

Chapter 4. TRANSBOUNDARY WATER RESOURCES MANAGEMENT PROBLEMS

4.1. Current Status and the Regional Management Structure

The existing water management complex (WMC) of the Amudarya and Syrdarya river basins to the great extent determines the conditions of economic development in the Central Asian region. The WMC is made up of natural and manmade structures providing water formation and conveyance, runoff transformation, intake and delivery

of water to water uses, hydropower generation, and control and measurement of the quantity and quality of water resources. All the interstate (transboundary) water resources, including surface and return waters, are subject to management.

4.1.1. Development History

Issues of rational water resource use and management emerged as far back as in the 1970-80s (Box 4.1). Creation of the single Automated Management System (AMS) in the Amudarya and Syrdarya river basins has allowed certain functions of water management and distribution to be delegated to the Basin Water Management Organizations, BVO "Amudarya", BVO "Syrdarya", and BVO "Zerdolvodkhoz" (Zarafshan river basin). This brought certain benefits. Firstly, a proper system of measurement and control over the use of water resources was established. Secondly, the percentage of unaccounted for and lost water from rivers and interstate canals was reduced. The management system became more flexible, suited all the Parties, and helped ensure a certain level of mutual understanding and confidence amongst the region's countries. The share of wa-

ter for each republic was determined in accordance with the quotas approved by Gosplan (State Planning Agency) of the USSR on the basis of general plans [84,85].

The two principles "to minimise *water deficiency* within the basin", and therefore, "minimise damage to the national economy from the shortages of water" were used as the basis for assessing the efficiency of water distribution [26,86]. Depending on hydrological forecasts, the BVO could decrease or increase water limits to each country by up to 10%. However, it was not responsible for water quality and water use in each country. In reality water discharge to the Aral Sea and its littoral zone was based on the principle "whatever remains".

Box 4.1

History of creation of the AMS for WMC in the Aral Sea Basin

The Ministry of Amelioration and Water Resources of the USSR initiated design studies for creation of a single AMS for the WMC in the Aral Sea Basin on the basis of the Decree of the Central Committee of the Communist Party of Soviet Union (CC CPSS) and the Council of Ministries of the USSR of 17 March, 1986, No 430 "On measures to speedup the economic and social development of the Karakalpak ASSR" and others.

World experience of AMS establishment by the large WMC was used as the analogue for creation of the single AMS for WMC in the Aral Sea basin: (i) the centralized management of water supply system in California (USA) and water resources of the Sogami river (Japan); (ii) decentralized system of telecontrol in Provence (France); and (iii) the AMS of Saratov WMC (USSR), and the others.

The main objective of creation of the AMS for WMC of the Amudarya and Syrdarya river basins was the rational water delivery to all regions through the optimal distribution of water resources both in terms of volumes and time, taking into account requirements of all water users and consumers with observance of the ecological norms, for achievement of the maximum benefit for the national economy. The system would have ensured discharge of the sanitary water releases to the river deltas, without disruption of the leaching and vegetative irrigation water applications, as well disturbance of hydropower generation facilities. The main management criterion was the minimum deviation from the specified parameters (ToR for the "AMS of the Amudarya river basin", design institute Sredazgiprovodkhopok, 1989, et alias).

4.1.2. Regional Management Structure

As was mentioned in Chapter 1, since gaining independence the Heads of five Central Asian countries have begun improving the regional structure for managing the interstate water resources in the Aral Sea basin

The first stage of coordinated action by the Central Asian countries was the establishment in 1992 in Almaty, of the Interstate Commission for Water Coordination (ICWC) with two its executive bodies the BVO “Amudarya” and the BVO “Syrdarya”. The meeting of the Heads of five Central Asian countries in Kzyl-Orda (26 March, 1993), laid the foundation for the organizational and legal structure of management. The ICWC ‘took over the baton’ for water resource management in both basins directly from the former Ministry of Amelioration and Water resources of the USSR. The Charters of the BVOs were approved, and Provision on the ICWC and other fundamental documents were developed and approved.

At the Kzyl-Orda meeting decisions were taken on establishing, on the basis of parity, the Interstate Council for the Aral Sea (ICAS) with a permanent Executive Committee (EC). In addition the principle of sharing water based on the “existing water use” as agreed under the Master Plans¹ was approved. The Interstate Sustainable Development Commission (ISDC) and ICWC were also established under ICAS, and the “Provision on the International Fund for Saving the Aral Sea” was adopted. At the Tashkent forum (13 July, 1993), the Heads of five countries approved the provisions on the Interstate Council for the Aral Sea. This works under the EC and Interstate commissions (ICWC, and ISDC).

