0.0	6.4	0.6	16.0	28.0	45.0	216
1984	16.0	42.0	60.7	16.0	20.9	1.2	0.0	0.3	0.6	7.9	14.0	2.0	182
1985	13.0	29.0	13.4	3.4	13.0	0.0	0.0	11.6	0.0	16.3	2.0	29.0	131
1986	20.0	2.0	21.0	1.0	21.2	0.0	6.2	2.1	5.6	5.0	20.0	40.0	144
1987	11.0	23.0	9.5	22.9	18.7	8.0	16.5	0.0	4.1	3.6	9.0	36.0	162
1988	20.0	30.0	15.2	7.4	6.5	14.1	13.5	3.8	18.2	6.7	6.0	23.0	170
1989	41.0	15.0	9.3	43.3	16.7	0.6	17.4	0.9	5.6	2.6	27.0	17.0	197
1990	29.0	19.0	33.0	20.9	5.6	4.1	0.8	0.0	0.0	23.6	20.0	35.0	195
1991	34.0	7.0	4.3	8.3	75.4	17.9	7.2	1.2	15.6	2.8	38.0	27.0	239
1992	27.0	26.0	5.1	31.2	16.8	0.7	0.0	20.1	0.0	0.6	3.0	23.0	154
1993	13.6	11.9	15.7	2.9	82.4	12.2	1.3	3.0	0.0	5.0	53.9	12.5	214
1994	25.5	21.1	19.9	0.3	22.7	15.7	1.2	5.4	0.8	3.0	29.4	10.6	155
1995	3.5	6.6	12.9	2.0	18.3	16.7	1.8	5.2	3.2	34.8	7.1	8.4	121
1996	4.6	2.1	11.4	3.9	9.8	5.8	13.0	0.0	3.6	34.9	7.4	5.8	107
Avg	15.3	13.9	18.7	18.7	19.1	8.5	5.0	3.4	3.6	12.5	16.9	18.3	155
Max	41.0	30.0	60.7	64.4	82.4	69.4	27.9	20.1	18.2	42.9	53.9	48.0	310.6
Min	0.0	0.3	3.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	2.0	1.0	80.7

Table A.7 One-Day Maximum and 3-Day Maximum Precipitation (mm)

Station : Kzyl-Orda

Year	One-Day Maximum Precipitation (mm)	Three-Day Maximum Precipitation (mm)
1963	16.0	29.4*
1964	17.0	17.8
1965	19.0	19.4
1966	12.4	13.3
1967	6.7	22.3
1968	13.9	27.9
1969	27.2	33.6
1970	7.9	9.1
1971	12.6	12.6
1972	25.8	55.9
1973	18.8	18.9
1974	18.0	18.0
1975	6.3	7.7
1976	11.7	18.9
1977	8.5	11.9
1978	14.2	17.4
1979	14.1	21.2
1980	15.8	22.5
1981	26.5	28.6
1982	11.1	13.9
1983	16.9	22.0
1984	17.1	27.0
1985	9.2	12.2
1986	14.9	26.9
1987	16.2	20.2
1988	14.5	17.8
1989	17.4	26.5
1990	17.4	19.0
1991	24.0	39.5
1992	12.0	12.4
1993	53.7	61.0
1994	15.7	15.7
1995	16.4	18.7
1996	15.0	21.0

Remark: * Estimated from 10-day Precipitation

Table A.8 Average Monthly Air Temperature (°C) - Monthly and Annual Average

Station : Kzyl-Orda

	Average Monthly Air Temperature (°C)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1963	-3.8	1.0	3.6	10.8	20.9	25.1	26.8	22.5	15.8	9.8	3.1	-5.1	10.9
1964	-8.6	-10.7	1.5	11.5	18.8	23.1	26.0	23.7	15.9	8.3	3.2	-6.6	8.8
1965	-8.6	-7.1	5.3	11.0	20.8	23.9	28.4	23.6	17.4	8.0	2.7	-3.2	10.2
1966	-4.3	-1.5	6.2	12.1	17.4	26.3	27.9	25.9	18.2	7.3	-1.8	-10.1	10.3
1967	-12.7	-9.9	0.9	13.7	20.1	24.5	26.1	24.4	16.5	9.1	1.0	-2.1	9.3
1968	-5.2	-7.3	5.0	10.1	20.7	24.6	25.4	25.3	16.7	7.1	-7.0	-9.3	8.8
1969	-19.0	-16.4	-1.3	11.9	18.5	25.4	26.5	22.8	17.6	8.7	2.6	-4.0	7.8
1970	-10.8	-2.8	0.0	14.3	20.3	24.6	27.2	24.1	17.9	9.6	5.0	-9.1	10.0
1971	-11.6	-7.6	1.0	10.7	19.2	24.7	27.4	23.5	19.6	10.9	5.0	8.0	10.9
1972	-15.4	-13.5	-3.2	12.0	19.2	24.1	25.1	22.6	16.8	9.2	2.5	-5.6	7.8
1973	-10.6	-5.7	1.5	13.4	19.1	26.1	27.4	24.8	15.3	8.0	3.4	-2.9	10.0
1974	-13.0	-15.3	0.6	11.6	20.9	25.2	28.4	23.5	18.3	11.1	1.3	-9.4	8.6
1975	-5.7	-8.8	2.1	15.3	19.8	26.3	29.5	25.4	19.5	7.9	-2.6	-5.4	10.3
1976	-1.1	-11.5	-5.5	12.0	21.6	25.8	27.6	27.6	17.4	4.6	-3.9	-9.6	8.7
1977	-16.2	-8.7	3.4	15.8	22.6	28.5	27.5	24.1	18.9	8.0	3.4	-5.4	10.2
1978	-9.3	-10.3	0.4	12.7	17.7	24.7	28.0	23.2	20.3	8.4	2.3	-2.6	9.6
1979	-7.8	-2.0	3.3	11.8	18.8	23.9	28.4	25.1	19.0	11.8	7.0	-5.0	11.2
1980	-11.2	-12.1	-3.3	13.1	20.9	25.4	28.8	23.5	17.1	9.6	4.9	-1.1	9.6
1981	-3.2	-3.5	4.8	11.8	17.6	22.7	28.0	25.4	17.8	9.4	1.0	-6.3	10.5
1982	-7.9	-8.7	-3.3	14.8	21.0	24.6	26.7	24.8	18.1	9.8	-6.0	-4.9	9.1
1983	-3.0	-1.0	3.2	16.3	20.4	25.3	29.9	25.8	17.1	8.7	3.5	-4.1	11.8
1984	-7.0	-14.9	-2.2	10.2	19.7	26.0	29.5	26.5	17.4	10.1	1.3	-14.9	8.5
1985	-8.8	-2.1	-2.4	14.0	19.5	26.5	27.4	23.7	18.2	7.7	-8.0	-4.0	9.3
1986	-4.2	-8.0	-0.7	13.6	21.1	24.7	27.3	24.2	19.8	8.3	-4.0	-3.8	9.8
1987	-3.8	-3.3	1.5	9.6	20.0	24.9	26.4	25.9	17.5	8.1	-1.5	-2.7	10.2
1988	-5.3	-11.7	-0.7	14.6	18.1	27.8	27.8	24.4	19.0	9.5	3.9	-1.5	10.5
1989	-5.9	-5.5	1.6	9.4	19.5	26.5	29.4	25.4	17.4	11.4	2.2	4.0	11.3
1990	-9.0	-3.1	5.2	13.8	20.8	27.9	27.2	25.0	20.1	9.0	2.1	-5.5	11.1
1991	-9.4	-9.2	-3.6	14.1	19.2	26.7	28.4	24.8	18.8	12.3	3.6	-4.0	10.1
1992	-3.6	-2.5	-1.3	12.8	17.7	24.9	27.0	22.6	16.7	8.7	3.5	-2.3	10.4
1993	-6.4	-6.0	0.9	12.4	17.8	25.6	27.7	24.7	16.4	8.9	-5.9	-11.0	8.8
1994	-9.8	-11.3	-2.5	11.1	20.7	27.1	26.2	25.6	17.2	11.0	4.1	-3.6	9.7
1995	-7.3	-1.2	3.8	23.8	20.4	26.8	28.3	24.5	20.7	10.2	4.8	-6.5	12.4
Mean	-8.2	-7.3	0.8	12.9	19.7	25.5	27.6	24.5	17.9	9.1	1.1	-4.8	9.9
Max	-1.1	1.0	6.2	23.8	22.6	28.5	29.9	27.6	20.7	12.3	7.0	8.0	12.4
Min	-19.0	-16.4	-5.5	9.4	17.4	22.7	25.1	22.5	15.3	4.6	-8.0	-14.9	7.8

Table A.9 Average Maximum Temperature (°C) - Monthly and Annual Average

Station : Kzyl-Orda

	Average Maxima Temperature (°C)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1974	-8.2	-9.1	7.7	17.6	27.9	32.2	34.9	30.1	25.6	19.5	7.5	-4.8	15.1
1975	-0.9	-2.0	10.7	22.7	27.5	33.3	36.5	32.4	27.3	15.0	4.0	-1.0	17.1
1976	-1.1	-5.6	0.9	18.3	28.4	32.3	33.8	34.9	24.3	10.2	1.6	-5.6	14.4
1977	-11.6	-2.9	10.0	23.6						14.6	8.3	-1.1	5.8
1978	-4.7	-5.0	6.3	19.4	23.9	31.5	34.8	30.1	28.6	16.0	6.8	1.5	15.8
1979	-2.9	3.0	7.0	18.9	26.3	31.0	35.0	32.4	26.1	18.8	8.0	3.3	17.2
1980	-6.1	-6.9	3.4	19.2	28.2	32.0	35.0	30.2	25.0	15.6	8.8	2.5	15.6
1981	0.1	1.3	11.2	18.1	23.7	28.7	34.5	31.9	25.1	16.6	6.8	-3.0	16.3
1982	-3.3	-2.6	3.0	22.7	28.4	31.4	33.4	31.2	25.7	16.0	3.3	0.7	15.8
1983	1.6	4.5	11.0	23.6	26.4	31.9	37.0	32.6	24.3	16.1	9.1	0.5	18.2
1984	-3.5	-8.5	4.9	17.6	26.7	35.9	36.1	33.9	25.4	17.5	7.0	-10.3	15.2
1985	-4.4	1.8	3.1	22.1	27.2	33.7	33.8	30.4	26.2	13.6	5.4	0.7	16.1
1986	-0.8	-2.2	4.0	21.2	28.6	31.4	34.0	31.1	27.5	16.3	4.7	-0.2	16.3
1987	1.4	2.8	6.0	16.1	27.0	31.4	32.5	32.7	24.4	12.3	4.4	2.8	16.2
1988	-1.0	-6.6	5.6	22.9	25.5	35.3	34.5	31.2	26.4	17.5	10.1	2.8	17.0
1989	-1.9	-0.5	8.9	18.4	26.5	33.0	35.7	32.6	24.8	18.6	7.6	3.1	17.2
1990	-4.1	-1.6	11.3	20.5	28.2	34.8	33.5	31.7	28.7	15.7	7.7	-0.9	17.1
1991	-4.2	-4.2	4.7	21.2	26.6	33.6	34.8	31.6	26.7	20.6	7.6	0.0	16.6
1992	-0.3	1.5	3.7	19.6	24.1	31.2	33.7	28.6	23.4	17.0	10.5	1.2	16.2
1993	-2.1	-1.7	6.8	19.3	24.4	31.6	33.3	30.8	23.8	16.2	-2.6	-6.7	14.4
1994	-5.7	-5.7	3.0	17.8	27.4	33.6	31.9	31.6	24.1	18.6	9.2	-0.2	15.5
1995	-2.0	4.4	10.6	23.8	26.7	33.4	34.7	33.5	26.1	17.2	10.9	-1.0	18.2
Mean	-3.0	-2.1	6.5	20.2	26.6	32.5	34.4	31.7	25.7	16.3	6.7	-0.7	15.8
Max	1.6	4.5	11.3	23.8	28.6	35.9	37.0	34.9	28.7	20.6	10.9	3.3	18.2
Min	-11.6	-9.1	0.9	16.1	23.7	28.7	31.9	28.6	23.4	10.2	-2.6	-10.3	5.8

Table A.10 Average Minima Temperature(°C)-Monthly and Annual Average

Station : Kzyl-Orda

Year	Average Minima Temperature (°C)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1974	-17.2	-20.5	-4.7	6.7	13.7	17.2	21.5	16.1	10.9	3.5	-4.0	-13.2	2.5
1975	-10.3	-14.9	-1.6	7.7	11.3	17.8	21.0	17.3	11.3	0.8	-8.1	-9.3	3.6
1976	-4.9	-16.2	-8.0	6.4	14.4	17.8	19.6	18.9	10.1	-0.3	-7.6	-13.0	3.1
1977	-20.7	-13.8	-1.2	8.2	14.4	20.2	19.7	16.2	10.4	1.6	-0.3	-9.3	3.8
1978	-12.9	-14.3	-4.1	6.7	12.2	17.7	20.5	15.2	12.8	2.4	-1.2	-6.1	4.1
1979	-11.5	-5.6	-4.0	5.6	11.9	16.2	20.8	17.1	11.8	6.6	-4.8	-3.1	5.1
1980	-15.6	-16.4	-8.0	7.3	13.8	17.8	21.1	16.2	9.4	4.4	2.0	-3.6	4.0
1981	-6.0	-7.1	0.4	6.5	12.1	16.9	21.0	18.5	11.2	2.9	-3.8	-9.0	5.3
1982	-12.2	-13.4	-5.2	-7.4	13.4	17.0	19.5	17.5	11.1	4.3	-3.9	-9.0	2.6
1983	-6.5	-3.5	-2.1	9.6	12.0	18.2	22.1	18.7	10.0	2.5	-0.5	-7.7	6.1
1984	-10.1	-20.3	-3.1	3.9	12.5	18.7	21.8	18.5	10.0	3.8	-3.1	-18.5	2.8
1985	-12.9	-5.2	-6.4	6.7	11.8	18.5	20.3	17.1	10.5	2.6	-5.4	-7.9	4.1
1986	-6.7	-12.9	-4.6	5.9	13.0	16.7	19.6	16.9	12.3	2.0	-4.1	-7.2	4.2
1987	-7.6	-7.7	-1.7	4.1	12.5	18.0	20.2	18.2	11.2	-0.5	-6.0	-7.0	4.5
1988	-8.9	-15.7	-3.8	7.1	11.0	19.1	21.0	17.3	12.4	2.4	-0.6	-5.0	4.7
1989	-9.7	-9.3	-3.7	2.7	11.8	18.2	21.8	17.8	10.1	4.5	-1.9	-2.0	5.0
1990	-13.0	-10.1	0.7	7.5	12.9	20.3	20.4	17.5	11.8	3.2	-1.8	-9.2	5.0
1991	-13.7	-13.5	-5.8	7.8	12.8	19.9	21.4	17.5	11.5	5.0	-0.1	-7.2	4.6
1992	-6.8	-5.5	-5.2	7.3	11.5	17.9	19.6	16.6	10.0	1.7	-1.7	-5.3	5.0
1993	-10.0	-10.1	-3.4	6.2	11.0	19.0	21.3	18.1	10.1	2.1	-8.9	-15.0	3.4
1994	-13.5	-16.5	-6.4	4.8	14.3	19.8	19.7	19.4	10.8	4.2	0.3	-6.3	4.2
1995	-11.2	-5.2	-1.6	8.6	13.8	19.5	21.5	19.7	12.7	4.3	-0.3	-11.0	5.9
Mean	-11.0	-11.7	-3.8	5.9	12.6	18.3	20.7	17.6	11.0	2.9	-3.0	-8.4	4.3
Min	-4.9	-3.5	0.7	9.6	14.4	20.3	22.1	19.7	12.8	6.6	2.0	-2.0	6.1
Min	-20.7	-20.5	-8.0	-7.4	11.0	16.2	19.5	15.2	9.4	-0.5	-8.9	-18.5	2.5

Table A.11 Average Monthly Relative Humidity of Air (%)

Station : Kzyl-Orda

Year	Average Relative Humidity (%)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1963	79	70	57	33	40	34	40	37	44	50	71	81	53
1964	79	80	77	70	40	41	42	42	43	53	68	72	59
1965	77	74	70	50	29	34	36	35	44	60	76	74	55
1966	74	65	58	40	31	34	35	38	36	42	67	71	49
1967	71	76	76	51	45	37	41	34	35	57	64	83	56
1968	82	81	72	41	38	33	39	30	34	50	70	75	54
1969	65	65	78	58	37	30	41	38	38	65	78	85	56
1970	79	76	61	42	31	29	34	38	42	49	58	80	52
1971	76	74	62	49	32	30	32	38	35	54	78	88	54
1972	75	77	74	52	48	38	38	36	31	38	73	78	55
1973	82	82	76	61	41	32	32	34	43	51	77	86	58
1974	81	74	68	63	44	30	37	36	36	34	69	62	53
1975	82	79	78	38	25	24	27	26	36	49	69	82	51
1976	81	81	79	55	34	34	29	23	34	72	78	77	56
1977	78	76	68	34	31	32	32	37	37	56	82	83	54
1978	77	76	73	58	55	44	34	28	37	52	70	85	57
1979	69	79	71	50	40	35	33	30	43	57	55	85	54
1980	79	79	73	62	47	42	32	36	39	63	83	88	60
1981	83	76	75	67	66	59	47	46	49	57	69	86	65
1982	82	88	78	50	35	33	37	40	55	72	88	87	62
1983	87	86	64	51	51		35	35	39	55	72	80	59
1984	77	75	83	48	45	37	29	32	42	58	77	70	56
1985	82	82	80	49	39	34	39	45	37	60	69	86	59
1986	88	77	76	42	32	29	30	38	35	53	77	89	56
1987	81	83	79	63	47	38	45	34	46	51	67	80	60
1988	86	79	77	48	47	33	39	41	52	53	75	85	60
1989	84	79	74	57	53	38	33	35	44	56	81	85	60
1990	81	88	78	58	33	29	29	27	42	68	84	89	59
1991	91	82	67	45	47	40	23			45			55
1992		73	65	47	42	32	30	40	39	44	55	73	49
1993	71	68	62	40	38	36	34	37	39	42	68	74	51
1994	80	73	75	46	45	39	43	41	49	50	79	82	59
1995	75	77	63	36	42	43	38	35	39	50	61	68	52
Mean	79	77	72	50	41	35	35	36	40	54	72	80	56
Max	91	88	83	70	66	59	47	46	55	72	88	89	65
Min	65	65	57	33	25	24	23	23	31	34	55	62	49

Table A.12 Average Daily Sunshine Duration (hours)