In January 1994, at the Nukus meeting of the Heads of the Central Asian countries, the World Bank’s Aral Sea Basin Program (ASBP) was adopted. The first phase of the ASBP comprised a package of programs to protect the environment of the Aral Sea basin, including: (i) implementation of a regional system to monitor water resources and their use in the Aral Sea littoral zone; (ii) development of principles for water quality improvement and limitation of all types of pollution; (iii) implementation of the interstate programs “Clean Water” and “Health”; (iv) studies and implementation of measure to enhance environmental conditions in the upper watershed; (v) provision of technical facilities to the “Syrdarya” and “Amudarya” BVOs.

The second phase of the ASBP identifying the priorities for development of the region for the period up to 2010 was approved by the Heads of the states at the International Water Forum in Dushanbe in August, 2003. The main directions of the ASBP-2 activities are as follows:

- Development of coordinated mechanisms for integrated water resources management in the Aral Sea basin; rehabilitation of the water management structures and improvement of water and land resources use;
- Improvement of the environmental monitoring systems and implementation of a program for combating natural disasters and strengthening of the material, technical, and legal base of international organizations;
- Development of a series of projects aimed at solving the region’s social problems and ensuring rational water consumption in different sectors of the economy in the Central Asian countries; realization of programs for environmental protection in the upper watersheds, sanitary and ecological enhancement of settlements and the natural ecosystems, etc;
- Development of the concept of sustainable development in the Aral Sea basin;
- Assistance to realization of the regional action program to combat desertification;
- Development of wetlands in the lower reaches of the Amudarya and Syrdarya rivers; and streamlining use of the mineralized collector and drainage waters.

As the part of the ASBP, the International Fund for Saving the Aral Sea (IFAS) was established as a high level organization with the task of coordinating ASBP implementation, attracting international attention to the environmental disaster caused by the recession of the Aral Sea, and mobilizing funds to help tackle the problems of the coastal lands identified as the disaster zone.

Although in the early stage of its existence the IFAS was a relatively dynamic organization (partly due to the direct support from the international community (EU-TACIS, UNDP, World Bank and the others), its activities at the regional level have

significantly declined since the middle of 1999. This also coincided with a reduction in financial assistance from the international donor community. However, the Heads of the Central Asian countries some efforts to reorganize and revive the IFAS. A new IFAS and its Executive Committee (EC IFAS) have been established and the work of the ASBP is continuing. (Figure 4.1)

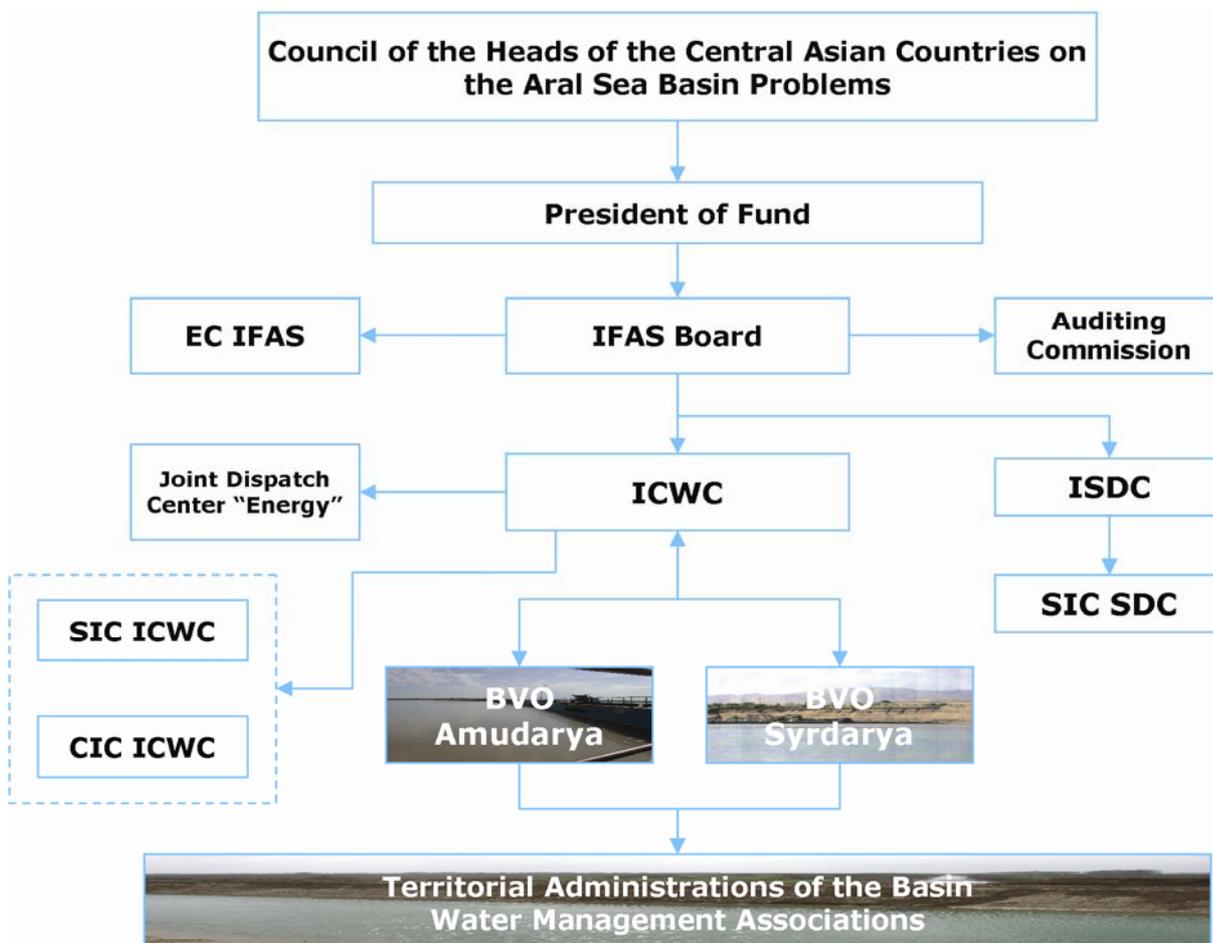
The new IFAS structure comprises the ICWC and ISDC and their subdivisions. According to this scheme the deputy prime ministers of the five countries are members of the IFAS Board. The Executive Committee of the IFAS (EC IFAS) is headed by the permanent chairman.