Station : Chirikrabad

	Average Daily Sunshine Duration (hours)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1964	4.9	7.5	7.1	6.0	11.6	13.3	13.4	12.5	11.2	8.6	6.0	6.1	9.0
1965	5.6	7.2	8.5	7.8	11.2	12.2	11.9	12.5	9.9	7.9	6.3	4.4	8.8
1966	5.8	6.5	7.8	8.3	11.8	12.4	11.6	12.3	10.3	8.5	7.9	4.8	9.0
1967	5.6	6.2	4.7	9.2	10.2	12.8	12.3	12.0	10.2	8.8	7.1	4.9	8.7
1968	4.8	5.8	8.0	9.0	10.4	11.3	13.0	12.4	10.8	7.6	6.0	4.6	8.6
1969	5.9	7.3	7.4	8.9	10.9	12.0	11.6	11.8	9.4	7.6	6.2	4.5	8.6
1970	5.5	7.0	8.4	8.3	10.6	12.9	11.9	12.2	10.7	9.2	7.6	5.5	9.2
1971	5.9	7.2	7.3	8.2	11.4	13.0	12.5	12.5	11.2	7.8	5.8	3.2	8.8
1972	5.9	7.5	7.7	9.0	9.9	13.1	13.1	11.7	10.1	8.8	6.3	3.2	8.9
1973	5.0	6.9	7.6	8.0	10.9	12.7	13.2	12.6	9.6	8.9	5.8	5.0	8.9
1974	5.6	6.9	7.0	6.1	11.9	12.9	12.2	11.7	9.9	9.0	6.0	4.6	8.7
1975	9.5	6.0	6.3	10.6	12.3	13.5	12.9	12.0	10.3	8.7	6.0	4.5	9.4
1976	6.3	6.9	6.0	7.5	11.2	12.7	12.0	10.4	9.4	5.0	6.0	4.6	8.2
1977	5.2	6.4	7.2	8.4	10.6	11.1	11.6	10.0	10.4	7.1	6.0	4.6	8.2
1978	5.2	7.4	7.9	6.8	8.3	11.4	13.0	12.4	10.0	7.8	4.6	3.9	8.2
1979	6.7	4.2	7.1	7.0	11.3	11.8	12.9	12.2	9.4	6.7	7.2	3.9	8.4
1980	5.1	6.6	8.8	7.7	10.6	11.9	13.3	12.1	10.8	7.4	3.9	5.3	8.6
1981	4.4	5.2	7.8	6.5	8.3	11.0	11.7	12.5	9.8	9.5	6.3	5.8	8.2
1982	4.8	7.3	6.4	8.7	11.2	12.5	12.7	11.6	8.7	6.8	6.0	4.5	8.4
1983			7.2	8.3	10.2	12.3	11.6	11.8	8.7	7.4	6.0	4.6	8.8
1984	5.8		5.3	9.4	10.7	12.3	11.6	11.8	10.6	7.3	5.1	6.0	8.7
1985	4.0	5.7	6.8	8.5	11.5	12.8	11.9	11.3	10.2	7.0	6.6	4.8	8.4
1986	5.6	7.0	6.7	10.1	10.0	12.8	12.4	11.5	10.1	7.6	5.3	4.9	8.7
1987	5.0	6.9	4.5	6.3	11.7	13.0	12.4	12.1	8.9	7.8	4.9	4.7	8.2
1988	3.1	6.6	8.3	8.9	10.9	11.9	11.9	10.8	9.1	8.9	6.0	4.6	8.4
1989	3.7	6.4	7.5	9.8	10.5	12.3	12.0	11.7	10.0	7.4	5.1	2.9	8.3
1990	5.3	4.6	7.4	8.9	11.2	12.1	12.2	10.8	10.5	7.3	6.0	4.5	8.4
1991	3.6	5.9	7.5	8.4	9.6	11.6	12.5	11.9	10.1	9.4	6.0	4.6	8.4
1992	4.0	4.8	7.1	7.2	9.3	11.1	13.1	10.8	9.6	7.8	6.0	4.6	8.0
1993		6.2	7.2	9.0	10.1	11.2	12.2	11.0		7.7	3.2	4.1	8.2
1994	4.8	5.7			10.8	10.9	12.5	11.5					9.4
1995													
Average	5.3	6.4	7.2	8.2	10.7	12.2	12.4	11.8	10.0	7.9	5.9	4.6	8.5
Max	9.5	7.5	8.8	10.6	12.3	13.5	13.4	12.6	11.2	9.5	7.9	6.1	9.4
Min	3.1	4.2	4.5	6.0	8.3	10.9	11.6	10.0	8.7	5.0	3.2	2.9	8.0

Table A.13 Average Monthly Wind Velocity (m/s)

Station : Kzyl-Orda

	Average Wind Velocity (m/s)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1963	3.8	5.2	4.6	8.8	3.2	4.5	3.6	3.6	3.9	3.0	4.3	4.3	4.4
1964	6.4	6.0	5.4	2.9	4.6	3.9	3.4	3.0	3.6	3.4	2.8	3.6	4.1
1965	3.6	4.3	3.8	4.4	5.0	3.3	3.4	3.9	3.6	3.0	3.0	4.5	3.8
1966	4.8	4.2	3.9	5.2	4.6	3.2	3.5	3.3	3.6	3.4	3.5	5.6	4.1
1967	4.0	4.3	4.2	3.7	3.6	4.0	3.1	4.4	3.9	4.0			4.0
1968	3.8	4.1	3.5	5.5	3.8	3.1	3.9	4.5	4.1	4.0	3.1	4.4	4.0
1969	4.4	5.4	4.3	4.6	3.1	3.5	3.2	5.7	3.8	3.2			3.8
1970	4.8	6.0	6.7	5.9	4.9	4.3	3.4	4.4	4.2	42.0	5.1	3.8	4.8
1971	3.0	4.4	5.4	4.1	4.4	3.6	4.3	2.9	4.2	2.7		2.4	3.7
1972	4.0	3.5	4.0	3.8	4.0	3.1	2.8	3.1	3.0	3.8		2.2	3.3
1973	3.4	3.8	3.5	4.8	4.4	3.1	3.4	2.8	2.9	3.1	3.0	2.7	3.4
1974	2.9	4.0	3.4	3.9	3.6	3.1	2.9	2.8	3.4	3.9	2.9	5.7	3.6
1975	2.7	2.6	2.9	4.5	4.4	3.9	3.0	3.8	3.2	3.1	2.9	3.1	3.3
1976	2.7	3.0	5.4	4.5	4.0	2.9	2.6	4.3	3.6	3.2	3.1	4.5	3.6
1977	3.3	4.4	4.1	5.3	3.8	3.0	3.1	3.4	2.9	2.8	2.9	3.0	3.5
1978	3.2	2.6	4.6	4.8	4.2	2.9	3.9	4.1	3.1	2.7	3.4	2.5	3.6
1979	5.5	2.7	5.0	4.7	4.8	2.5	3.7	4.7	3.2	3.2	4.4	2.6	3.9
1980	2.9	3.4	4.8	4.6	3.5	3.2	3.0	3.0	3.0	2.5	2.9	2.5	3.3
1981	3.9	5.0	3.9	2.9	2.8	2.1	2.0	2.1	2.3	2.1	2.9	3.0	2.9
1982	2.2	2.5	3.0	3.5	2.6	2.6	2.3	2.4	2.6	1.4	1.6	1.7	2.4
1983	1.6	1.8	2.9	3.6	2.9	1.8	1.7	2.2	1.8	1.5	1.4	1.3	2.0
1984	3.8	2.3	2.5	3.5	2.7	2.5	3.2	2.9	2.5	2.3	2.3	4.4	2.9
1985	2.5	3.4	3.3	3.5	3.6	2.9	2.6	2.9	4.5	3.0	2.7	2.4	3.1
1986	2.3	3.7	2.9	3.9	2.8	2.7	2.7	2.8	3.1	2.3	2.9	2.7	2.9
1987	2.5	2.6	4.7	3.9	2.7	3.7	2.0	2.4	2.2	3.3	3.2	2.0	2.1
1988	2.6	6.6	4.1	3.7	3.2	2.6	2.4	2.9	1.9	2.9	2.9	2.7	3.2
1989	2.1	2.8	4.3	3.6	2.0	3.4	3.1	2.7	3.4	2.6	2.2	1.4	2.8
1990	1.9	2.6	2.0	2.9	3.3	2.8	1.9	2.5	2.6	2.4	2.2	1.5	2.4
1991	2.1	2.7	2.6	3.7	3.4	2.1	1.9	2.5	1.9	2.0	1.9	2.4	2.4
1992	1.6	1.8	2.7	3.8	2.0	2.2	2.4	2.2	2.7	2.2	2.0	1.9	2.3
1993	1.5	2.6	2.5	3.3	3.3	2.2	2.4	2.1	2.9	1.6	2.2	1.9	2.4
1994	2.4	3.0	3.0	3.7	4.0	2.7	2.3	2.9	3.6	3.1	2.6	2.3	3.0
1995	2.5	1.8	3.7	4.1	3.1	2.1	2.5	2.8	2.7	2.3	1.8	1.7	2.6
Avg	3.2	3.6	3.9	4.2	3.6	3.0	2.9	3.2	3.1	4.0	2.8	2.9	3.4
Max	6.4	6.6	6.7	8.8	5.0	4.5	4.3	5.7	4.5	42.0	5.1	5.7	4.8
Min	1.5	1.8	2.0	2.9	2.0	1.8	1.7	2.1	1.8	1.4	1.4	1.3	2.0

Table A.14 Summary of Monthly and Annual Climatic Data

Station	Climatic Parameter	Unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Chardara	Air Temperature	°C	-0.4	0.5	6.9	15.2	21.4	26.7	29.0	27.1	21.1	13.1	6.6	0.7	14.0
	Air Relative Humidity	%	83.0	78.0	72.0	61.0	52.0	40.0	40.0	40.0	42.0	56.0	70.0	81.9	59.7
	Wind Speed	m/s	2.8	2.7	2.5	2.7	2.9	2.9	2.9	2.7	2.4	2.3	2.5	2.6	2.7
	Sunshine Duration*	hrs	4.6	6.3	6.9	8.7	10.2	11.9	12.2	11.8	10.1	7.5	5.5	4.8	8.3
	Rainfall	mm	33.1	32.2	38.1	38.0	25.0	6.3	6.0	0.5	2.4	11.6	24.0	41.4	258.7
Turkestan	Air Temperature	°C	-2.5	-1.4	5.4	14.6	20.5	26.2	29.2	26.6	19.8	10.6	4.0	-1.4	12.6
	Air Relative Humidity	%	78.0	72.0	65.0	49.0	44.0	33.0	32.0	33.0	38.0	54.0	69.0	79.0	53.8
	Wind Speed	m/s	2.2	2.6	2.9	4.0	3.7	3.6	3.7	3.6	3.5	2.7	2.4	2.3	3.1
	Sunshine Duration	hrs	5.1	6.5	7.4	9.3	10.8	12.7	12.9	12.4	10.5	8.2	6.0	5.3	8.9
	Rainfall	mm	22.2	23.6	26.0	29.9	23.0	4.4	3.2	1.5	3.1	11.8	22.4	31.7	202.8
Kzyl-Orda	Air Temperature	°C	-8.2	-7.3	0.8	12.9	19.7	25.5	27.6	24.5	17.9	9.1	1.1	-4.8	9.9
	Air Relative Humidity	%	79.2	77.3	71.7	50.1	41.0	35.4	35.3	35.7	40.4	53.5	72.1	80.3	56.0
	Wind Speed	m/s	3.2	3.6	3.9	4.2	3.6	3.0	2.9	3.2	3.1	4.0	2.8	2.9	3.4
	Sunshine Duration*	hrs	5.3	6.4	7.2	8.2	10.7	12.2	12.4	11.8	10.0	7.9	5.9	4.6	8.5
	Rainfall	mm	16.3	13.9	18.7	18.7	19.1	8.5	5.0	3.4	3.6	12.5	16.9	18.3	154.9
Zhusali	Air Temperature	°C	-8.5	-9.8	-1.7	11.7	19.2	25.5	28.7	25.4	17.8	8.1	0.2	-5.5	9.3
	Air Relative Humidity	%	83.0	81.0	79.0	51.0	42.0	33.0	31.0	34.0	41.0	57.0	76.0	83.0	57.6
	Wind Speed	m/s	4.0	4.7	5.0	5.0	4.6	4.2	4.3	4.2	4.1	3.9	4.1	4.1	4.4
	Sunshine Duration*	hrs	5.1	5.9	7.2	8.8	10.7	12.0	12.2	11.7	9.6	7.3	5.1	4.8	8.4
	Rainfall	mm	13.7	10.4	15.5	19.8	11.0	9.0	6.4	5.5	4.8	8.6	13.6	15.7	135.4
Kazalinsk	Air Temperature	°C	-8.4	-9.5	-2.1	11.3	19.0	25.0	27.9	24.6	17.2	8.0	0.3	-5.3	9.0
	Air Relative Humidity	%	80.0	76.0	74.0	53.0	46.0	41.0	42.0	44.0	49.0	62.0	77.0	81.0	60.4
	Wind Speed	m/s	2.0	2.7	2.5	2.5	2.1	1.8	1.4	1.4	1.5	1.5	1.8	2.0	1.9
	Sunshine Duration	hrs	5.1	5.9	7.2	8.8	10.7	12.0	12.2	11.7	9.6	7.3	5.1	4.8	8.4
	Rainfall	mm	11.2	6.6	15.2	17.1	9.8	5.4	4.7	7.4	5.9	13.1	15.4	15.2	128.5

* Estimated from nearest station

Table A.15 Summary of monthly and annual ETo in the Syr Darya River Basin

Month	ETo (mm/day)				ETo (mm/Month)			
	Chardara	Kzyl-Orda	Zhusali	Kazalinsk	Chardara	Kzyl-Orda	Zhusali	Kazalinsk
Jan	0.73	0.49	0.45	0.35	22.6	15.28	13.92	10.97
Feb	1.23	0.85	0.73	0.68	35.54	24.77	21.21	19.63
Mar	2.37	2.05	1.72	1.5	73.46	63.47	53.33	46.59
Apr	4.46	5.2	5.36	4.06	133.72	156.09	160.8	121.74
May	6.51	7.29	7.8	5.89	201.96	226.07	241.78	182.61
Jun	8.42	8.55	9.7	7.15	252.75	256.43	290.91	214.39
Jul	8.71	8.68	10.41	7.06	270.09	269.22	322.64	218.88
Aug	7.64	7.75	8.81	5.89	236.78	240.17	273.16	182.59
Sep	5.41	5.38	5.93	3.87	162.38	161.51	177.88	116.01
Oct	2.92	3.19	2.82	1.81	90.51	99.01	87.35	55.99
Nov	1.45	1.01	1.04	0.68	43.42	30.31	31.3	20.4
Dec	0.66	0.46	0.46	0.32	20.61	14.39	14.14	9.93
Annual	4.21	4.24	4.60	3.27	1543.82	1556.72	1688.42	1199.73

Table A.16 Aral Sea - Annual Water Level

Year	Water Level		Lake Surface	Lake Volume	Volume Changes
	Aral/South Aral (m a.s.l.)	North Aral (m a.s.l.)	(km2)	(km3)	(km3)
1963	52.63	52.63	65,522	1020	
1964	52.30	52.30	64,811	1000	-20
1965	52.38	52.38	64,811	1000	0
1966	52.02	52.02	64,100	981	-19
1967	51.53	51.53	63,007	949	-32
1968	51.34	51.34	62,570	936	-13
1969	50.94	50.94	61,678	912	-24
1970	51.43	51.43	62,788	943	31
1971	51.16	51.16	62,133	924	-19
1972	50.69	50.69	60,969	893	-31
1973	50.18	50.18	59,788	863	-30
1974	50.07	50.07	59,552	857	-6
1975	49.30	49.30	58,116	816	-41
1976	48.47	48.47	56,387	764	-52
1977	47.85	47.85	55,294	731	-33
1978	47.17	47.17	54,065	693	-38
1979	46.70	46.70	53,387	671	-22
1980	45.91	45.91	52,037	629	-42
1981	45.39	45.39	50,980	598	-31
1982	44.90	44.90	50,277	578	-20
1983	43.74	43.74	48,150	519	-59
1984	43.11	43.11	47,025	490	-29
1985	42.16	42.16	44,716	444	-46
1986	41.39	41.39	42,862	409	-35
1987	40.47	40.47	40,778	372	-37
1988	39.71	39.71	39,161	344	-28
1989	39.33	39.33	38,243	328	-16
1990	38.46	38.46	36,030	295	-33
1991	37.49				
1992	37.18	40.3			
1993	36.93				
1994	36.88				
1996	36.5	40.5			

Table A.17 Monthly Average Inflow Discharge into Chardara Reservoir (m^3/sec) for period 1970 -1996

	Inflow Discharge (m^3/s)													Inflow Volume (MCM)		
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Apr-Sep	Oct-Mar	Annual
1970*	1048	683	606	804	1008	831	475	309	584	616	658	541	680	10,551	10,887	21,438
1971	638	763	526	704	673	867	306	265	233	263	287	358	490	8,008	7,371	15,379
1972	306	512	712	830	829	683	355	299	337	375	437	328	500	8,767	7,025	15,792
1973	582	593	593	832	1139	967	563	442	368	391	356	253	590	11,359	7,229	18,589
1974*	281	379	313	300	194	161	136	79	111	117	133	146	196	2,578	3,557	6,135
1975*	149	204	242	139	407	310	117	66	95	116	147	157	179	2,990	2,653	5,643
1976*	174	234	254	591	471	398	143	115	136	150	186	155	251	4,869	3,032	7,900
1977	201	207	248	109	213	605	337	107	138	209	231	244	237	3,968	3,515	7,484
1978	262	330	351	357	572	640	318	223	219	215	274	265	336	6,133	4,436	10,569
1979	356	493	439	870	1000	634	384	337	287	206	279	283	464	9,252	5,355	14,607
1980*	218	716	709	528	687	286	257	319	218	193	176	130	370	6,058	5,598	11,656
1981*	195	267	534	534	657	394	490	402	212	238	217	242	365	7,104	4,447	11,550
1982*	448	763	500	297	363	459	358	236	170	203	295	408	375	4,963	6,786	11,750
1983	330	338	461	286	688	405	95	149	153	161	245	201	293	4,684	4,541	9,225
1984	165	436	851	421	490	281	199	154	152	181	209	281	318	4,471	5,593	10,064
1985	343	557	429	501	507	292	229	176	180	230	274	208	327	4,965	5,299	10,263
1986	198	382	557	502	391	239	110	108	141	228	272	279	284	3,917	5,009	8,927
1987	171	357	548	768	639	548	364	205	237	286	350	598	423	7,261	6,064	13,325
1988	680	833	607	869	987	690	434	386	605	589	597	493	648	10,449	9,980	20,429
1989	365	581	615	241	603	426	484	275	281	324	407	452	421	6,105	7,164	13,269
1990	381	693	619	554	711	532	252	223	272	364	595	499	475	6,697	8,209	14,905
1991	622	826	664	383	533	391	372	235	306	311	366	509	460	5,853	8,588	14,440
1992*	691	681	750	489	324	588	330	214	244	287	639	757	500	5,749	10,018	15,767
1993*	510	826	1075	744	1248	1131	408	228	340	369	653	999	711	10,787	11,600	22,388
1994*	1250	1154	1373	1217	1100	729	399	207	311	482	869	886	831	10,419	15,734	26,153
1995*	985	1054	1028	433	196	153	229	156	168	290	360	700	479	3,511	11,526	15,037
1996*	710	789	1042	567	376	461	235	143	193	417	526	754	518	5,184	11,169	16,354
Average	454	580	617	551	630	522	310	224	248	289	372	412	434	6,543	7,125	13,668
Max	1250	1154	1373	1217	1248	1131	563	442	605	616	869	999	831	11359	15734	26153
Min	149	204	242	109	194	153	95	66	95	116	133	130	179	2578	2653	5643