The ICWC is the collegiate management body, responsible for transboundary water resources management, water sharing, water monitoring and support to measures associated with water resources at interstate level. Its activities facilitate adoption of the decisions agreed by five countries and decrease the possibility of conflict. The ISDC

coordinates the nature protection policy in line with for the goal of sustainable development and is responsible for the development and implementation of the national strategy and program of measures for achieving planned targets on sustainable use of natural resources and environment protection. The scientific and information centers provide data, analytical and metrological support to the relevant bodies, and facilitate capacity building, improvement of public awareness, and exchange of information amongst all the stakeholders, etc.

The establishment of the new structure of IFAS has been a positive move since its organizations are now legal entities with international status. This status also applies to the ICWC and its executive bodies, responsible for the basin's water resource management. These changes represent real progress towards strengthening and improvement of the managerial and legal basis of the ICWC and its organizations.

Figure 4.1. **Structure of the International Fund for Saving of the Aral Sea (IFAS)**



4.1.3. Current Status and Infrastructure of BVOs

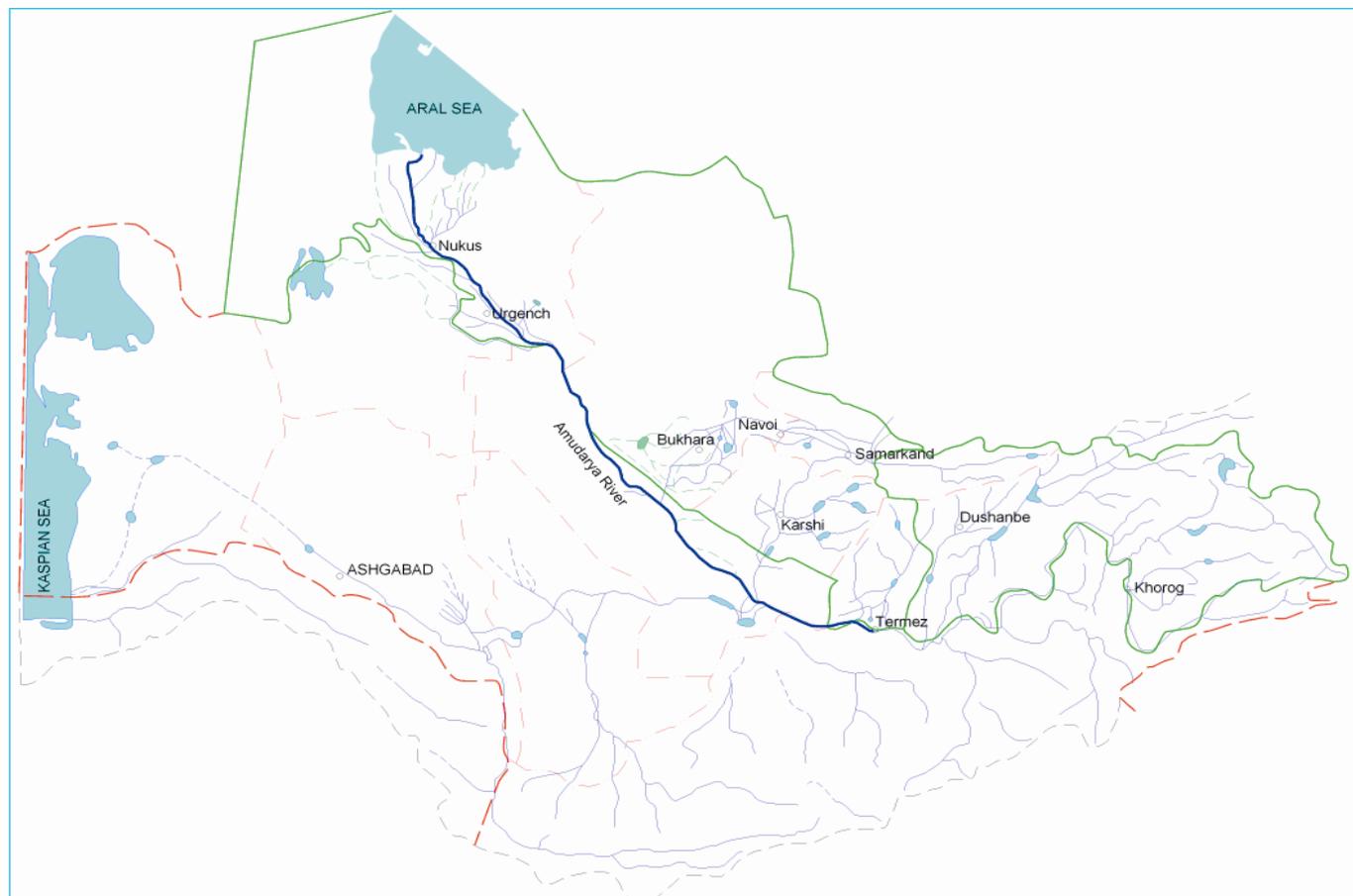
Rights of ownership and management of the Aral Sea basin's infrastructure are divided between the national Governments and BVOs. The main basin water management organizations are the BVO "Amudarya" and BVO "Syrdarya", which manage the interstate water sharing in the region under ICWC guidance. The regional infrastructure of BVOs was formed by the five republics through the temporary transfer of water structures, including the head river intakes, control structures, interstate canals, gage stations and other facilities. The remaining infrastructure, including the on-farm elements is attributed to the national infrastructure.

The BVOs have the relevant regional administrations for the operation and maintenance of intakes, control structures, and the interstate canals (Figures 4.2 and 4.3). They carry out their activities in accordance with the BVO charter, current legislation of the ICWC member countries and ICWC decisions, as well as agreements, protocols, and other normative acts.

The management of the WMC is very complex because different elements of the infrastructure are located over the whole area of the five Central Asian republics and far apart from each other (Annex 4). The specific features of WMC can be listed as follows:

- The large amount of information of different kinds showing the condition of the WMC;
- The large number and spatial dispersion of the management bodies and sources of information;
- The uncertain nature of the hydrological information;
- Inconsistency in the management modes of WMC participants;
- The lack of unified economic criteria for water resources use.

Figure 4.2. **Amudarya River Basin Scheme [96]**



In regulation and distribution of water resources amongst the republics the BVO Amudarya and BVO Syrdarya follow three main principles: (i) precise distribution of water resources in accordance with the established intake limits; (ii) maintenance of equity in all situations and strengthening of friendly relationships amongst all the participants and water users/consumers; (iii) recognition of water as the stabilizing factor in the region that brings together all the stakeholders and countries.

However, the effectiveness of the BVOs, as executive bodies dealing with interstate distribution of water, is restricted for the following reasons:

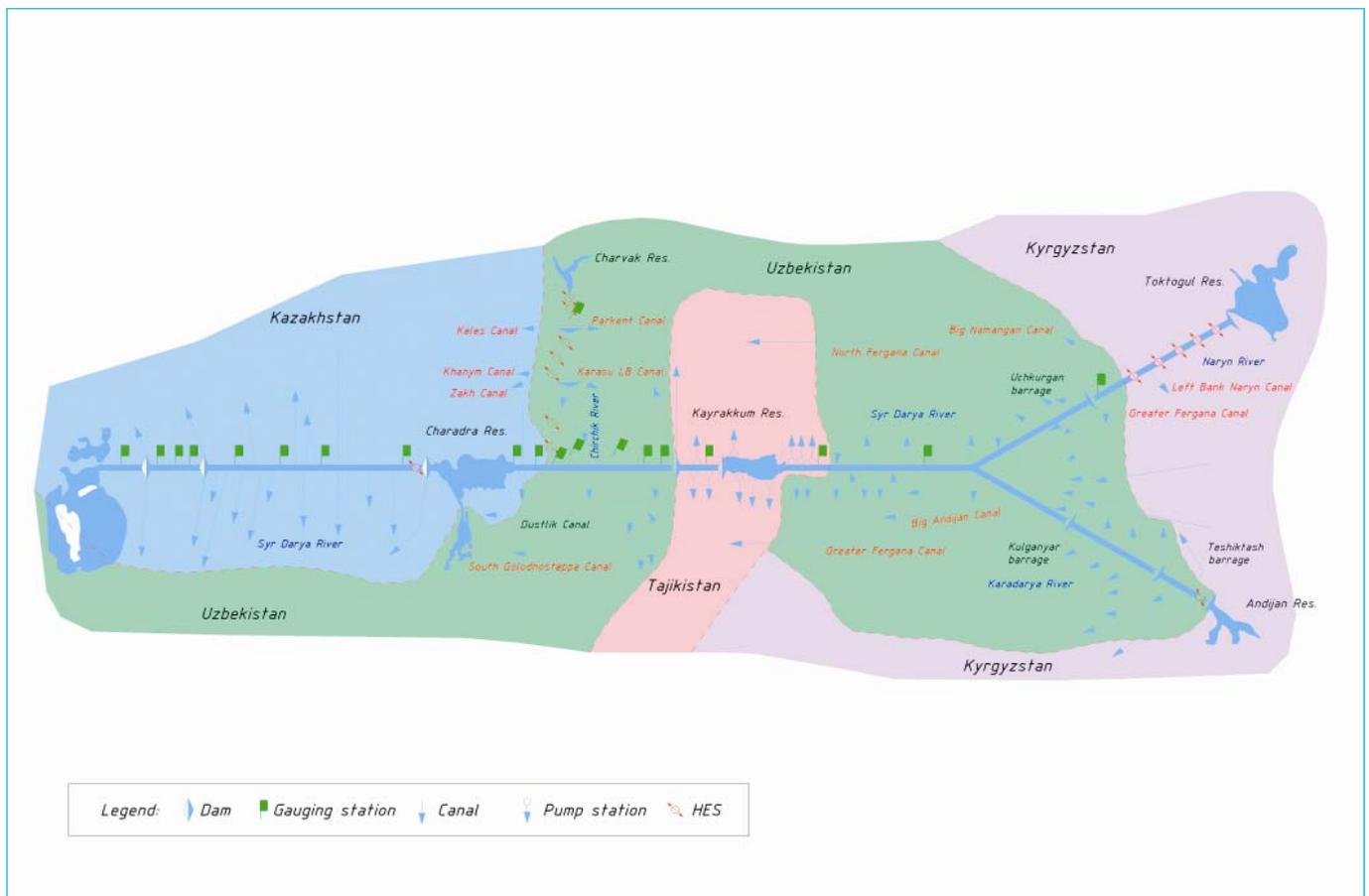
- Some intake structures of interstate importance, as well as the most important hydro-power complexes with reservoirs are managed by national bodies;
- The BVOs do not control the volume and schedule of underground water extraction and discharge of return waters, or the quality

of water resources;

- The equipment and infrastructure of intakes and gage stations at the key points of rivers is in poor condition;
- The interaction between the BVOs and national hydro-meteorological services is inadequate;
- There is a lack of precise rules for the management and exploitation of river basins; protected zones on important interstate rivers importance have not yet been established, etc.

In the current conditions of limitations and change, the complexity of the WMC management requires the role, power and capacity of the BVOs to be strengthened. This would ensure the reliable exploitation and management of the WMC with the minimization of threats from floods, droughts, and other emergency situations.

Figure 4.3. **Syrdarya River Basin Scheme [72]**



4.1.4. Joint Activities to Stabilize the Situation in the Aral Sea Littoral Zone

The possibility for the coordinated management and use of water resources in the region, and the capacity of joint actions and initiatives for cooperation have been demonstrated by the measures adopted by the countries to restore the disturbed natural ecosystems of river deltas and the dried up bed of the Aral Sea.

All five Central Asian countries consider the Aral Sea littoral zone as an independent water user so its demand for water will be taken into account along with the demands from the countries. These water demands should be established on the basis of the intergovernmental concept for saving the Aral Sea littoral zone taking into account the annual variations in river runoff. At the same time, all countries admit the importance of coordinating demands in order to ensure both quality of water and conservation of the biodiversity and bioproductivity of the deltas.