Remark: * Average data

Table A.18 Monthly, Seasonal and Annual Discharge of the Syr Darya

Station : Chardara

	Monthly Discharge (m³/s)												Seasonal Discharge (m³/s)			Discharge Volume (MCM)		
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Apr to Sep	Oct to Mar	Annual	Apr to Sep	Oct to Mar	Annual
1970	450.0	433.0	264.0	726.0	975.0	1060.0	845.0	627.0	378.0	328.0	378.0	359.0	776.8	370.3	573.6	12297.1	5803.9	18101.0
1971	525.0	615.0	429.0	698.0	1010.0	900.0	866.0	738.0	296.0	141.0	114.0	127.0	751.3	325.2	538.3	11910.6	5056.3	16966.9
1972	128.0	161.0	350.0	844.0	1020.0	975.0	867.0	732.0	218.0	181.0	327.0	372.0	785.5	253.2	519.3	12447.3	4012.4	16459.7
1973	257.0	192.0	358.0	873.0	1250.0	1130.0	1060.0	768.0	206.0	220.0	201.0	191.0	881.2	236.5	558.8	13969.5	3733.5	17703.4
1974	103.0	81.9	85.3	513.0	856.0	592.0	405.0	61.7	56.5	52.4	54.4	79.3	414.0	76.1	245.0	6553.3	1196.2	7749.6
1975	54.3	50.3	51.1	376.0	501.0	333.0	303.0	84.8	72.1	50.6	49.9	71.6	278.3	54.6	166.5	4405.2	860.6	5265.8
1976	48.9	52.3	53.3	369.0	641.0	508.0	459.0	166.0	54.9	56.1	56.3	58.9	366.3	54.3	210.3	5806.3	858.7	6665.1
1977	48.8	75.9	125.0	510.0	641.0	514.0	427.0	82.3	73.2	66.3	84.1	76.6	369.6	79.5	224.5	5844.6	1249.9	7094.4
1978	49.7	50.1	149.0	515.0	704.0	614.0	570.0	281.0	90.0	107.0	107.0	65.1	462.3	88.0	275.2	7324.6	1391.7	8716.3
1979	64.5	65.2	125.0	739.0	1100.0	807.0	841.0	410.0	130.0	100.0	187.0	290.0	671.2	138.6	404.9	10641.1	2194.6	12835.7
1980	136.0	129.0	323.0	579.0	788.0	697.0	688.0	285.0	90.8	103.0	106.0	113.0	521.3	151.7	336.5	8259.4	2405.9	10665.3
1981	64.7	70.3	70.4	545.0	818.0	749.0	680.0	262.0	94.7	98.8	100.0	100.0	524.8	84.0	304.4	8313.5	1323.6	9637.1
1982	100.0	163.0	227.0	477.0	813.0	706.0	641.0	216.0	63.1	60.1	57.0	55.6	486.0	110.5	298.2	7702.8	1727.8	9430.6
1983	59.2	63.6	59.9	413.0	729.0	661.0	604.0	176.0	55.9	58.4	58.6	57.8	439.8	59.5	249.7	6970.4	934.9	7905.3
1984	55.3	52.8	52.3	402.0	761.0	668.0	618.0	147.0	46.6	58.5	55.6	59.3	411.3	55.6	233.5	6998.4	880.1	7874.5
1985	52.1	54.3	122.0	478.0	834.0	679.0	638.0	141.0	56.3	56.8	59.8	56.4	471.1	66.9	269.0	7465.1	1055.9	8521.0
1986	61.5	59.0	62.4	398.0	666.0	616.0	568.0	106.0	62.8	63.8	54.5	55.3	392.8	59.4	226.1	6219.4	934.8	7154.3
1987	53.6	55.0	66.3	514.0	756.0	676.0	677.0	308.0	260.0	150.0	227.0	284.0	531.8	139.3	335.6	8421.5	2205.0	10626.5
1988	298.0	536.0	703.0	775.0	923.0	776.0	788.0	421.0	408.0	375.0	488.0	482.0	681.8	480.3	581.1	10788.1	7584.4	18372.4
1989	361.0	209.0	367.0	565.0	874.0	768.0	702.0	302.0	177.0	163.0	160.0	162.0	564.7	240.3	402.5	8944.0	3794.3	12738.2
1990	141.0	242.0	528.0	634.0	842.0	786.0	768.0	519.0	291.0	287.0	289.0	300.0	640.0	292.8	466.4	10137.2	4626.0	14763.3
1991	318.0	379.0	535.0	619.0	844.0	746.0	709.0	313.0	159.0	197.0	267.0	292.0	565.0	333.0	449.0	8948.1	5230.1	14178.2
1992	303.0	314.0	566.0	653.0	803.0	735.0	748.0	542.0	368.0	348.0	343.0	385.0	643.2	377.3	510.3	10183.4	5979.6	16162.9
1993	446.0	429.0	782.0	669.0	1230.0	1070.0	989.0	803.0	512.0	483.0	352.0	380.0	877.2	478.7	677.9	13901.9	7550.8	21452.7
1994	382.0	354.0	495.0	892.0	1080.0	938.0	705.0	654.0	418.0	526.0	486.0	406.0	781.2	426.5	603.8	12359.4	6720.3	19079.7
1995	381.0	417.0	707.0	585.0	763.0	646.0	472.0	143.0	100.0	107.0	243.0	364.0	451.5	369.8	410.7	7140.8	5814.3	12955.1
Avg	190.1	203.2	292.2	591.0	855.1	741.6	676.1	359.5	182.2	170.7	188.9	201.6	568.1	207.8	387.9	8998.1	3274.1	12272.1
Max	525.0	615.0	782.0	892.0	1250.0	1130.0	1060.0	803.0	512.0	526.0	488.0	482.0	881.2	480.3	677.9	13969.8	7584.4	21452.7
Min	48.8	50.1	51.1	369.0	501.0	333.0	303.0	61.7	46.6	50.6	49.9	55.3	278.3	54.3	166.5	4405.2	858.7	5265.8

Table A.19 Monthly, Seasonal and Annual Discharges of the Syr Darya

Staion : Koktyube

	Discharge (m³/s)												Discharge (m³/s)			Discharge Volume (MCM)		
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Apr to Sep	Oct to Nov	Annual	Apr to Sep	Oct to Nov	Annual
1974									75.0	71.7								
1975				273.0	471.0	291.0	245.0	127.0	67.9	60.4	61.2	83.4	246.3	68.3	157.3			
1976	64.3	65.5	62.6	222.0	521.0	434.0	400.0	227.0	80.6	59.9	60.1	56.2	314.1	61.4	187.8	4984.1	920.7	5954.8
1977	46.3	55.6	130.0	334.0	528.0	462.0	405.0	145.0	94.3	80.3	70.7	98.0	328.1	81.8	204.9	5195.0	1294.3	6489.3
1978	65.1	57.5	141.0	372.0	697.0	647.0	535.0	346.0	178.0	116.0	112.0	98.6	454.2	93.4	273.8	7199.5	1475.9	8675.4
1979	140.0	225.0	152.0	509.0	1080.0	876.0	865.0	538.0	243.0	158.0	213.0	319.0	695.2	199.7	447.4	11025.8	3132.0	14157.8
1980	165.0	134.0	322.0	541.0	800.0	728.0	696.0	436.0	164.0	125.0	113.0	114.0	560.8	162.2	361.5	8889.0	2573.2	11462.2
1981	91.5	107.0	115.0	410.0	829.0	826.0	719.0	428.0	184.0	131.0	125.0	124.0	566.0	115.6	340.8	8973.2	1818.9	10792.1
1982	150.0	195.0	261.0	350.0	737.0	699.0	652.0	334.0	144.0	91.5	75.4	73.0	486.0	141.5	313.7	7707.1	2216.6	9923.8
1983	88.2	93.8	70.6	234.0	664.0	611.0	558.0	271.0	102.0	76.4	68.6	64.5	406.7	77.0	241.8	6453.5	1207.4	7660.9
1984	72.3	87.8	102.0	280.0	715.0	658.0	583.0	270.0	142.0	94.3	89.4	89.4	441.3	89.2	265.3	6999.1	1410.6	8409.7
1985	103.0	129.0	145.0	324.0	726.0	629.0	583.0	271.0	135.0	80.7	62.8	58.5	444.7	96.5	270.6	7052.0	1511.9	8563.9
1986	66.6	62.9	59.0	231.0	661.0	634.0	481.0	202.0	88.9	76.1	52.9	64.7	383.0	63.7	223.3	6072.3	1002.8	7075.1
1987	85.4	58.0	66.0	391.0	793.0	685.0	709.0	382.0	337.0	181.0	217.0	300.0	550.7	151.7	351.2	8722.1	2404.6	11131.7
1988	273.0	433.0	630.0	693.0	921.0	765.0	732.0	476.0	419.0	377.0	468.0	471.0	667.7	432.0	554.8	10567.5	6987.9	17555.4
1989	358.0	198.0	310.0	382.0	755.0	683.0	599.0	326.0	190.0	147.0	134.0	136.0	488.8	213.8	351.3	7747.5	3373.5	11121.0
1990	170.0	186.0	399.0	534.0	722.0	658.0	625.0	492.0	295.0	272.0	273.0	262.0	554.3	269.3	407.3	8779.9	4113.9	12893.7
1991	321.0	381.0	478.0	534.0	778.0	724.0	633.0	369.0	196.0	192.0	229.0	267.0	539.0	311.3	425.2	8536.3	4884.7	13421.0
1992	280.0	299.0	510.0	591.0	757.0	725.0	651.0	556.0	390.0	355.0	336.0	355.0	612.2	355.8	484.0	9690.4	5637.7	15328.1
1993	436.0	441.0	681.0	680.0	927.0	1030.0	859.0	796.0	536.0	491.0	387.0	387.0	804.7	470.5	637.6	12737.3	7413.4	20150.6
Avg	165.3	178.3	256.3	418.3	741.4	671.9	607.0	368.0	200.6	162.1	165.7	179.6	502.3	181.9	342.1	8185.4	2968.2	11153.6
Max	436.0	441.0	681.0	693.0	1080.0	1030.0	865.0	796.0	536.0	491.0	468.0	471.0	804.7	470.5	637.6	12737.3	7413.4	20150.6
Min	46.3	55.6	59.0	222.0	471.0	291.0	245.0	127.0	67.9	59.9	52.9	56.2	246.3	61.4	157.3	4984.1	920.7	5954.8

Table A.20 Monthly, Seasonal and Annual Discharge of the Syr Darya

Station : Tomenariyk

	Monthly Discharge (m³/s)												Seasonal Discharge (m³/s)			Discharge Volume (MCM)		
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Apr to Sep	Oct to Mar	Annual	Apr to Sep	Oct to Mar	Annual
1970	369.0	487.0	370.0	510.0	725.0	791.0	712.0	611.0	324.0	303.0	318.0	351.0	612.2	366.3	489.3	9697.4	5733.4	15430.8
1971	353.0	601.0	456.0	465.0	742.0	615.0	590.0	578.0	361.0	139.0	110.0	106.0	558.5	294.2	426.3	8850.8	4562.1	13412.9
1972	77.1	123.0	251.0	753.0	832.0	793.0	708.0	651.0	348.0	222.0	248.0	306.0	680.8	204.5	442.7	10777.6	3244.0	14021.6
1973	282.0	251.0	312.0	793.0	1010.0	849.0	807.0	699.0	390.0	251.0	220.0	200.0	758.0	252.7	505.3	12005.8	3976.4	15982.2
1974	128.0	139.0	170.0	282.0	627.0	416.0	265.0	113.0	70.9	77.1	58.5	60.3	295.7	105.5	200.6	4684.8	1654.1	6338.9
1975	90.1	85.2	115.0	169.0	324.0	181.0	164.0	100.0	53.5	54.8	54.7	69.5	165.3	78.2	121.7	2620.8	1230.2	3850.9
1976	65.3	55.3	48.4	132.0	441.0	332.0	299.0	190.0	63.0	50.0	56.0	48.0	242.8	53.8	148.3	3856.9	850.7	4707.6
1977	57.3	55.3	133.0	224.0	390.0	323.0	281.0	91.6	59.6	65.7	56.1	85.3	228.2	75.5	151.8	3614.9	1193.3	4808.2
1978	62.4	57.2	98.5	269.0	520.0	486.0	334.0	253.0	108.0	98.8	105.0	102.0	328.3	87.3	207.8	5201.9	1379.3	6581.2
1979	98.8	176.0	163.0	439.0	909.0	623.0	590.0	380.0	184.0	137.0	193.0	281.0	520.8	174.8	347.8	8262.3	2746.8	11009.2
1980	185.0	136.0	305.0	392.0	573.0	479.0	439.0	312.0	144.0	128.0	118.0	119.0	389.8	165.2	277.5	6177.1	2620.6	8797.7
1981	95.4	100.0	113.0	324.0	648.0	640.0	469.0	323.0	165.0	124.0	122.0	119.0	428.2	112.2	270.2	6783.3	1767.2	8550.4
1982	124.0	129.0	238.0	208.0	556.0	508.0	451.0	234.0	125.0	89.3	76.3	67.0	347.0	120.6	233.8	5503.8	1898.1	7401.8
1983	104.0	97.3	77.3	140.0	461.0	428.0	380.0	214.0	83.7	67.2	70.9	66.6	284.5	80.6	182.5	4514.9	1263.1	5778.0
1984	82.9	69.1	98.6	182.0	491.0	445.0	382.0	179.0	74.8	54.8	57.1	68.7	293.1	71.9	182.5	4649.7	1138.1	5787.8
1985	77.3	116.0	130.0	233.0	515.0	441.0	394.0	185.0	91.8	62.4	61.8	60.2	310.5	84.6	197.5	4922.9	1324.4	6247.3
1986	64.0	62.1	54.8	134.0	460.0	449.0	321.0	139.0	55.5	61.7	59.2	54.6	259.8	59.4	159.6	4119.1	933.4	5052.5
1987	60.9	67.6	60.8	230.0	585.0	500.0	504.0	288.0	296.0	173.0	213.0	300.0	400.5	145.9	273.2	6347.5	2308.5	8656.0
1988	278.0	338.0	571.0	565.0	777.0	653.0	606.0	429.0	418.0	392.0	460.0	476.0	574.7	419.2	496.9	9093.8	6638.0	15731.8
1989	415.0	264.0	329.0	326.0	597.0	543.0	470.0	276.0	170.0	155.0	149.0	144.0	397.8	242.7	320.3	6303.1	3818.4	10121.6
1990	124.0	171.0	424.0	441.0	585.0	520.0	471.0	413.0	271.0	248.0	260.0	252.0	450.2	229.8	340.0	7127.9	3626.7	10754.6
1991	258.0	323.0	422.0	407.0	586.0	555.0	460.0	284.0	167.0	176.0	215.0	263.0	409.8	276.2	343.0	6488.6	4335.8	10824.5
1992	307.0	312.0	395.0	455.0	560.0	536.0	445.0	403.0	305.0	309.0	312.0	317.0	450.7	325.3	388.0	7130.4	5147.4	12277.8
1993	673.0	455.0	569.0	624.0	769.0	924.0	722.0	715.0	498.0	461.0	346.0	357.0	708.7	476.8	592.8	11211.8	7515.1	18726.9
Avg	184.6	194.6	241.9	362.6	611.8	543.1	469.3	335.9	201.2	162.5	164.2	178.0	420.7	187.6	304.1	6664.5	2954.4	9618.8
Max	673.0	601.0	571.0	793.0	1010.0	924.0	807.0	715.0	498.0	461.0	460.0	476.0	758.0	476.8	592.8	12005.8	7515.1	18726.9
Min	57.3	55.3	48.4	132.0	324.0	181.0	164.0	91.6	53.5	50.0	54.7	48.0	165.3	53.8	121.7	2620.8	850.7	3850.9

Table A.21 Monthly, Seasonal and Annual Discharges of the Syr Darya

Station : Kergeltnes

	Discharge (m³/s)												Discharge (m³/s)			Discharge Volume (MCM)		
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Apr to Sep	Oct to Mar	Annual	Apr to Sep	Oct to Mar	Annual
1970	368.0	611.0	435.0	449.0	635.0	768.0	620.0	548.0	372.0	325.0	318.0	358.0	555.3	402.5	478.9	8792.3	6282.5	15074.8
1971	349.0	513.0	522.0	455.0	683.0	593.0	536.0	525.0	372.0	172.0	136.0	130.0	527.3	302.2	414.8	8353.8	4711.2	13063.0
1972	93.0	122.0	202.0	646.0	713.0	642.0	572.0	541.0	351.0	228.0	239.0	307.0	577.5	198.5	388.0	9139.0	3137.7	12276.7
1973	238.0	226.0	312.0	601.0	776.0	693.0	658.0	586.0	367.0	248.0	226.0	201.0	613.7	241.8	427.8	9718.3	3808.3	13526.5
1974	110.0	139.0	157.0	202.0	460.0	356.0	251.0	114.0	63.7	67.8	52.6	39.6	241.1	94.3	167.7	3821.1	1475.4	5296.5
1975	65.2	54.3	94.1	120.0	264.0	155.0	135.0	97.1	41.4	45.2	34.7	62.3	135.4	59.3	97.4	2148.9	935.9	3084.8
1976	76.1	55.8	61.0	71.1	327.0	280.0	236.0	169.0	51.5	38.9	46.2	36.5	189.4	52.4	120.8	3004.1	823.9	3828.0
1977	41.4	41.7	101.0	140.0	322.0	275.0	251.0	101.0	41.8	51.2	37.2	53.5	188.5	54.8	121.7	2989.3	866.4	3855.7
1978	47.6	38.2	65.8	172.0	410.0	393.0	351.0	257.0	86.8	75.8	79.8	94.1	278.3	66.9	172.6	4416.1	1058.0	5474.1
1979	95.0	127.0	165.0	253.0	647.0	558.0	520.0	384.0	207.0	139.0	158.0	208.0	428.2	148.7	288.4	6792.9	2342.6	9135.4
1980	122.0	116.0	239.0	316.0	461.0	431.0	398.0	316.0	140.0	111.0	108.0	111.0	341.2	134.5	239.3	5454.0	2122.1	7576.1
1981	98.3	88.6	100.0	178.0	477.0	535.0	443.0	350.0	174.0	111.0	121.0	133.0	359.5	108.7	234.1	5700.7	1712.6	7413.3
1982	113.0	136.0	237.0	167.0	459.0	471.0	425.0	263.0	125.0	96.2	82.0	57.5	318.3	120.3	219.3	5049.8	1890.7	6939.5
1983	89.2	105.0	71.2	72.7	352.0	376.0	332.0	204.0	85.4	70.5	71.7	62.4	237.0	77.3	157.2	3762.8	1209.4	4972.2
1984	62.7	73.6	119.0	121.0	367.0	370.0	326.0	187.0	78.7	57.7	66.9	39.6	241.6	69.9	155.8	3833.7	1098.7	4932.4
1985	58.1	91.2	126.0	161.0	381.0	381.0	326.0	192.0	93.0	63.9	57.4	52.2	256.2	74.8	165.5	4061.8	1173.5	5235.3
1986	58.4	55.1	59.0	75.4	329.0	360.0	266.0	130.0	51.1	52.3	46.8	46.5	203.4	53.0	128.2	3227.0	833.7	4060.6
1987	69.0	61.5	60.6	134.0	441.0	436.0	421.0	254.0	243.0	164.0	156.0	254.0	322.3	127.5	224.9	5109.4	2019.8	7129.2
1988	255.0	304.0	535.0	499.0	617.0	566.0	511.0	393.0	316.0	347.0	381.0	411.0	488.7	372.2	430.4	7731.2	5869.2	13600.3
1989	314.0	242.0	300.0	298.0	509.0	501.0	414.0	263.0	168.0	149.0	142.0	148.0	358.8	215.8	287.3	5683.0	3393.5	9076.6
1990	116.0	171.0	294.0	370.0	524.0	475.0	411.0	371.0	252.0	230.0	241.0	245.0	400.5	216.7	308.6	6341.4	3416.5	9757.9
1991				382.0	485.0	490.0	397.0	293.0	196.0	202.0	231.0		373.8	72.2	334.5	5915.4	1139.8	7055.2
Avg	134.3	160.7	202.8	267.6	483.7	456.6	400.0	297.6	177.8	138.4	138.0	145.2	347.2	148.4	252.9	5502.0	2332.8	7834.8
Max	368.0	611.0	535.0	646.0	776.0	708.0	658.0	586.0	372.0	347.0	381.0	411.0	613.7	402.5	478.9	9718.3	6282.5	15074.8
Min	41.4	38.2	59.0	71.1	264.0	155.0	135.0	97.1	41.4	38.9	34.7	36.5	135.4	52.4	97.4	2148.9	823.9	3084.8