All countries have recognized that restoring the Aral Sea up to the previous water level is unachievable in the foreseeable future (Box 4.2). According to estimates of the WB, and others, restoration of the sea within 25 years would require 75 billion m³ of water annually (more than half of the total annual runoff of the Amudarya and Syrdarya rivers). This is unrealistic because it would require closure of the majority of irrigation systems in the Central Asian countries. For reduction of the catastrophic impacts of the falling water level in the Aral Sea the ASBP has recommended large scale but achievable interventions.

The IFAS and the region's countries are trying to improve the socio-economic situation in the littoral areas particularly health care and drinking water supply in the vicinity of Muinak and Aralsk cities. Part of this work has been supported by various donor organizations, notably the World Bank, but the major part was financed by the CA countries themselves. With GEF support, the Government of Uzbekistan has completed a project to restore the wetlands around lake Sudoche (see Chapter 5). In addition, the Government provides funding for the design and construction of water structures which create local ponds and regulate the water use system in the Amudarya river delta. Pilot activities, such as those of the GTZ agency aimed at creating forest shelter belts on the dry sea bottom, are also making a significant contribution.

Box 4.2

The Intergovernmental Concept for Saving the Aral Sea Littoral Zone

In the Intergovernmental Concept, adopted by the Heads of the Central Asian countries in 1994, it was admitted that in the current conditions it is impossible to restore the Aral Sea itself, and therefore, the task is not to restore the Aral Sea, but to save its littoral zone. Chapter IV of the Concept emphasizes: "...to create the active zonal controllable ecosystem that ensure stability of restoration of the disturbed natural development in the Aral Sea littoral zone". Activities aimed at creating artificial ecosystems in the deltas and on the dried bottom of the sea are of high priority from the viewpoint of nature protection and should include:

- Creation of a controllable pond system on the dried bottom of the Amudarya river and control over part of the Small sea for the Syrdarya river;
- Creation of a polder system on the dried sea bottom;
- Carrying out phyto - ameliorative works to fix the drifting sands;
- Discharge of the collector and drainage waters into the sea aquatorium through the scattered zones in sands.

In addition, the remaining water areas of the Aral Sea with increased salt concentration should be identified their salt and water balance and levels should be forecast. Measures to prevent the pollution of coastal areas should also be taken.

There is no doubt that all these contributions are insufficient to repair the damage caused by the Aral Sea disaster. According to some Muinak¹³ inhabitants "...the volume of water coming to us from the Amudarya river is in any case insufficient to restore the fishery". Despite this, Uzbekistan and Kazakhstan, as the directly interested countries, are trying to identify their priorities and abilities to carry out protection work in the future.

The demand for water from the Aral Sea littoral zone is estimated at 8 km³/year and 5 km³/year for the Amudarya and Syrdarya river basins respectively. In the more distant future (by 2025) this inflow to the two basins should be increased as a minimum up to 11 km³/year (Amudarya) and 8 km³/year (Syrdarya).

To ensure the environmental sustainability of the aquatic ecosystems in the Aral Sea littoral zone, BVO "Amudarya" specialists recommend that the

¹³CAWater – Info based on materials from the CentrAsia.org, 20.07.2006.



intergovernmental agreements should specify optimal water sharing and the regime for its release to the river deltas in years with various water availability. This would guarantee water for conservation of fish and other species of flora and fauna in drought years [96]. To develop strategically important decisions about the future of the Aral Sea and its littoral zone, it is recommended that:

- A master plan and a feasibility study should be developed for the improvement of water-supply in the southern part of the Aral Sea littoral zone with an area of more than 2 million ha. The aim of this would be the restoration of the species diversity and ecological sustainability of the natural ecosystems in the Amudarya river delta.

- Studies of the future of the Aral Sea itself should be conducted, including the possibility of retaining one of its parts (in particular, the western deep-water section) as a biologically active environment. At the same time, the future of the remaining parts of the sea should be determined in order to prevent further threats and especially dangerous phenomena.

These multi-purpose measures would restore the Amudarya river delta as a delta complex of interstate importance. This complex will be also be of great environmental and socio-economic importance for the whole Aral Sea basin. In order to increase the efficiency and reliability of this complex operation a strong institutional and normative/legal basis must be created.