Table A.22 Monthly, Seasonal and Annual Discharge of the Syr Darya

Station : Kzyl-Orda

	Monthly Discharge (m3/s)												Seasonal Discharge (m3/s)			Discharge Volume (MCM)		
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Apr to Sep	Oct to Mar	Annual	Apr to Sep	Oct to Mar	Annual
1970	400.0	564.0	416.0	399.0	439.0	428.0	364.0	383.0	337.0	301.0	336.0	411.0	393.3	404.7	399.0	6220.5	6327.9	12548.4
1971	268.0	397.0	448.0	359.0	450.0	320.0	265.0	333.0	324.0	158.0	98.7	110.0	345.2	246.6	295.9	5460.3	3851.8	9312.1
1972	78.1	125.0	249.0	570.0	486.0	380.0	342.0	374.0	313.0	221.0	235.0	270.0	410.3	196.4	303.3	6485.1	3113.5	9598.6
1973	200.0	183.0	294.0	462.0	610.0	471.0	426.0	516.0	399.0	257.0	251.0	228.0	480.7	235.7	358.2	7609.4	3717.9	11327.3
1974	127.0	122.0	167.0	144.0	262.0	172.0	106.0	51.1	28.3	47.9	65.9	47.3	127.2	96.2	111.7	2014.9	1508.4	3523.3
1975	77.0	63.4	96.4	66.3	104.0	52.7	35.4	40.2	36.0	33.5	42.0	48.4	56.6	60.1	58.4	895.8	946.0	1841.8
1976	84.2	47.0	68.0	43.5	145.4	110.5	94.7	73.5	29.8	24.1	39.6	40.6	77.9	50.6	64.3	1236.1	801.5	2037.6
1977	45.0	46.5	78.7	53.2	128.7	118.0	108.0	55.5	30.3	41.9	41.8	74.2	82.3	54.7	68.5	1304.7	863.2	2167.9
1978	51.9	46.9	72.6	102.2	181.3	185.3	139.3	123.3	79.4	68.3	80.7	106.7	135.2	74.2	103.2	2140.2	1124.8	3265.0
1979	82.9	131.0	152.1	144.0	394.7	327.0	284.0	228.7	144.3	88.7	139.2	183.7	253.8	129.6	191.7	4025.1	2036.7	6061.7
1980	132.0	99.2	199.0	220.0	213.0	187.0	158.0	177.0	97.6	90.5	93.0	136.0	175.4	125.0	150.2	2775.7	1983.0	4758.7
1981	92.7	76.8	803.0	131.0	212.0	269.0	183.0	187.0	161.0	117.0	108.0	103.0	190.5	100.9	145.7	3012.9	1592.4	4605.4
1982	96.2	127.7	193.7	131.0	180.7	176.0	148.0	93.8	84.3	64.5	73.7	59.3	135.6	102.2	118.9	2135.9	1602.5	3738.4
1983	91.8	99.5	65.3	54.8	133.7	111.3	125.7	104.8	71.2	45.8	73.5	57.5	105.8	72.2	89.0	1676.3	1128.6	2804.8
1984	73.6	86.6	94.1	91.1	147.0	141.0	117.0	82.4	40.1	35.8	56.4	41.1	103.1	64.6	83.8	1633.3	1018.2	2651.6
1985	53.0	78.4	119.0	118.0	152.0	150.0	127.0	67.9	72.6	58.7	52.2	52.9	114.6	69.0	91.8	1812.0	1084.6	2896.5
1986	53.4	57.7	58.9	52.8	121.0	128.3	103.4	55.4	35.6	52.9	44.4	26.9	82.8	49.0	65.9	1311.1	769.1	2080.2
1987	44.4	47.6	63.2	87.4	173.7	199.3	179.3	109.3	169.7	102.7	111.4	149.0	153.1	86.4	119.8	2421.3	1366.2	3787.5
1988	175.7	257.3	360.7	302.7	237.0	233.7	216.3	230.0	228.3	289.0	327.0	385.7	257.2	299.2	278.2	4058.5	4735.9	8794.4
1989	304.3	205.7	256.3	195.3	216.3	230.0	171.3	158.0	157.0	122.7	122.0	138.7	188.0	191.6	189.8	2970.9	3015.4	5986.3
1990	117.0	120.7	491.3	208.0	221.3	232.7	177.0	216.0	201.0	178.7	188.3	231.3	209.3	171.2	190.3	3308.6	2704.1	6012.7
1991	242.0	264.7	314.0	239.3	216.3	229.0	149.3	139.7	147.3	157.7	195.0	268.0	186.8	240.2	213.5	2949.3	3775.0	6724.3
1992	325.0	345.3	299.3	291.0	227.7	232.7	143.0	190.3	241.3	244.7	260.0	271.7	221.0	291.0	256.0	3485.5	4593.3	8079.8
1993	317.0	357.7	395.3	370.7	307.3	441.3	310.0	379.0	412.3	393.0	339.0	283.3	370.1	347.6	358.8	5842.1	5463.4	11305.4
1994	393.3	344.3	408.7	412.3	446.0	346.0	358.7	375.0	356.3	230.0	404.0	292.5	387.4	345.5	366.4	6126.6	5427.6	11554.2
1995	471.2	464.7	443.0	309.0	241.3	168.0	128.0	61.9	63.8	44.7	100.7	278.7	162.0	300.6	231.3	2556.9	4700.9	7257.8
Avg	169.3	183.1	215.6	213.9	254.9	235.3	191.5	184.7	166.9	133.5	149.2	165.2	207.9	169.3	188.6	3287.6	2663.6	5951.2
Max	471.2	564.0	448.0	570.0	610.0	471.0	426.0	516.0	412.3	393.0	404.0	411.0	480.7	404.7	399.0	7609.4	6327.9	12548.4
Min	44.4	46.5	58.9	43.5	104.0	52.7	35.4	40.2	28.3	24.1	39.6	26.9	56.6	49.0	58.4	895.8	769.1	1841.8

Table A.23 Monthly, Seasonal and Annual Discharges of the Syr Darya

Station : Karaozek

	Discharge (m3/s)												Discharge (m3/s)			Discharge Volume (MCM)		
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Apr to Sep	Oct to Mar	Annual	Apr to Sep	Oct to Mar	Annual
1970	162.0	268.0	180.0	374.0	494.0	462.0	378.0	386.0	347.0	314.0	325.0	228.0	406.8	246.2	326.5	6435.8	3858.5	10294.2
1971	167.0	226.0	224.0	285.0	460.0	335.0	306.0	362.0	385.0	192.0	187.0	132.0	355.5	173.0	264.3	5626.2	2711.5	8337.7
1972	92.6	132.0	238.0	581.0	485.0	393.0	362.0	384.0	310.0	206.0	172.0	168.0	419.2	168.1	293.6	6625.2	2663.8	9289.0
1973	139.0	110.0	157.0	439.0	538.0	417.0	391.0	473.0	383.0	231.0	221.0	204.0	440.2	173.7	306.9	6966.6	2743.3	9709.9
1974	103.0	133.0	140.0	115.0	231.0	154.0	82.3	38.9	17.1	19.0	14.7	27.2	106.4	72.8	89.6	1684.9	1134.4	2819.4
1975	57.8	49.4	74.4	52.9	79.8	40.7	23.2	21.6	22.0	18.9	22.7	42.9	40.0	44.6	42.2	633.4	698.0	1331.3
1976	62.3	39.9	41.9	23.5	116.9	109.4	81.2	58.0	36.2	26.8	31.2	24.2	70.9	37.7	54.3	1124.0	596.2	1720.2
1977	36.1	26.1	35.3	39.4	114.3	87.8	85.6	47.6	27.7	30.3	16.6	18.2	63.1	27.1	47.1	1064.5	427.3	1491.8
1978	36.4	34.6	47.8	51.1	145.0	146.0	120.3	111.9	51.6	40.1	55.3	49.8	104.3	44.0	74.2	1655.0	693.6	2348.6
1979	77.7	80.5	114.9	84.7	337.7	308.0	268.0	228.7	172.7	132.7	167.3	136.0	233.3	118.2	175.7	3700.6	1863.9	5564.0
1980	115.3	96.7	200.0	145.0	178.0	169.0	158.0	150.0	82.5	74.5	82.0	57.0	147.1	104.3	125.7	2329.4	1651.7	3981.2
1981	68.8	47.3	65.6	95.1	185.0	206.0	106.0	122.0	166.0	103.0	121.0	73.3	146.7	79.8	113.3	2316.9	1260.3	3577.2
1982	95.3	109.6	201.7	107.1	164.0	172.3	143.3	85.8	70.2	55.6	84.0	76.0	123.8	103.7	113.7	1959.3	1630.6	3589.9
1983	93.6	105.0	53.2	39.3	137.0	148.3	122.0	87.7	48.7	28.3	50.7	41.5	97.2	62.0	79.6	1589.9	965.5	2506.4
1984	59.7	57.7	80.4	96.7	132.0	135.0	117.0	82.1	41.7	30.5	32.8	21.6	101.2	48.8	75.0	1603.2	771.2	2374.3
1985	42.7	68.0	109.0	99.1	142.0	142.0	120.0	68.1	63.1	45.3	31.2	22.8	105.7	53.2	79.4	1672.6	834.2	2506.8
1986	47.8	35.8	41.5	51.7	128.7	135.7	104.5	57.2	33.2	49.6	19.3		85.1	32.8	64.3	1349.2	516.7	1865.9
1987			26.5	79.8	144.7	178.7	171.7	112.9	199.7	141.0	132.0	55.4	147.9	59.2	124.2	2337.1	939.3	3276.3
1988	159.7	250.3	408.7	307.3	328.7	363.7	255.0	273.0	327.7	327.3	360.3	282.7	309.2	298.2	303.7	4883.0	4717.3	9600.3
1989	303.3	190.7	252.0	221.3	236.0	232.7	177.0	132.0	151.7	131.0	121.3	84.0	191.8	180.4	186.1	3029.6	2839.0	5868.6
1990	89.5	119.3	168.3	209.0	222.7	209.7	165.3	211.7	189.3	171.3	196.0	138.7	201.3	150.5	175.9	3182.1	2371.2	5553.3
1991	153.7	205.7	299.7	265.3	180.0	193.3	126.0	123.7	147.7	177.7	205.3	174.0	162.7	202.7	182.7	2566.9	3185.9	5752.8
1992	186.0	199.0	235.0	209.0	185.0	197.0	132.0	178.0	249.0	258.0	258.0	176.7	191.7	218.8	205.2	3023.6	3459.2	6482.7
1993	297.3	326.7	360.7	349.0	293.7	395.3	317.7	303.7	306.3	393.7			341.1	229.7	332.5	5384.0	3607.1	8991.1
1994	412.0	457.3	494.3	398.3	301.0	326.0	319.3	325.3	367.7	362.3	385.3	251.7	354.6	393.8	374.2	5604.4	6177.2	11781.6
1995	375.7	430.7	382.7	285.0	270.7	193.0	143.7	71.0	75.2	94.5	81.1	183.3	173.1	239.0	206.0	2733.7	3719.2	6453.0
Avg	136.6	152.4	179.1	189.8	243.1	225.0	183.7	172.9	167.9	138.5	132.1	107.9	197.1	137.0	170.2	3116.6	2155.2	5271.8
Max	412.0	457.3	494.3	581.0	538.0	462.0	391.0	473.0	396.3	393.7	385.3	282.7	440.2	393.8	374.2	6966.6	6177.2	11781.6
Min	36.1	26.1	26.5	23.5	79.8	40.7	23.2	21.6	17.1	18.9	14.7	18.2	40.0	27.1	42.2	633.4	423.3	1331.3

Table A.24 Monthly, Seasonal and Annual Discharge of the Syr Darya

Station : Karaozek Flow

	Monthly Discharge Volume (m3/s)												Seasonal Discharge Volume (m3/s)			Discharge Volume (MCM)		
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Apr-Sep	Oct-Mar	Annual	Apr-Sep	Oct-Mar	Annual
1971	128	218	292	883														
1972											57.87	128						
1973	111	125	165															
1974										113	42.7	6.87						
1975	11.9	9.31	13.8	3.17	0.47		0.17	0.45	1.37	5.32	4.83	3.59	1.126	8.025	4.6	14.7	127.7	142.4
1976	8.1	11.0	22.9	12.9	1.8	0.8	0.8	0.1	0.0	0.0	5.0	2.7	2.7	8.3	5.5	42.7	130.8	173.5
1977	4.1	13.5	43.2	2.7	2.8	0.9	0.5	0.3	1.3	10.3	31.9	8.0	8.4	18.5	10.0	22.5	291.3	313.8
1978	5.1	4.5	14.5	24.5	7.3	19.7	4.2	3.8	17.4	22.1	6.8	3.5	12.8	9.4	11.1	200.8	149.3	350.1
1979	3.2	16.5	36.3	44.5	56.7	19.7	14.0	9.2	6.9	4.4	6.2	6.2	25.1	12.1	18.6	397.9	190.1	588.0
1980	17.0	4.6	8.3	25.0	23.7	10.7	7.0	18.9	13.4	16.0	7.0	39.0	24.8	15.3	20.0	389.5	244.8	634.3
1981	28.9	29.5	34.1	42.6	27.0	63.0	77.0	65.0	9.3	17.3	10.9	4.3	47.3	20.8	34.1	750.5	326.4	1076.9
1982	10.5	16.1	26.4	12.4	10.8	3.5	2.5	2.9	4.4	0.1	0.0	0.0	6.1	8.9	7.5	96.3	138.1	234.4
1983			9.7	11.8	3.4	3.9	3.5	5.5	9.1	12.6	9.8	9.7	6.2	7.9	7.9	97.4	111.1	208.5
1984	12.6	11.5	14.5	18.9	7.6	3.4	3.3	2.8			15.8	15.0	7.2	11.5	10.5	91.4	182.3	276.7
1985	23.1	28.9	33.0	23.1	4.5	4.2	3.6	3.3	14.1	16.3	21.9	16.2	8.8	23.2	16.0	137.7	363.9	501.6
1986	24.0	25.8	21.6	6.4	3.7	4.3	3.6	3.2	3.2	10.2	31.5	28.2	4.1	23.6	13.8	64.4	369.1	
1987	43.6	49.5	37.7	13.5	12.3	11.5	11.7	10.0	10.7			14.9	11.6	24.3	21.5	183.5	377.6	
1988	16.0	11.3	16.3	35.7	12.6	23.2	7.6	5.7	14.4	16.4	15.7	26.4	16.5	17.0	16.8	259.2	270.2	529.4
1989	59.1	35.9	31.2	16.9	9.3	9.3	6.6	6.1	6.1	5.7	13.0	15.9	9.0	26.8	17.9	142.5	420.8	563.3
1990	22.0	32.6	53.2	22.2	8.7	8.8	8.7	8.9	9.4	9.7	7.5	6.9	11.1	22.0	16.5	175.2	344.2	519.3
1991	41.7	50.4	69.2	49.2	18.7	17.9	15.4	13.9	11.3	0.0	0.0	0.0	21.1	26.9	24.0	331.8	419.0	750.8
1992	139.0	136.3	64.3	65.3	42.7	44.0	16.0	30.3	10.3	13.0	11.7	10.0	34.8	64.1	49.4	548.6	1003.1	1551.7
1993	47.8	74.7	72.7	54.9	17.4	56.2	32.2	33.4	56.4	45.1	46.4	43.0	41.7	54.5	48.1	656.3	852.5	
1994	51.0	56.5	60.5	92.7	95.4	50.2	36.2	39.8	52.3	53.0	67.9	52.0	61.3	56.8	59.0	965.1	892.6	1857.7
1995	90.4	114.0	93.1	47.6	10.8	9.8	8.2	5.6	10.7	41.5	37.1	29.0	45.4	67.2	41.3	242.2	1047.2	1289.4
Avg	40.8	49.2	53.5	34.7	18.0	18.2	12.5	12.8	13.1	15.5	20.5	20.4	17.6	25.1	21.6	276.8	393.0	642.3
Max	139.0	218.0	292.0	92.7	95.4	63.0	77.0	65.0	56.4	53.0	67.9	128.0	61.1	67.2	59.0	965.1	1047.2	1857.7
Min	3.2	4.5	8.3	2.7	0.5	0.8	0.2	0.1	0.0	0.0	0.0	0.0	1.1	3.0	4.6	14.7	111.1	142.4

Table A.25 Monthly, Seasonal and Annual Discharges of the Syr Darya

Station : Zhusali

	Discharge (m3/s)												Discharge (m3/s)			Discharge Volume (MCM)		
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Apr-Sep	Oct-Mar	Annual	Apr-Sep	Oct-Mar	Annual
1970	252.0	449.0	534.0	473.0	432.0	400.0	339.0	351.0	319.0	319.0	322.0	222.0	390.7	339.7	370.2	6172.6	5475.1	11647.7
1971	210.0	364.0	494.0	396.0	373.0	274.0	250.0	305.0	346.0	195.0	128.0	110.0	324.0	249.0	286.5	5119.0	3896.7	9015.8
1972	69.7	127.0	206.0	499.0	468.0	342.0	290.0	327.0	317.0	219.0	184.0	167.0	373.8	162.1	268.0	5907.6	2556.5	8464.1
1973	134.0	177.0	365.0	499.0	460.0	400.0	362.0	463.0	427.0	210.0	258.0	217.0	435.2	226.8	331.0	6878.7	3577.3	10455.9
1974	122.0	137.0	163.0	129.0	209.0	124.0	68.1	41.3	29.5	31.3	22.4	26.9	100.2	83.8	92.0	1585.0	1308.7	2893.8
1975	67.0	65.8	95.1	56.3	52.2	25.6	11.3	11.5	23.5	22.6	24.2	41.8	30.1	52.8	41.4	474.1	828.6	1302.6
1976	62.2	42.8	38.0	26.0	65.5	63.7	50.1	43.7	28.5	20.1	20.7	30.9	46.3	35.8	41.0	733.0	562.2	1295.2
1977	40.4	35.2	26.8	41.9	69.0	55.1	55.6	26.2	21.9	21.2	13.8	27.3	45.0	27.5	36.2	712.1	430.8	1142.9
1978	57.0	42.8	55.2	46.3	87.0	94.8	66.7	64.7	53.0	41.8	53.7	62.0	68.8	52.1	60.4	1088.1	821.3	1909.3
1979	53.8	71.8	108.0	51.8	245.0	230.0	191.0	174.0	144.0	103.0	116.0	138.0	172.6	98.4	135.5	2737.5	1553.2	4290.7
1980	118.0	71.8	177.0	200.0	133.0	121.0	92.1	119.0	84.9	77.0	84.9	80.2	125.0	101.5	113.2	1973.7	1604.9	3578.7
1981	83.9	74.7	84.0	80.7	139.0	185.0	128.0	154.0	123.0	115.0	121.0	100.0	135.0	96.4	115.7	2135.1	1519.9	3655.0
1982	94.3	104.0	159.0	111.0	108.0	117.0	99.0	77.5	67.1	57.2	23.4	65.9	96.6	92.3	94.5	1526.9	1450.0	2976.9
1983	101.0	119.0	79.3	28.6	87.0	102.0	80.2	80.8	53.9	29.3	51.0	50.9	72.1	71.8	71.9	1142.5	1117.8	2260.3
1984	56.0	58.9	78.3	69.8	96.6	101.0	76.0	56.0	38.0	29.8	33.2	20.7	72.9	46.2	59.5	1153.5	723.5	1877.0
1985	32.0	54.6	91.9	97.8	100.0	106.0	88.4	49.4	46.3	33.7	32.5	34.6	80.5	46.6	63.5	1271.8	731.1	2002.9
1986	47.6	43.3	46.9	36.7	82.0	94.3	63.5	36.3	17.1	39.2	28.2	26.4	55.0	38.6	46.8	870.8	606.7	1477.5
1987	0.3	0.3	8.1	58.0	86.6	115.0	110.0	84.5	172.0	135.0	101.0	141.0	101.4	64.3	84.3	1647.1	1024.2	2671.4
1988	153.0	174.0	247.0	285.0	228.0	223.0	167.0	201.0	270.0	307.0	327.0	372.0	228.3	263.3	245.8	3602.5	4158.5	7761.1
1989	346.0	268.0	213.0	195.0	163.0	159.0	114.0	89.8	123.0	106.0	100.0	120.0	140.6	182.2	161.4	2218.8	2864.9	5083.8
1990	71.5	92.4	154.0	145.0	153.0	140.0	98.5	138.0	168.0	139.0	160.0	128.0	140.4	125.0	132.7	2217.4	1969.5	4186.9
1991	104.0	149.0	197.0	179.0	135.0	154.0	90.2	81.6	132.0	126.0	150.0	175.0	125.3	150.2	137.7	1975.2	2361.7	4336.8
1992	135.0	163.0	183.0	196.0	156.0	171.0	91.6	132.0	219.0	227.0	240.0	249.0	161.4	199.3	180.4	2543.4	3140.4	5683.8
1993	198.0	216.0	312.0	293.0	200.0	353.0	259.0	317.0	395.0	363.0			302.8	181.5	240.6	4776.7	2860.8	7637.5
Avg	108.7	126.9	171.5	174.6	180.3	173.1	134.8	142.7	151.2	123.6	114.7	113.3	159.4	123.9	141.2	2519.3	1954.3	4183.6
Max	346.0	449.0	534.0	499.0	468.0	400.0	362.0	463.0	427.0	363.0	327.0	372.0	435.2	349.7	370.2	6878.7	5475.1	11647.7
Min	0.3	0.3	8.1	26.0	52.2	25.6	11.3	11.5	17.1	20.1	13.8	20.7	30.1	27.5	36.2	474.1	430.8	1142.9

Table A.26 Monthly, Seasonal and Annual Discharge of the Syr Darya

Station : Kazalinsk

	Discharge (m³/s)												Discharge (m³/s)			Discharge Volume (MCM)		
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Apr to Sep	Oct-Mar	Annual	Apr to Sep	Oct-Mar	Annual
1970	264.0	383.0	485.0	436.0	332.0	267.0	248.0	264.0	214.0	268.0	257.0	233.0	293.5	315.0	304.3	4637.4	4940.7	9578.1
1971	299.0	326.0	414.0	416.0	312.0	180.0	164.0	229.0	316.0	194.0	125.0	104.0	274.5	243.7	259.1	4329.9	3820.5	8150.5
1972	74.4	117.0	165.0	442.0	336.0	231.0	201.0	252.0	314.0	191.0	166.0	165.0	296.0	146.4	221.2	4671.6	2318.1	6989.7
1973	115.0	159.0	294.0	478.0	378.0	278.0	263.0	374.0	382.0	242.0	240.0	194.0	358.8	207.3	283.1	5668.3	3270.0	8938.3
1974	132.0	153.0	165.0	115.0	69.9	29.1	3.7	12.3	16.7	14.7	15.4	8.0	41.1	81.3	61.2	646.8	1266.3	1913.2
1975	45.4	48.4	60.9	9.2	3.9	3.9	1.6	1.1	4.0	10.8	16.6	27.4	3.9	34.9	19.4	61.8	547.1	608.9
1976	56.7	43.5	35.4	14.8	5.7	9.2	8.1	7.6	6.9	6.6	7.7	13.1	8.7	27.2	17.9	137.1	428.4	565.6
1977	19.4	28.6	36.6	6.3	10.0	4.4	4.6	3.8	6.7	13.1	17.2	32.2	6.0	24.5	15.2	94.6	385.1	479.7
1978	45.0	34.9	41.0	15.8	13.6	21.8	13.9	14.6	24.7	15.5	18.3	39.0	17.4	32.3	24.8	274.2	508.2	782.4
1979	52.9	63.3	68.4	10.7	131.0	170.0	122.0	127.0	130.0	96.8	72.0	141.0	116.8	82.4	99.6	1839.0	1301.6	3150.6
1980	121.0	69.9	135.0	131.0	25.3	28.8	142.0	65.3	87.1	75.5	87.1	84.3	83.3	95.5	89.4	1316.5	1514.6	2831.1
1981	85.5	55.1	48.2	18.9	32.8	97.0	43.8	106.0	152.0	169.0	84.1	89.6	75.1	78.6	76.8	1183.5	1241.3	2424.8
1982	108.0	109.0	120.0	66.6	8.6	21.2	9.1	29.8	49.2	41.8	52.7	45.9	30.8	79.6	55.2	482.4	1245.9	1728.3
1983	79.6	76.1	43.4	5.8	7.2	6.9	5.5	20.4	24.9	17.5	30.7	39.8	11.8	47.9	29.8	186.5	746.6	933.0
1984	43.6	37.4	42.2	29.5	7.5	5.9	4.9	5.3	10.3	12.6	13.4	15.1	10.6	27.4	19.0	165.9	432.4	598.4
1985	18.1	34.1	60.9	35.2	7.4	12.8	6.5	12.0	16.6	13.0	11.5	30.8	15.1	28.1	21.6	236.8	441.2	678.0
1986	42.0	37.5	22.8	8.6	8.9	9.1	6.4	4.5	7.2	8.8	13.9	24.8	7.5	25.0	16.2	117.8	390.3	508.1
1987	22.1	20.2	9.7	14.0	11.5	17.3	24.8	36.4	119.0	139.0	82.9	125.0	37.2	66.5	51.8	584.3	1056.0	1640.3
1988	178.0	221.0	252.0	237.0	156.0	173.0	89.8	171.0	242.0	272.0	271.0	345.0	178.1	256.5	217.3	2806.3	4060.5	6866.8
1989	220.0	258.0	195.0	160.0	84.7	110.0	59.1	73.6	136.0	115.0	105.0	138.0	103.9	171.8	137.9	1634.6	2685.5	4320.1
1990	125.0	120.0	90.5	108.0	79.0	80.8	41.8	84.7	206.0	124.0	125.0	186.0	100.1	128.4	114.2	1573.7	2021.8	3595.5
1991	166.0	138.0	141.0	139.0	67.4	93.5	39.0	38.3	108.0	127.0	153.0	182.0	81.2	152.8	117.0	1275.3	2417.3	3692.6
1992	199.0	226.0	186.0	128.0	85.7	89.5	21.5	53.0	156.0	230.0	226.0	103.0	89.0	195.6	142.0	1397.2	3055.6	4452.8
1993	260.0	240.0	280.0	245.0	180.0	220.0	160.0	280.0	350.0	330.0	300.0	350.0	239.2	283.3	261.3	3723.1	4465.2	8238.2
1994	390.0	390.0	425.0	360.0	286.0	220.0	197.0	220.0	320.0	319.0	363.0	340.0	267.2	331.2	319.2	4215.7	5832.3	10048.1
1995	375.0	380.0	430.0	220.0	180.0	88.2	34.9	25.5	42.0	33.9	38.8	85.0	98.4	218.8	158.6	1551.6	3414.1	4965.2
Avg	133.7	145.3	162.2	149.6	108.5	94.9	73.7	97.4	132.4	116.2	111.3	120.8	109.4	131.6	120.5	1725.9	2069.5	3795.3
Max	390.0	390.0	485.0	478.0	378.0	278.0	263.0	374.0	382.0	330.0	363.0	350.0	358.8	371.2	319.2	5668.3	5832.3	10048.1
Min	18.1	20.2	9.7	5.8	3.9	3.9	1.6	1.1	4.0	6.6	7.7	8.0	3.9	24.5	15.2	61.8	385.1	479.7

Table A.27 Monthly, Seasonal and Annual Discharges of the Syr Darya

Station : Kerateren

	Monthly Discharge (m³/s)												Seasonal Discharge (m³/s)			Discharge Volume (MCM)		
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Apr to Sep	Oct to Mar	Annual	Apr to Sep	Oct to Mar	Annual
1993	260.0	300.0	300.0	200.0	157.0	178.0	150.0	168.0	360.0	328.0	349.0	320.0	202.2	309.5	255.8	3185.1	4865.9	8051.0
1994	360.0	360.0	410.0	310.0	230.0	187.0	196.0	236.0	286.0	280.0	280.0	307.0	239.2	332.8	286.0	3775.9	5231.3	9007.1
1995	327.0	260.0	280.0	285.0	217.0	96.0	41.0	8.0	50.0	63.0	44.0	80.0	111.2	175.7	143.4	1749.3	2751.8	4501.1
1996	260.0	230.0	270.0	170.0	97.5	28.7	24.9	73.2	164.0	236.0	282.5	279.6	93.1	259.7	176.4	1464.0	4109.6	5573.0
Avg	301.8	287.5	315.0	241.3	172.9	122.4	95.5	121.3	215.0	226.7	238.9	246.7	161.4	269.4	215.4	2543.6	4239.5	6783.0
Max	360.0	360.0	410.0	310.0	230.0	187.0	196.0	236.0	360.0	328.0	349.0	320.0	239.2	332.8	286.0	3775.9	5231.3	9007.1
Min	260.0	230.0	270.0	170.0	97.5	28.7	41.0	8.0	50.0	63.0	44.0	80.0	93.1	175.7	143.4	1464.0	2751.8	4501.1

Table A.28 Summary of Monthly, Seasonal and Annual Discharges in the Syr Darya

Station		Monthly Discharge (m³/s)												Seasonal Discharge (m³/s)			Discharge Volume (MCM)		
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Apr-Sep	Oct-Mar	Annual	Apr-Sep	Oct-Mar	Annual
Chardara	Avg	190.1	203.2	292.2	591.0	855.1	744.6	676.1	359.5	182.2	170.7	188.9	201.6	568.1	207.8	387.9	8998.1	3274.1	12272.1
(1970-1995)	Max	525.0	615.0	782.0	892.0	1250.0	1130.0	1060.0	803.0	512.0	526.0	488.0	432.0	881.2	480.3	677.9	13969.8	7584.4	21452.7
	Min	48.8	50.1	51.1	369.0	501.0	333.0	303.0	61.7	46.6	50.6	49.9	55.3	278.3	54.3	166.5	4405.2	858.7	5265.8
Kokiyube	Avg	165.3	178.3	256.3	418.3	741.4	671.9	607.0	368.0	200.6	162.1	165.7	179.6	502.3	181.9	342.1	8185.4	2968.2	11153.6
(1976-1993)	Max	436.0	441.0	681.0	693.0	1080.0	1030.0	865.0	796.0	536.0	491.0	468.0	471.0	804.7	470.5	637.6	12737.3	7413.4	20150.6
	Min	46.3	55.6	59.0	222.0	471.0	294.0	245.0	127.0	67.9	59.9	52.9	56.2	246.3	61.4	157.3	4984.1	970.7	5954.8
Tomenariyk	Avg	184.6	194.6	241.9	362.6	611.8	543.1	469.3	335.9	201.2	162.5	164.2	178.1	420.7	187.6	304.1	6661.5	2954.4	9618.8
(1970-1993)	Max	673.0	601.0	571.0	793.0	1010.0	924.0	807.0	715.0	498.0	461.0	460.0	476.0	758.0	476.8	592.8	12005.8	7515.1	18726.9
	Min	57.3	55.3	48.4	132.0	324.0	181.0	164.0	91.6	53.5	50.0	54.7	48.0	165.3	53.8	121.7	2620.8	850.7	3850.9
Kergelmes	Avg	134.3	160.7	202.8	267.6	483.7	456.6	400.0	297.6	177.8	138.4	138.0	145.2	347.2	148.4	252.9	5502.0	2332.8	7834.8
(1970-1991)	Max	368.0	611.0	535.0	646.0	726.0	708.0	658.0	586.0	372.0	347.0	381.0	411.0	613.7	402.5	478.9	9718.3	6282.5	15074.8
	Min	41.4	38.2	59.0	71.1	264.0	155.0	135.0	97.1	41.4	38.9	34.7	36.5	135.4	52.4	97.4	2143.9	823.9	3034.8
Kzyl-Orda	Avg	169.3	183.1	215.6	213.9	254.9	235.3	191.5	184.7	166.9	133.5	149.2	165.2	207.9	169.3	188.6	3287.6	2663.6	5951.2
(1970-1995)	Max	471.7	564.0	448.0	570.0	610.0	471.0	426.0	516.0	412.3	393.0	404.0	411.0	480.7	404.7	399.0	7609.4	6327.9	12548.4
	Min	44.4	46.5	58.9	43.5	104.0	57.7	35.4	40.2	28.3	24.1	39.6	26.9	56.6	49.0	58.4	895.8	769.1	1841.8
Karaozek	Avg	136.6	152.4	179.1	189.8	243.1	225.0	183.7	172.9	167.9	138.5	132.1	107.9	197.1	137.0	170.2	3116.6	2155.2	5271.8
(1970-1995)	Max	412.0	457.3	494.3	581.0	538.0	462.0	391.0	473.0	306.3	393.7	385.3	282.7	440.2	393.8	374.2	6966.6	6177.2	11781.6
	Min	36.1	26.1	26.5	23.5	79.8	40.7	23.2	21.6	17.1	18.9	14.7	18.2	40.0	27.1	42.2	633.4	427.3	1331.3
Zhusali	Avg	108.7	126.9	171.5	174.6	180.3	173.1	134.8	142.7	151.2	123.6	114.7	113.3	159.4	124.9	144.2	2519.3	1964.3	4483.6
(1970-1993)	Max	346.0	449.0	534.0	492.0	468.0	400.0	362.0	463.0	427.0	363.0	327.0	372.0	435.2	349.7	370.2	6878.7	5475.1	11647.7
	Min	0.3	0.3	8.1	26.0	52.2	25.6	11.3	11.5	17.1	20.1	13.8	20.7	30.1	27.5	36.2	474.1	430.8	1142.9
Kazalinsk	Avg	133.7	145.3	162.2	149.6	108.5	94.9	73.7	97.4	132.4	116.2	111.3	120.8	109.4	131.6	120.5	1725.9	2069.5	3795.3
(1970-1995)	Max	390.0	390.0	485.0	478.0	378.0	278.0	263.0	374.0	382.0	330.0	363.0	350.0	358.8	371.2	319.2	5668.3	5832.3	10043.1
	Min	18.1	20.2	9.7	5.8	3.9	3.9	1.6	1.1	4.0	6.6	7.7	8.0	3.9	24.5	15.2	61.8	385.1	479.7
Karataren	Avg	301.8	287.5	315.0	241.3	122.9	122.4	95.5	121.3	215.0	226.7	238.9	246.7	161.4	269.4	215.4	2543.6	4239.5	6783.0
(1993-1996)	Max	360.0	360.0	410.0	310.0	220.0	187.0	196.0	236.0	360.0	328.0	349.0	320.0	239.2	332.8	286.0	3775.9	5231.3	9007.1
	Min	260.0	230.0	270.0	170.0	97.5	28.7	11.0	8.0	50.0	63.0	44.0	80.0	93.1	175.7	143.4	1464.0	2751.8	4501.1
Karaozek-Flow	Avg	40.8	49.2	53.5	34.7	18.0	18.2	12.5	12.8	13.1	15.5	20.5	20.4	17.6	25.1	21.6	276.8	393.0	642.3
	Max	139.0	218.0	292.0	92.7	95.4	63.0	77.0	65.0	56.4	53.0	67.9	128.0	61.1	67.2	59.0	965.1	1047.2	1857.7
(1975-1995)	Min	3.2	4.5	8.3	2.7	0.5	0.8	0.2	0.1	0.0	0.0	0.0	0.0	1.1	7.0	4.6	14.7	111.1	142.4
Keles-Mouth	Avg	12.0	13.1	17.2	25.4	21.8	10.0	7.7	8.6	12.4	12.9	12.7	12.6	14.3	13.4	13.9	226.2	210.8	436.9
(1971-1994)	Max	27.3	26.1	28.3	41.1	43.0	34.4	16.2	22.0	30.7	24.3	24.9	26.9	31.7	26.3	29.0	455.8	389.5	857.4
	Min	5.1	4.4	9.0	5.5	3.0	1.0	1.5	2.1	5.3	4.5	5.2	5.0	3.1	5.5	4.3	62.4	106.5	177.8
Arlys-Rail St	Avg	18.3	27.8	47.3	56.9	26.6	12.1	6.9	6.2	8.1	8.1	10.1	15.0	19.5	21.1	20.3	306.3	331.1	637.4
(1970-1994)	Max	61.4	97.2	133.0	162.0	81.9	40.0	16.0	10.4	25.1	14.6	19.1	53.7	50.2	62.7	56.4	788.4	980.8	1769.1
	Min	7.4	8.1	10.9	9.0	8.1	5.1	1.5	1.7	4.5	4.3	6.2	6.9	6.5	10.2	8.7	102.7	159.0	273.5