4.2. Main Transboundary Water Management Issues

The previous chapters stressed that Uzbekistan, as well as the other countries of the middle and lower river reaches, face not only ecological and socio-economic problems associated with impacts of the Aral Sea disaster, but also environmental degradation and severe water shortages. The total water demand of Uzbekistan is almost entirely met (82%) by the transboundary water resources of the Amudarya and Syrdarya rivers. For the

population of the Fergana valley, and the middle and lower reaches of the Amudarya and Syrdarya rivers there are no alternative sources of supply. The underground water is insufficient both in quantity and quality to meet the demands of a population of 26 million (Chapter 2). Water deficiency is the main factor limiting the development of the country's economy, especially in the lower reaches of the Amudarya river.

4.2.1 Water Agreements and Joint Resources Use Issues

The current legal basis for the joint management and distribution of water in the Aral Sea basin is the intergovernmental Agreement "On cooperation in the area of joint management, use and protection of water resources of the international sources", signed by the Heads of five Central Asian countries in February 1992. In addition, over the last ten years the five countries have adopted a number of bilateral and multilateral agreements and acts on the basis of previously approved water sharing schemes and the 1992 Agreement (Annex 1). At the same time, the main principle of International Water Law, the "*obligation not to cause significant damage*" is still not observed by the countries, especially by those located in the upper watersheds. There is still no agreement between the countries on essential terminology and no shared understanding of the term 'transboundary water resources'.

Analysis of application of the water agreements shows that they have been very ineffective in solv-

ing the existing ecological, economic and social problems. The "Parties" to the current agreements do not always precisely comply with the adopted commitments due to the weakness of mechanisms for their execution. In some cases, since they are not practical, monitoring of their implementation is not carried out. The mechanisms for resolving disputes and ensuring that agreements are observed are missing.

It is worth mentioning that the problems in implementing the bilateral annual agreements and in solving the energy issues can be explained by the substantial differences in the economic structure of countries, as well as by the constraints and barriers typical of the transitional period. Market economy conditions exist, but not yet in all countries and all sectors. The recent changes (introduction of visas, creation of borders, strengthening of customs requirements, introduction of duties, etc.) also put constraints on joint activities to strengthen water relationships.

Naryn - Syrdarya Cascade of Reservoirs

The most serious disagreements have arisen in the Syrdarya river basin due to changes in the operational rules of the Naryn-Syrdarya cascade of reservoirs, which had a negative impact on its operation as a single water management complex as well as on the established water balance of the river.

The operational mode of the Toktogul reservoir in the Kyrgyz Republic is no longer coordinated with

the operational modes of the other water management facilities of Tajikistan, Uzbekistan, and Kazakhstan, located in the middle and lower reaches of the Syrdarya river. The data in Table 4.1 confirms that the Toktogul reservoir with a total capacity of 19.5 km³ now operates mainly to generate cheap electric energy both for internal needs and export. Consequently increased water releases from the reservoir are observed every year during the winter.

Table 4.1. **Trends in Changes of the Toktogul Reservoir Operation Mode, km³**

	Inflow	Losses	Releases		Total	Annual Average Balance of Reservoir
			Non-Veget. Period	Vegetation Period		
Designed (1970)	11.83	0.30	2.80	8.50	11.30	0.20
Annual Average for 1975-1991 (16 years)	11.30	0.30	2.70	8.10	10.80	+ 0.20
Annual Average for 1991-2001 (10 years)	13.00	0.30	7.20	6.10	13.30	- 0.60
2000-2001	12.80	0.30	8.40	5.90	14.30	- 1.80

Source: BVO-Syrdarya, 2002

Changes in the operational mode of the Toktogul reservoir have led to a decrease in the guaranteed water supply in the Syrdarya river basin during the vegetation period of 4.5-5.0 km³ per year. Within-year water deficiency in the Fergana valley in years with average water availability varies from 57-61% (June-August) to 85% in September causing serious losses and threats for the population and habitat (Chapter 2). Similar deterioration in the water management, socio-economic and ecological situation is taking place in the middle and lower reaches of the Syrdarya river (Box 2.2). Since 1992, around 27 km³ (by 3 km³/year on average) of water has had to be discharged into the Arnasai depression during the winter time due to the limited discharge capacity of the Syrdarya river bed downstream from the Chardara reservoir. The water discharged into the Arnasai depression is not only lost for further use, but also causes damage to the infrastructure, water logging of agricultural lands and settlements and other threats. The annual damage from this phenomenon to Uzbekistan alone is estimated at \$700 million [55].