Table A.29 Water Discharge in the Kuvandarya River

Year	Annual Discharge at the Head of the Kuvandarya River	Annual Discharge in the Kuvandarya river before Junction point with Collectors	Inflow from the North and South Collectors into the Kuvandarya River		Flow in the Kuvandarya River Below Junction Point with Collectors		
					Annual Discharge Volume	Average Discharge	Maximum Discharge
	(MCM)	(MCM)	Date of Flow	(MCM)	(MCM)	(m³/s)	(m³/s)
1991	37.9	14.6	21 May -31 Aug	210.8	225.4	19.2	33.4
1992	34.1	12.4	24 May -10 Sep	255.5	267.9	19.0	35.3
1993	79.6	33.7	21 May -11 Sep	362.0	395.7	22.7	41.6
1994	96.9	35.7	25 May -12 Sep	413.7	449.4	30.0	48.6
1995	49.1	16.8	21 May -10 Sep	290.7	307.5	21.7	36.3
1996	70.9	25.9	26 May -10 Sep	246.8	272.7	20.4	35.5
Average	61.4	23.2		296.6	319.8	22.2	38.5

Source : Zhanadarya Water Management Office, Kzyl-Orda

Table A.30 Average Monthly Flow in the Kuvandarya River

	Average Monthly Discharge (m³/s) in the Kuvandarya River After Meeting of North and South Collector					Annual
Year	May	Jun	Jul	Aug	Sep	(MCM)
1991	17.5	26.9	23.4	27.3		220.8
1992	4.2	29.9	26.5	27.8	6.8	255.5
1993	12.5	35.8	34.0	39.8	10.5	362.0
1994	21.7	38.8	45.5	39.2	12.0	413.7
1995	11.5	29.1	33.4	25.1	5.6	290.7
1996	8.5	22.7	25.2	31.7	4.4	246.8
Average	12.7	30.5	31.3	31.8	7.9	298.3

Source : Zhanadarya Water Management Office, Kzyl-Orda

Table A.31 Water Use in the Kuvandarya Area

Year	Hay Making Area	Water Use for Hay Making	Lakes System		Area of Other crops	Water Use for Other Crops
			Area	Volume		
	(ha)	(MCM)	(ha)	(MCM)	(ha)	(MCM)
1991	12,300	36.6	460	5.1	255	4.9
1992	7,400	19.2	380	4.2	820	13.8
1993	8,100	20.9	400	4.6	857	14.1
1994	26,300	79	540	6.5	403	6.7
1995	18,610	56.1	410	5.0	790	13.4
1996	12,000	35.8	450	5.5	460	7.9
Average	14,118	41	440	5.2	593	10.1

Source : Zhanadarya Water Management Office, Kzyl-Orda

Table A.32 Major Lakes in the Zhandarya and Kuvandarya River Canals

Name of Canal	Name of Lake	Storage Capacity (MCM)	Area (ha)
Zhanadarya	Ala-Kashar	5.67	378
Kuvandarya	Airport	2.2	200
	Karatai	6.8	500
	Karakol	5.83	324
	Zanger	6.21	690
	Akkol	2.93	225
	Mariamkol	8.25	750
	Altynkol	3.3	300
Total		41.19	3367

Source : Zhanadarya Water Management Office, Kzyl-Orda

Table A.33 SYR DARYA - Suspended Load (mg/l)

Station : Kergelmes

	Suspended Load (mg/l)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1970	150	260	380	630	660	520	430	280	290	200	240	270	359.2
1971	39	92	250	450	470	370	360	240	230	130	75	120	235.5
1972	33	110	110	720	480	350	230	180	140	220	170	150	241.1
1973	38	47	280	500	560	310	220	130	130	150	88	110	213.6
1974	34	34	90	230	420	200	110	74	53	100	100	51	124.7
1975	26	18	110	340	400	98	39	31	40	38	83	69	107.7
1976	18	33	47	160	340	170	68	80	32	30	27	19	85.3
1977	17	19	160	180	230	150	150	55	33	33	19	35	90.1
1978	18		77	280	230	230	120	100	33	49	56	27	
1979	25	59	180	400	500	270	200	230	91	50	120	180	192.1
1980	64	40	85	390	410	230	210	150	59	54	47	45	148.7
1981	44	81	71	440	340	220	190	150	62	45			
1982	21	28	190	190	430	230	180	100	60	35	43	31	128.2
1983	30	53	68	43	430	270	200	130					
1984	26	27	130	180	330	150	140	98	38	13	6.4	33	97.6
1985	27	56	46	220	340	260	180	110	63	45	31	30	117.3
1986	20	25	34	290	450	290	120	52	36	42	34	43	119.7
1987	28	18	33	200	420	230	200	110	99	52	95	25	125.8
1988	38	41	160	240	130	82	170	170	220	190	230	200	155.9
1989		110	160	150	240	190	90	69	55	150	150	190	141.3
AVG.	36.6	60.6	133.1	311.7	390.5	241.0	180.4	127.0	92.8	85.6	89.7	90.4	153.3
MAX.	150	260	380	720	660	520	430	280	290	220	240	270	359.0
MIN.	17	18	33	43	130	82	39	31	32	13	6.4	19	85.3

Table A.34 SYR DARYA - Suspended Load (mg/l)

Station : Tomenariyk

	Suspended Load (mg/l)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1970	270	520	230	410	520	440	450	320	240	230	210	200	336.7
1971	110	260	450	510	430	410	360	270	220	87	74	82	271.9
1972	49	93	660	620	460	350	330	330	140	83	140	160	284.6
1973	70	200	250	530	480	430	370	240	130	67	60	54	240.1
1974	44	28	85	120	320	230	140	21	51	20	25	65	95.8
1975	73	60	46	440	210	72	45	13	20	25	56	60	93.3
1976	18	75	32		210	310	160	29	4.9	6.3	14	5.6	
1977	7.7	12	120	210	580	170	130	47	18	24	11	9	111.6
1978	7.4	20	100	320	240	66	87	77	21	3.4	53	120	92.9
1979	15	130	230	380	76	33	11	46	14	72			
1980	25	56	300	150	110						22		
1981	32	44	67	180	94	130	40						
1982	14	34	72	170	110	160	130		40	9.9	17	57	
1983	45	35	18	12	48		19						
1984	17	130	74	240	110	130	61	23	5.2	26	32		
1985	41	21	70	210	91	88	54	38	84	84	26		
1986	17	16	14	230	210	160	130	47	19	38	23	31	77.9
1987	30	53	55	420	240	130	55	28	59	79	150	140	119.9
1988	110	190	280	200	110	90	120	270	110	97	82	51	142.5
1989	48	160	210	210	280	120	180	120	80	43	54	64	130.8
AVG.	52.2	106.9	168.2	292.7	246.5	195.5	151.2	119.9	73.9	58.5	61.7	78.5	133.8
MAX.	270	520	660	620	580	440	450	330	240	230	210	200	337.0
MIN.	7.4	12	14	12	48	33	11	13	4.9	3.4	11	5.6	77.9

Table A.35 Estimated Discharge in the Syr Darya at the Upstream of the Kzyl-Headworks

Year	Discharge (m^3/s)												Discharge (m3/s)			Discharge Volume (MCM)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Apr-Sep	Oct-Mar	Annual	Apr-Sep	Oct-Mar	Annual
1970	400.0	564.0	416.0	470.5	694.5	686.6	601.0	528.0	338.0	301.0	336.0	411.0	553.1	404.7	478.9	8759.3	6327.9	15087.3
1971	268.0	397.0	448.0	427.5	685.2	567.7	512.0	472.0	324.9	158.0	98.7	110.0	498.2	246.6	372.4	7892.8	3851.8	11744.5
1972	78.1	125.0	249.0	642.5	735.1	642.4	582.4	518.1	314.0	221.0	235.0	270.0	572.4	196.4	384.4	9061.0	3113.5	12174.5
1973	200.0	184.0	294.0	539.0	874.3	749.4	681.1	672.1	400.1	257.0	251.0	228.0	652.7	235.7	444.2	10342.7	3717.9	14060.6
1974	127.0	122.0	167.0	198.9	450.6	370.6	288.0	162.5	29.1	47.9	65.9	47.3	249.9	96.2	173.1	3965.0	1508.4	5473.4
1975	77.0	63.4	96.4	116.8	277.4	240.4	202.8	142.6	36.7	33.5	42.0	48.4	169.5	60.1	114.8	2689.2	946.0	3635.2
1976	84.2	47.0	68.0	85.7	284.2	286.3	237.3	168.0	34.4	24.1	39.6	40.6	182.7	50.6	116.6	2900.4	801.5	3701.9
1977	45.0	46.5	78.7	77.9	324.7	326.6	289.2	158.4	36.4	41.9	41.8	74.2	202.2	54.7	128.4	3211.3	863.2	4074.5
1978	51.9	46.9	72.6	131.3	409.3	408.2	324.5	246.9	86.1	68.3	80.7	106.7	267.7	71.2	169.5	4248.3	1124.8	5373.2
1979	82.9	131.0	152.1	219.8	629.8	563.4	522.8	401.1	158.5	88.7	139.2	183.7	415.9	129.6	272.7	6602.2	2036.7	8638.9
1980	132.0	99.2	199.0	280.3	442.4	425.2	387.5	325.2	97.6	90.5	93.0	136.0	326.4	125.0	225.7	5175.6	1983.0	7158.6
1981	97.7	76.8	103.0	165.0	428.2	503.5	431.7	350.3	164.3	117.0	108.0	103.0	340.5	100.9	220.7	5400.1	1592.4	6992.5
1982	96.2	127.7	191.7	155.7	343.9	425.8	387.8	262.5	89.6	64.5	73.7	59.3	277.6	102.2	189.9	4402.7	1602.5	6005.2
1983	91.8	99.5	65.3	62.5	344.8	371.4	329.9	222.9	76.9	45.8	73.5	57.5	234.7	72.2	153.5	3727.9	1128.6	4856.5
1984	73.6	86.6	94.1	96.7	351.7	360.3	312.9	190.6	42.0	35.8	56.4	41.1	225.7	64.6	145.1	3584.0	1018.2	4602.2
1985	53.0	78.4	119.0	123.7	331.7	354.5	302.8	185.1	73.0	58.7	52.2	52.9	228.5	69.0	148.8	3623.9	1084.6	4708.5
1986	53.4	57.7	58.9	54.9	272.4	330.5	255.2	133.3	36.8	52.9	44.4	26.9	180.5	49.0	114.8	2864.6	769.1	3633.7
1987	44.4	47.6	63.2	90.3	360.9	412.9	358.0	224.1	170.3	102.7	111.4	149.0	269.4	86.4	177.9	4271.4	1366.2	5637.7
1988	175.7	257.3	360.7	391.6	424.5	489.2	425.3	330.4	279.3	289.0	327.0	385.7	390.0	299.2	344.6	6167.8	4735.9	10903.7
1989	304.3	205.7	256.3	209.4	411.0	421.2	345.2	264.3	157.0	122.7	122.0	138.7	301.3	191.6	246.5	4774.5	3015.4	7789.9
1990	117.0	120.7	191.3	263.0	422.0	408.3	334.1	314.2	201.0	178.7	188.3	231.3	323.8	171.2	247.5	5128.0	2704.1	7832.0
1991	242.0	264.7	314.0	294.9	397.2	412.1	323.8	237.6	149.4	157.7	195.0	268.0	302.5	240.2	271.4	4787.2	3775.0	8562.2
1992	325.0	345.3	299.3	397.5	429.9	433.4	339.1	326.6	241.3	244.7	260.0	271.7	361.3	291.0	326.1	5713.5	4594.3	10307.9
1993	317.0	357.7	395.3	493.9	515.7	655.1	543.3	553.0	412.3	393.0	339.0	283.3	528.9	347.6	438.2	8364.6	5463.4	13827.9
1994	393.3	344.3	408.7	510.4	660.0	567.1	589.2	519.8	386.3	230.0	404.0	292.5	538.8	345.5	442.1	8532.0	5427.6	13959.6
1995	471.7	464.7	443.0	413.5	419.7	372.7	294.7	154.7	63.8	44.7	100.7	278.7	286.5	300.6	293.5	4531.2	4700.9	9232.1
Avg	169.3	183.1	215.6	265.9	458.5	453.3	392.4	310.2	169.2	133.5	149.2	165.2	341.6	169.3	255.4	5412.4	2663.6	8075.9
Max	471.7	564.0	448.0	642.5	874.3	749.4	681.1	672.1	412.3	393.0	404.0	411.0	652.7	404.7	478.9	10342.7	6327.9	15087.3
Min	44.4	46.5	58.9	54.9	272.4	240.4	202.8	133.3	29.1	24.1	39.6	26.9	169.5	49.0	114.8	2689.2	769.1	3633.7

Table A.36 Estimated Available Monthly Discharge for the Kzyl-Orda Left Main Canal

Year	Discharge (m^3/s)						Discharge (MCM)
	Apr	May	Jun	Jul	Aug	Sep	Apr-Sep
1976	40.1	158.6	162.9	132.0	85.1	0.0	1532.4
1977	24.0	185.1	192.2	166.8	91.9	0.0	1749.1
1978	23.9	210.4	203.8	171.8	111.2	0.0	1911.5
1979	70.3	212.9	211.5	216.2	152.8	6.9	2306.8
1980	45.8	207.9	218.3	211.0	130.7	0.0	2156.9
1981	28.3	199.0	213.2	224.5	144.6	0.0	2147.4
1982	17.8	143.6	224.4	217.4	152.4	3.8	2012.6
1983	4.7	194.8	206.7	186.7	101.7	1.0	1852.4
1984	5.6	187.4	199.3	177.8	95.9	0.0	1766.3
1985	3.3	162.8	183.2	156.2	103.3	0.0	1614.7
1986	0.8	137.2	181.2	137.4	67.4	0.0	1395.4
1987	0.0	169.1	195.1	159.4	100.6	0.0	1654.7
1988	71.0	166.1	191.7	186.2	86.5	0.0	1856.3
1989	10.7	172.5	169.0	152.9	94.5	0.0	1590.4
1990	47.9	180.7	158.1	139.2	87.1	0.0	1624.3
1991	46.9	163.5	162.7	154.8	83.9	0.0	1620.4
1992	99.0	180.0	180.3	177.2	124.3	0.0	2013.5
1993	114.5	188.8	187.8	206.8	155.7	0.0	2260.2
1994	89.7	193.4	198.2	206.7	129.2	0.0	2161.0
1995	95.8	163.0	187.1	152.6	84.1	0.0	1803.9
1996	68.9	208.0	172.0	182.2	116.7	1.0	1984.5
Average	43.3	180.2	190.6	176.9	109.6	0.6	1858.0
Max	114.5	212.9	224.4	224.5	155.7	6.9	2306.8
Min	0.0	137.2	158.1	132.0	67.4	0.0	1395.4

Table A.37 10-day Probable Available Discharge at the Kzyl-Orda Headworks

Return Period	Drought Discharge (m^3/s)																	
	Apr			May			Jun			Jul			Aug			Sep		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
1/5 Year	59.7	61.5	135.7	277.6	330.2	355.3	368.9	345.0	318.2	300.4	284.0	263.4	236.2	189.1	96.7	51.7	49.7	49.0
1/2 Year	186.9	199.1	226.5	351.6	395.6	427.6	444.1	411.9	381.7	360.4	352.7	339.8	315.1	273.3	189.1	126.6	128.3	124.1

Table A.38 10-day Probable Available Discharge at the Head of Left Main Canal

Return Period	Discharge (m^3/s)														
	Apr			May			Jun			Jul			Aug		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
1/5 Year	0.0	0.0	32.9	128.5	173.5	179.3	183.7	173.4	163.1	158.6	153.4	142.2	130.3	99.9	22.3
1/2 Year	11.9	30.7	72.2	153.4	194.5	201.0	200.7	189.0	184.0	179.4	177.7	172.7	158.9	121.4	42.1

Table A.39 Irrigation Area and Water Diverted from the Syr Darya

Year	Irrigated Area (ha)					Syr Darya Water Use for Irrigation (MCM)							
	Kzyl-Orda Oblast			South Kazakh.	Total of	Kzyl-Orda Oblast			South Kazakhstan			Total of Two Oblasts	
	LMC	RMC	Total Oblast	KzylK & D/S A	Two Oblasts	LMC	RMC	Total Oblast	KzylK Canal	Others D/S A	Total Oblast	D/S A Chardara	Incl. Kzylk
1985	79,611	8,856	251,710	81,500	333,210	1780	208	4987	1520	310	1830	5297	6817
1986	81,394	8,054	248,410	83,300	331,710	1569	163	4159	1350	225	1575	4384	5734
1987	83,980	8,642	258,490	85,500	343,990	1870	194	5150	1418	275	1693	5424	6842
1988	85,010	9,318	262,680	87,000	349,680	2121	269	5594	1712	137	1848	5730	7442
1989	83,562	8,944	264,190	87,700	351,890	1796	213	4992	1410	216	1625	5208	6618
1990	81,868	8,874	258,390	88,700	347,090	1878	195	4869	1381	124	1505	4994	6375
1991	83,658	8,893	261,430	90,400	351,830	1846	212	5314	1567	182	1749	5495	7063
1992	68,887	8,338	257,170	90,400	347,570	2010	243	5071	1464	299	1763	5370	6834
1993	81,691	8,050	264,250	90,200	354,450	2258	276	5669	1357	268	1625	5936	7294
1994	78,958	5,269	243,100	91,000	334,100	2163	219	6457	1345	104	1449	6561	7906
1995	75,269	7,304	231,460	92,000	323,460	1830	173	4779	1007	107	1114	4886	5893
Mean	80,353	8,231	254,662	87,973	342,635	1920	215	5185	1412	204	1616	5390	6801

Remark : LMC =Left Main Canal, RMC = Right Main Canal, KzylK = Kzylkumsk Canal,
D/S A = Area Down Stream of Chardara in South Kazakhstan Irrigated by the Syr Darya

Source : Water Resources Committee, Kzyl-Orda

Table A.40 Crops and Irrigation Areas in the Irrigation Systems of the Syr Darya Basin (1995)

Oblast	Name of Irrigation System	Design Discharge (m^3/s)	Irrigation Water Volume (MCM)	Total Irrigation Area (ha)	Crop Area (ha)					
					Cereal			Fodder	Cotton	Other Crops
					Paddy	Other Cereals	Total			
South Kazakhstan	Kzylkumsk Canal	200	1,077.70	66,500	9,000	19,800	28,800	25,600	9,100	3,000
	Others		36.30	25,500	0	9,000	9,000	11,500		5,000
	Total		1,114.00	92,000	9,000	28,800	37,800	37,100	9,100	8,000
Kzyl-Orda	Sumagar	15	19.96	1,580	350	630	980	240		360
	Kelintube	80	408.03	27,490	7,940	5,790	13,730	8520		5240
	Zadarya	12	5.00	890		220	220	260		410
	Kandi-Aral	12	11.13	1,280		220	220	410		650
	Sunak-Ata	40	62.28	3,380	1,280	1,040	2320	710		350
	Taipakkol	15	4.96	760				300		460
	Novochilisky	120	608.40	37,035	10,593	8,566	19,159	9595		8281
	Kamisti-Kak	28	66.16	3,294	1,050	950	2000	917		377
	Botabai	35	9.20	1,365		958	958	195		212
	Zhetikul-Zharma	40	109.02	5,187	100	1,941	2041	2751		395
	Novosolotubinsky	14	39.64	2,041		531	531	820		690
	Zhana-Arik	12	81.34	2,855	1,100	380	1480	700		675
	Zhana-Darya	50	224.35	2,826		752	752	1755		319
	Kzyl-Orda RMC	110	173.10	7,304	1,650	1,748	3398	1574		2332
	Kzyl-Orda LMC	220	1,829.80	75,269	28,650	17,793	45843	25557		3869
	Aitek	60	304.25	13,584	5,500	2,601	8101	4649		834
	Kazalinsk RMC	85	192.04	10,239	3,920	1,655	5,575	3928		736
	Kazalinsk LMC	100	393.59	15,731	5,810	2,735	8,545	6024		1162
	Baskaza	15	39.99	1,488	180	120	300	839		349
	Kok-Su	12	15.18	365		100	100	150		115
	Kara-Uzyak	50	2.70	200						200
	Others		175.54	17,297	673	2,488	3161	3315		10821
	Total		4,778.66	231,460	68,196	51,218	119,414	73,209		38,837
	Grand Total		5,892.66	323,460	77,196	80,018	157,214	110,309	9,100	46,837

Table A.41 Irrigation Area of the Irrigation Systems in Kzyl-Orda Oblast in Year 1996

	Name of Irrigation System	Construction Date	Design Discharge (m³/s)	Length of main Canal (Km)	Developed Irrigation Area (ha)	Irrigation Water Volume (MCM)					Total Irrigation Area (ha)	Paddy (ha)	Spring Wheat (ha)	Winter Wheat (ha)	Maize (ha)	Lucerne (ha)	Other Crops (ha)
						Cultivation Period (Apr-Sep)			During Flood	Total							
						Irrigation Use	Ecology Purposes	Total Use									
	South Kazakhstan Oblast																
1	Kzyl-Kumsk	1967	200	116	73,600	1102	116	1218		1218	65000	9000	3000	5000	2000	8000	38000
2	Small Systems		25		20,000	143	77	220		220	8100		1000	2000	2000	2000	1100
	Total				93,600	1245	193	1438		1438	73100	9000	4000	7000	4000	10000	39100
	Kzyl-Orda Oblast																
1	Sumagar	1975	15	31.7	2,522	35.00		35.00		35.00	2,442	350		660	170	855	407
2	Kelintube	1966	100	86.4	31,940	530.50	24.60	555.10		555.10	24,181	7,095	102	5,320	817	7,118	3729
3	Zadarya	1962	12	20.5	764	6.80		6.80		6.80	442	20			42	20	360
4	Kandi-Aral	1943	12	26.8	905	4.30	1.30	5.60	2.6	8.20	494					230	264
5	Sunak-Ata	1946	40	30.4	6,306	75.70	10.10	85.80		85.80	3,853	1,000	98	832	190	860	873
6	Taipakkol	1953	15	10.0	154	3.50	20.60	24.10	20	44.10	230				55	150	25
7	Novochilisky	1941	120	20.4	38,628	614.30	46.60	660.90		660.90	30,550	9,119	380	6,807	571	7,659	6014
8	Kamistu-Kak	1946	28	42.5	3,060	64.90	3.10	68.00		68.00	2,832	930		1,057		703	142
9	Botabai	1972	30	67.9	2,509	11.90	1.90	13.80	2.4	16.20	485	40	100	60	70	50	165
10	Zhetikul	1944	40	33.6	5,333	62.50	9.60	72.10	2.8	74.90	2,311	245	150		150	1,215	551
11	Novosolotubinsky	1942	13	11.5	1,220	29.70	4.60	34.30	2.5	36.80	920		150	150		500	120
12	Zhana-Arik	1983	15	28.0	4,932	62.40	9.70	72.10	1	73.10	4,620	1,150	2,300	200	50	480	440
13	Zhana-Darya	1972	50		5,466	26.80	132.10	158.90	42.2	201.10	1,691	60		280		1,180	171
14	Kzyl-Orda LMC	1958	210	85.2	90,024	1462.80	392.90	1855.70	59.7	1915.40	64,478	27,375	4,316	8,500	1,871	19,827	2589
15	Kzyl-Orda RMC	1951	50	15.4	10,323	146.30	22.30	168.60	12.1	180.70	5,821	2,000	1,300	150	30	1,065	1276
16	Aitek	1945	60	50.7	15,679	317.70		317.70		317.70	11,312	5,150	1,131	800	300	2,990	941
17	Kazalinsk LMC	1970	100	53.9	19,372	397.80	29.80	427.60		427.60	12,677	6,370	400	843	50	4,021	993
18	Kazalinsk RMC	1970	40	21.5	14,289	186.50	12.80	199.30	3.4	202.70	7,837	3,830	200	165	50	2,824	768
19	Baskara	1970	15	46.3	2,990	22.30	4.80	27.10	29.8	56.90	1,319	120	100			608	491
20	Others				29,547	110.20	27.30	137.50	2	139.50	16,935	1,115	1,095	100	207	3,801	10617
	Total				285,963	4171.90	754.10	4,926	181	5106.50	195,430	65,969	11,822	25,924	4,623	56,156	30,936
	Total in Two Oblasts				379,563	5,417	947	6,364	181	6,545	268,530	74,969	15,822	32,924	8,623	66,156	70,036

Table A.42 Difference of Syr Darya River Discharge Between Chardara and Kazalinsk Stations

Year	Discharge (m³/s)						Discharge (m³/s)	Volume (MCM)
	Apr	May	Jun	Jul	Aug	Sep	Apr to Sep	Apr to Sep
1970	290.0	643.0	793.0	597.0	413.0	164.0	483.3	7659.6
1971	252.0	698.0	720.0	702.0	509.0	0.0	476.8	7580.6
1972	402.0	734.0	744.0	666.0	487.0	0.0	489.5	7775.7
1973	395.0	872.0	852.0	797.0	394.0	0.0	522.3	8301.6
1974	398.0	786.1	562.9	401.3	49.4	39.8	372.9	5906.5
1975	366.8	497.1	329.1	301.4	83.7	68.1	274.4	4343.4
1976	354.2	635.4	498.8	450.9	158.5	48.0	357.6	5669.2
1977	503.7	601.0	509.6	422.4	78.5	66.5	363.6	5749.9
1978	499.2	690.4	592.2	556.1	266.4	65.3	444.9	7050.3
1979	728.3	969.0	637.0	719.0	283.0	0.0	554.4	8792.1
1980	448.0	762.7	668.2	546.0	199.7	3.7	438.1	6942.9
1981	526.1	785.2	652.0	636.2	156.0	0.0	449.7	7130.0
1982	410.4	804.4	684.8	631.9	186.2	13.9	455.3	7220.4
1983	407.2	721.8	654.1	598.5	155.6	31.0	428.0	6783.9
1984	377.5	753.5	662.1	613.1	141.7	36.3	430.7	6828.5
1985	442.8	826.6	666.2	631.6	129.0	39.7	456.0	7228.3
1986	389.4	657.1	606.9	501.6	101.5	55.6	385.3	6101.6
1987	500.0	744.5	658.7	652.2	271.6	141.0	494.7	7837.2
1988	538.0	767.0	603.0	698.2	250.0	166.0	503.7	7981.7
1989	405.0	789.3	658.0	642.9	228.4	41.0	460.8	7309.3
1990	526.0	763.0	705.2	726.2	434.3	85.0	540.0	8563.5
1991	470.0	776.6	652.5	670.0	274.7	59.0	483.8	7672.8
1992	525.0	717.3	655.5	726.5	489.0	212.0	554.2	8786.2
1993	424.0	1040.0	850.0	829.0	523.0	162.0	638.0	10128.8
1994	532.0	794.0	718.0	508.0	434.0	98.0	514.0	8143.7
1995	365.0	583.0	557.8	437.1	117.5	58.0	353.1	5589.2
Avg	441.4	746.6	649.7	602.4	262.1	63.6	458.7	7272.2
Max	728.3	1040.0	852.0	829.0	523.0	212.0	638.0	10128.8
Min	252.0	497.1	329.1	301.4	49.4	0.0	274.4	4343.4

Table A.43 Hay and Lake System in Kzyl-Orda Oblast

Year	LMC Kzyl-Orda			RMC Kzyl-Orda			Total Kzyl-Orda Oblast		
	Hay area (ha)	No of Lakes	Volume of Lake (MCM)	Hay area (ha)	No of Lakes	Volume of Lake (MCM)	Hay area (ha)	No of Lakes	Volume of Lake (MCM)
1985	1,733	12	6.5	165	4	44.6	65,000	143	810
1986	1,080	11	3.6	300	4	31.0	65,000	83	290
1987	3,960	13	11.0	490	4	42.0	95,900	112	960
1988	8,500	13	17.0	1,500	4	54.0	100,300	143	1,520
1989	3,950	13	7.0	1,000	4	44.6	101,000	122	330
1990	3,600	13	8.3	1,250	4	44.6	110,000	124	423
1991	3,680	13	6.3	670	4	31.5	97,000	119	296
1992	8,500	13	5.8	670	4	35.4	91,000	124	310
1993	3,300	13	5.7	1,080	4	34.6	90,800	126	360
1994	3,250	13	4.6	470	4	29.0	90,000	113	265
1995	3,805	12	6.4	805	4	25.0	69,000	108	200
1996	2,200	13	7.2	900	4	54.0	72,000	122	320
Average	3,963	13	7.5	775	4	39.2	87,250	120	507

Table A.44 Syr Darya Water Use in the Kzyl-Orda and South Kazakstan Oblasts (1995)

S.N.	Item	Syr Darya Water Use (MCM)							
		Kzyl-Orda Oblast		South Kazakstan				Total	
		Plan	Actual	Plan	Actual				
					Kzylkumsk Canal	Others D/S Char	Total	D/s of Chardara	Total Incl. Kzylkumsk
1	Domestic and Industrial Needs								
	April to August	130	130	102	-	110	110	240	240
	September to March	130	130	68	-	75	75	205	205
	Total	260	260	170	-	185	185	445	445
2	Fishing	90	90	140		68	68	158	158
3	Agricultural Needs								
	Irrigation	4620	3917	1593	1007	107	1114	4024	5031
	Ecology Needs (Hay, Lake system	400	470	160	71	77	148	547	618
	Losses in Canals	400	392		45	-	45	392	437
	Total	5420	4779	1753	1123	184	1307	4963	6086
	Grand Total	5770	5129	2063	1123	437	1560	5566	6689

Remark: D/S = Syr Darya River Downstream of Chardara

Source : Water Resources Committee

Table A.45 Syr Darya Water Use in Kzyl-Orda Oblast

	Item	Syr Darya Water Use in Kzyl Orda Oblast (MCM)			
		1995		1996	
		Plan	Actual	Plan	Actual
1	Domestic and Industrial Needs				
	April to August	130	130	130	120
	September to March	130	130	130	123
	Total	260		260	243
2	Fishing	90	90	83	83
3	Agricultural Needs				
	Irrigation	4620	3917	4321	4172
	Ecology Needs (Hay, Lake system)	400	471	240	396
	Losses in Zhandarya and LMC	400	392	396	358
	Total	5420	4779	4957	4926
	Grand Total	5770	4869	5300	5252

Table A.46 Irrigation Area and Irrigation Water Use

Year	Irrigation Area (ha)			Irrigation Water Use (MCM)		
	Shagan Farm	Ilyasov Farm	Total Area of Two Farms	Shagan Farm	Ilyasov Farm	Total Use in Two Farms
1985	6733	6286	13019	137	123	260
1986	7013	5763	12776	107	98	205
1987	7104	5811	12915	133	118	251
1988	7295	6015	13310	130	117	247
1989	6948	5901	12849	120	106	226
1990	7139	5931	13070	138	117	255
1991	7047	5969	13016	135	113	248
1992	7378	6088	13466	132	112	244
1993	6849	5894	12743	128	122	250
1994	6560	5490	12050	131	115	246
1995	6081	4977	11058	121	101	222
1996	5205	3585	8790	120	108	228
Average	6779	5643	12422	128	113	240

Source : Water Resource Committee, Kzyl-Orda

Table A.47 Crop Area in Ilyasov Farm during Year 1985-1996

Year	Crop Area (ha)						
	Paddy	Lucerne	Spring Wheat	Winter Wheat	Maize	Others	Total
1985	3350	1980	450		360	146	6286
1986	3000	1230	860	300	240	133	5763
1987	3060	1292	620	300	370	169	5811
1988	3200	1215	547	300	390	363	6015
1989	3000	1215	500	380	488	318	5901
1990	2700	1230	700	475	500	326	5931
1991	2470	1519	700	500	500	280	5969
1992	2470	1300	800	500	800	218	6088
1993	2670	1200	800	500	500	224	5894
1994	2470	1300	400	800	400	120	5490
1995	1900	1500	400	800	250	127	4977
1996	1500	1000	500	400	100	85	3585
Average	2649	1332	606	478	408	209	5643

Source : Water Resource Committee, Kzyl-Orda

Table A.48 Crop Area in Shagan Farm during Year 1985-1996

Year	Crop Area (ha)						
	Paddy	Lucerne	Spring Wheat	Winter Wheat	Maize	Others	Total
1985	3750	1982	450		413	138	6733
1986	3434	1704	1030	400	289	156	7013
1987	3570	1926	630	300	370	308	7104
1988	3700	1623	712	300	410	520	7295
1989	3500	1495	620	400	462	471	6948
1990	3100	1621	800	400	600	618	7139
1991	2700	1821	800	620	600	506	7047
1992	2700	2120	800	550	800	408	7378
1993	2800	1900	700	600	500	349	6849
1994	2700	1900	500	800	400	260	6560
1995	2400	1900	500	800	200	281	6081
1996	2000	1500	500	1000	100	105	5205
Average	3030	1791	670	561	431	343	6779

Source : Water Resource Committee, Kzyl-Orda

Table A.49 Water Balance of the Syr Darya Flow

S.N.	Item	Description	Discharge Volume (MCM)		Water Balance
			1985-1995	With the Project	(MCM)
1	Release from Chardara to Kzylkumsk Canal	Irrigation Water Use	1412	1060	-352
2	Release from Chardara to Syr Darya river	Discharge at Chardara Station	14182	14534	352
3	Other Inflows	Inflow from Ariys River	600	600	0
		Return Flow from Irrigation	770	770	0
		Sub Total	1370	1370	0
					0
4	Water Use	Irrigation Water Use			
		a) Kzyl-Orda Oblast	5185	3736	1449
		b)Remaing Area of South-Kazakhstan*	205	205	0
		Sub Total	5390	3941	-1449
		Domestic Use	445	445	0
		Fishing	150	150	0
		Ecology	694	694	0
		Losses in Canals	500	500	0
		Total	7179	5730	-1449
					0
5	Losses	Other Uses & Losses in Rivers	4805	4805.0	0
6	Flow to Aral Sea	Discharge at Karateren Station**	3568	5369	1801

* Irrigation area of the South Kazakhstan excluding the Kzylkumsk canal area
** Estimated Value

Figures

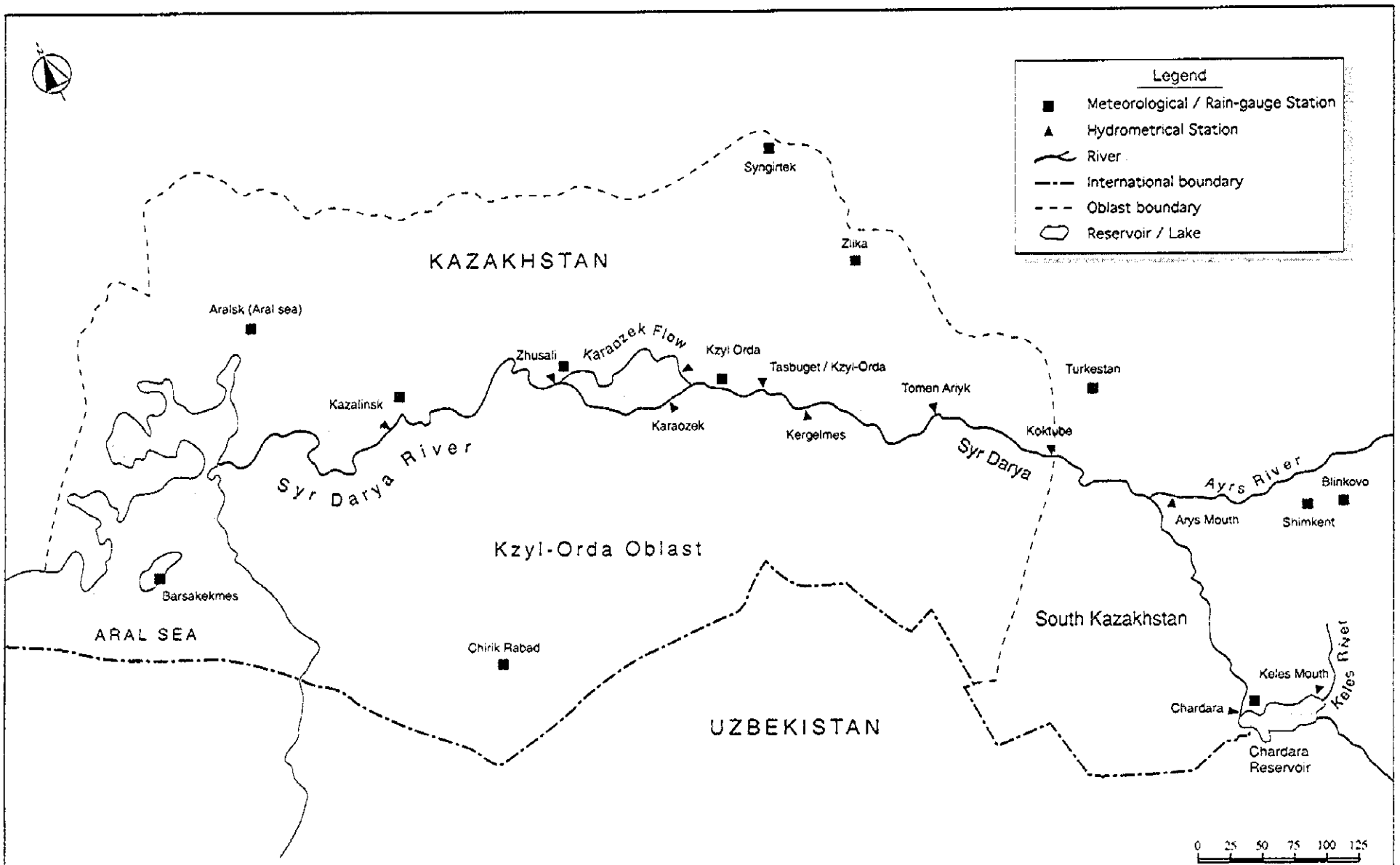

Figure A.1 Location Map of Meteorological and Hydrometrical Stations in the Syr Darya River Basin

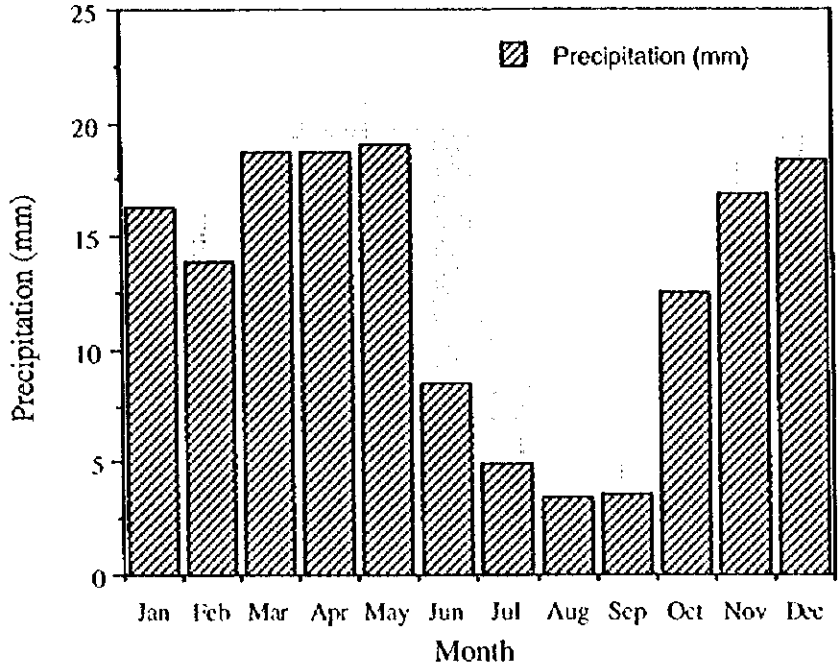

Figure A.2 Monthly Precipitation at the Kzyl-Orda Meteorological Station

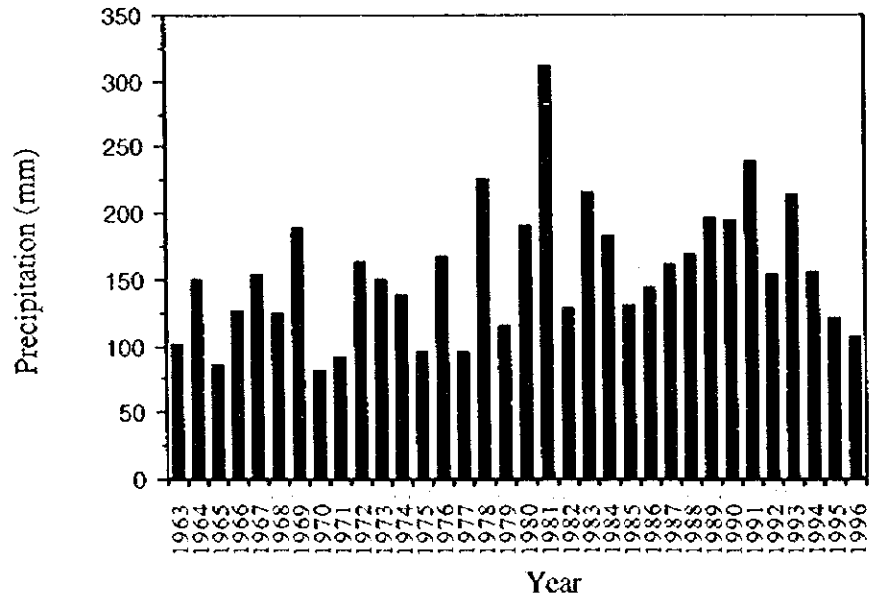

Figure A.3 Annual Precipitation at the Kzyl-Orda Meteorological Station

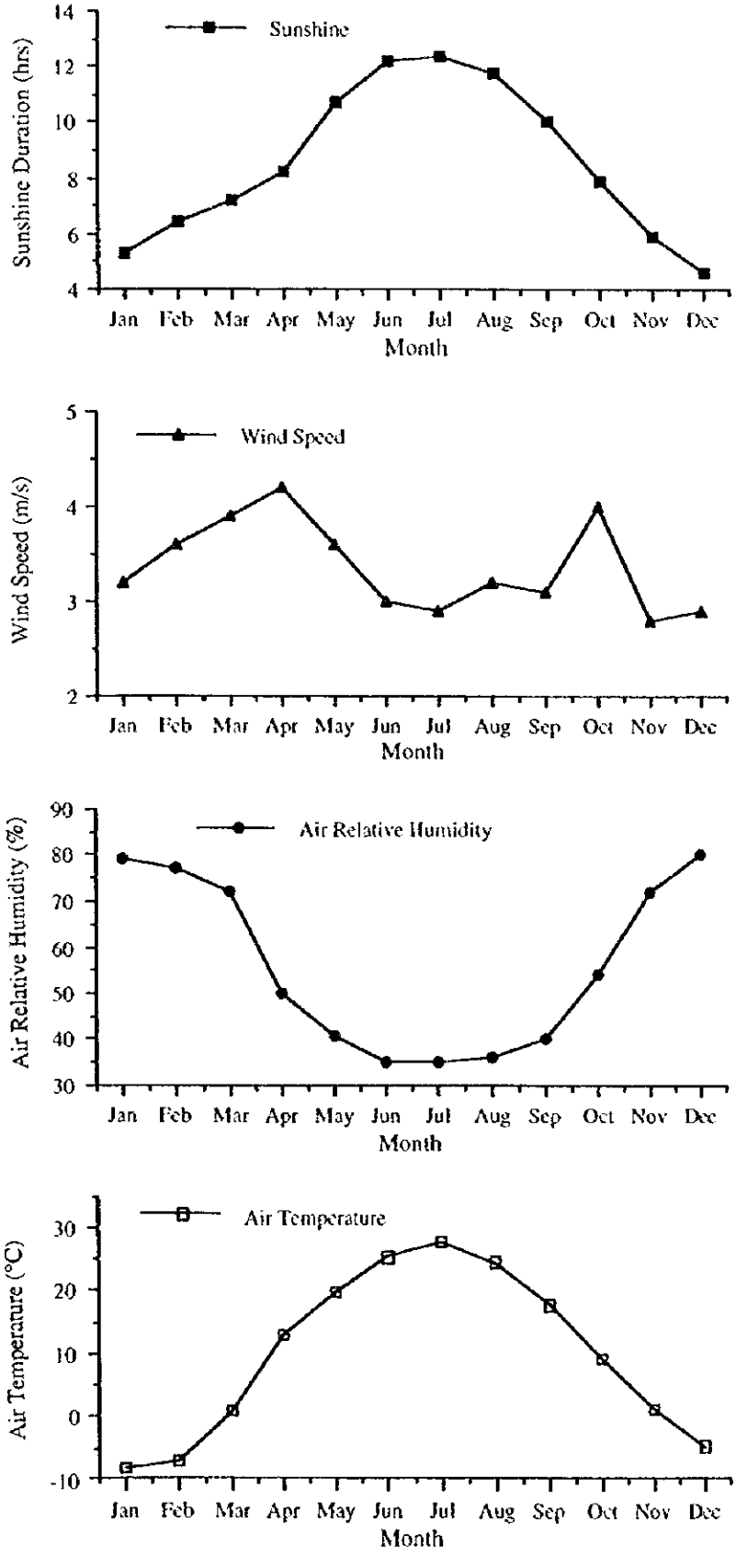

Figure A.4 Summary of Meteorological Aspect

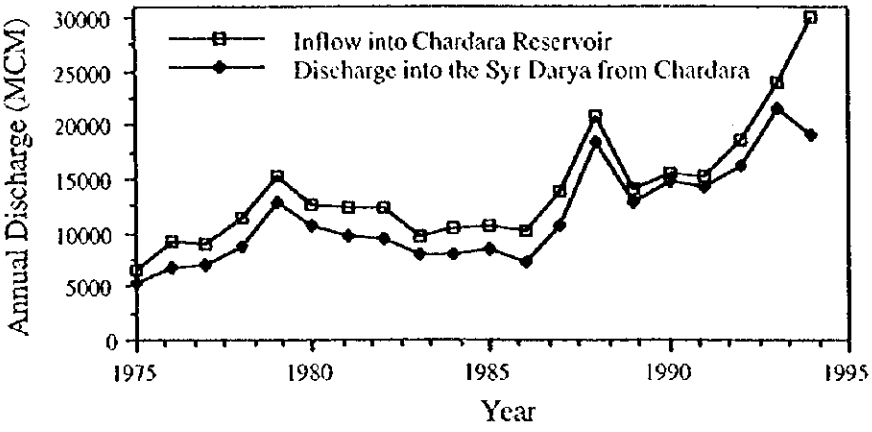

Figure A.5 Annual Discharges at the Chardara Reservoir

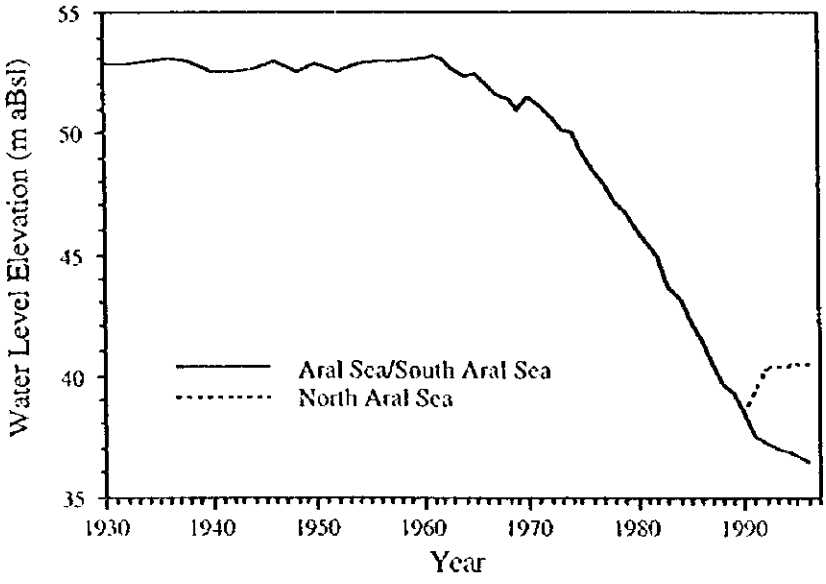

Figure A.6 Annual Water Level Of Aral Sea

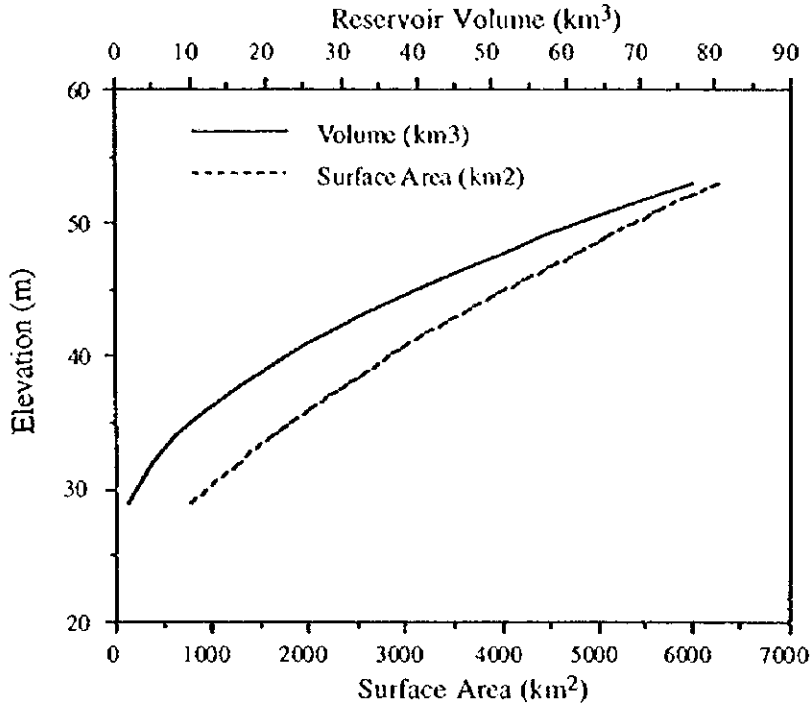

Figure A.7 Characterstic Curves of North Aral Sea

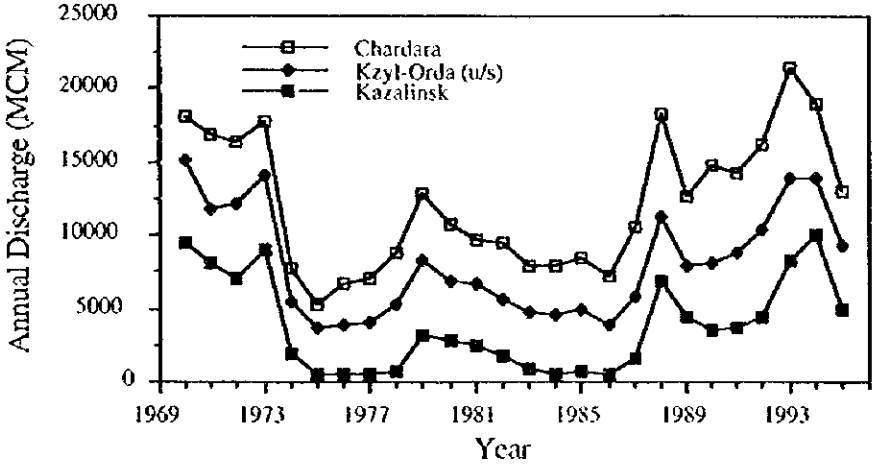

Figure A.8 Annual Discharges at the Chardara, Kzyl-Orda and Kazalinsk

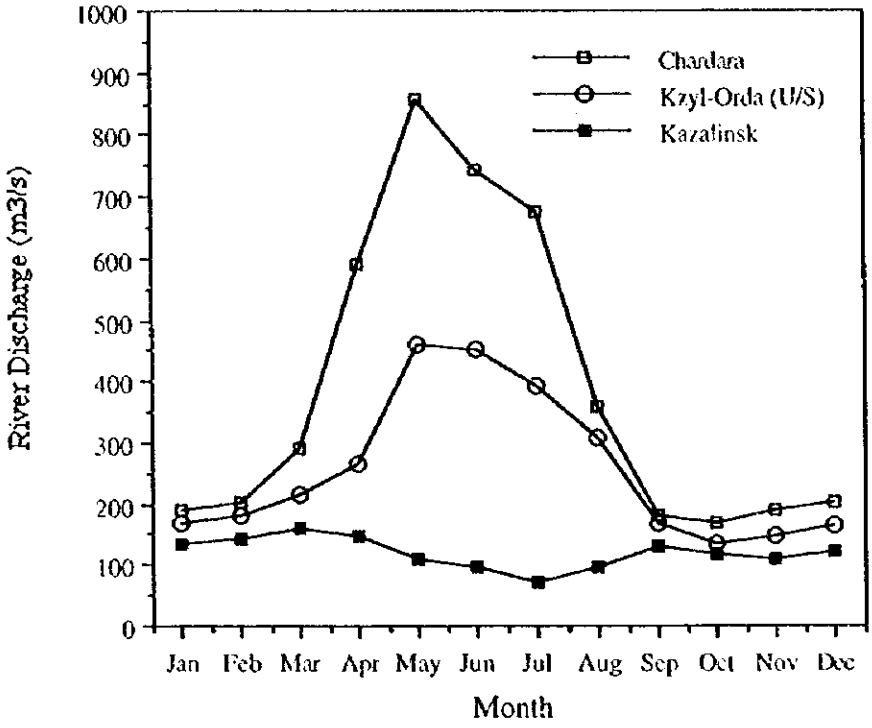

Figure A.9 Monthly Discharge in the Syr Darya

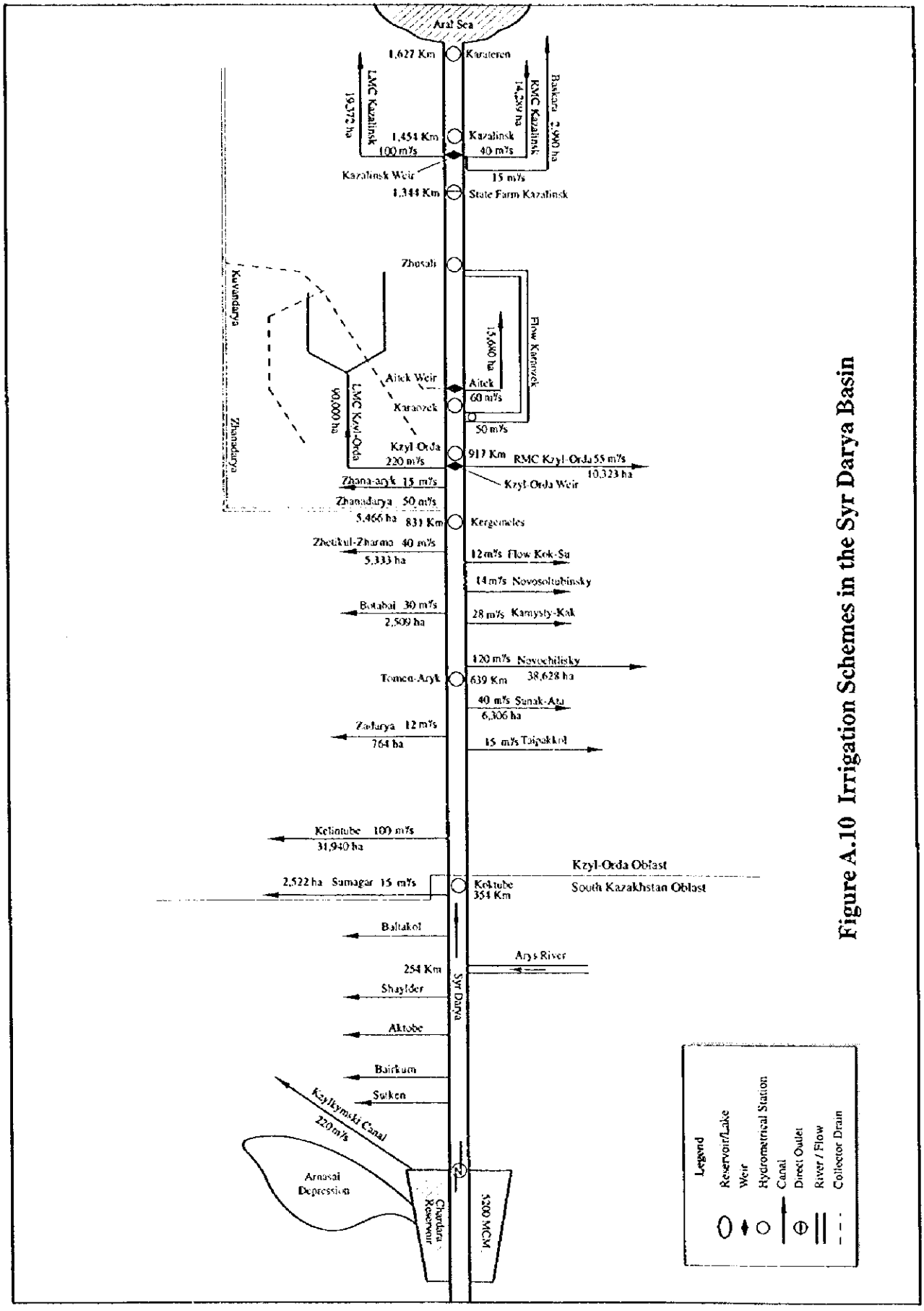

Figure A.10 Irrigation Schemes in the Syr Darya Basin