In the current economic conditions in Central Asia the Framework Agreement of 1998, on management of the Naryn-Syrdarya cascade of reservoirs is the best that might be expected. The countries agreed that electric energy generated in the cascade should be the basis for payment for services provided by the upstream countries. At the same time, this has led to the situation that already in April of 2002, the volume of water in Toktogul reservoir dropped down to a new critical level of 7.5 km³. Moreover, the period 1989-1999, was characterized by increased water availability in the Amudarya river basin (114% of the norm). Selection of 1989, as the benchmark was not random. The initial filling of the Toktogul reservoir to the Normal Water Level (NWL) started in 1974 and was accomplished by August 1988, but in the other five regulating reservoirs in the Syrdarya river basin the designed storage capacity had still not been achieved by 1989.

The countries of the middle and lower river reaches have the historic right to use water from transboundary rivers. Construction of the Tok-



togul reservoir did not change this situation, but ensured that the guaranteed water supply could also be used to generate hydroelectric power. Having been faced with the necessity for more rational water use and adaptation to the changed operational mode of the Toktogul reservoir, the countries of the middle and lower river reaches now direct their efforts towards ensuring a guaranteed water supply and a decrease in water consumption. Uzbekistan has changed the cropping pattern with a significant reduction in the rice growing area. Measures aimed specifically at reducing specific water consumption in irrigated agriculture are also being undertaken.

The GEF WEMP assessment (2002) shows that the Kyrgyz Republic is increasingly considering water as an economic commodity with a value and therefore one which may be marketed¹⁴. It also considers that the downstream countries use “its water” for their own benefit. However, the natural hydrological cycle, rights of water users,

The Amudarya River Basin

At present the Amudarya river runoff is not highly regulated which leads to a delicate water balance and makes it difficult to use this source of water for economic purposes. Seasonal regulation of the Amudarya river runoff is provided by the Nurek and Tuyamuyun reservoirs. Currently Tajikistan is completing construction of the Sangtuda I and II hydropower dams (with a total designed capacity of 890 MW), and the Rogun I and II dams (with a designed capacity of 3,600 MW).

For Uzbekistan the water situation in the Amudarya river basin is less delicate because the bilateral agreement about joint and rational use of the Amudarya river water resources, signed by the Presidents of Uzbekistan and Turkmenistan in Chardjev (16 January, 1996), is being observed by both parties. Article 6 of this agreement specifies that the Parties have established equal sharing of water from the Amudarya river at the Atamyrat (Kerki) site. Before 1996, water sharing was carried out according to the same principle relying on the Intergovernmental agreement of 21 April, 1991.

At the same time, there are significant difficulties associated with ensuring a guaranteed water supply and the deteriorating water quality in the Amudarya river. As was mentioned in Chapter 2,

and the fact that maximum profits Kyrgystan makes from electric power, generated by the Toktogul reservoir come at the cost of losses incurred by the countries of the middle and lower river reaches, throw doubt on the validity of considering water as an economic commodity.

According to the recommendation of the GEF/WB WEMP (2002), the countries concerned should fix the operational mode of the Toktogul reservoir for a five year period in order to guarantee that annual releases would not exceed the annual inflow. This would allow reservoir volume to be maintained for long-term river flow regulation. The most beneficial option for the countries of the middle and lower river reaches is summer water releases from the Toktogul reservoir of between 6.5 and 6.0 км³, which would only be possible if winter releases were significantly reduced. It is important that an agreement is reached on a level of supply which, although lower, will at least be guaranteed.

water delivery to the Karshi steppe and Bukhara oasis, located on the right bank of the Amudarya river, is carried out by the Karshi and Amu-Bukhara pumping station cascades. The head intakes of these cascades are located in Turkmenistan. Deterioration of the equipment in these stations cut down the withdrawal of water from the Amudarya river by 2 км³. Suspension of the “Rehabilitation of the Karshi Pumping Stations Cascade” project, financed by the World Bank and other donors, due to intergovernmental disagreements, is disrupting the water supply to more than 1.5 million people, whose livelihoods depend directly on this water source.

The problems associated with the deterioration of water quality along the entire Amudarya river course downstream from Termez are of special concern to the government and public. Water consumers in the middle (Bukhara) and lower reaches of the Amudarya river, who receive water with mineralization of 1.5-1.8 g/l and hardness of more than 2 MAC (Chapter 2) that is unsuitable for municipal and agricultural needs, are the most vulnerable. The population of Khorezm and the Republic of Karakalpakstan has almost no access to the good quality drinking water that meets the State Standard (GOST).

¹⁴Letter of the National Coordinator of the Kyrgyz Republic, Mr. B. Mambetov (26.10.2004, No 22-2229) to the OCAC about establishment of the system of interrelationships in use of water and energy resources on the partly market conditions.



Since adopting of the above mentioned bilateral agreement of 16 April, 1996, Uzbekistan has made the significant efforts to improve river flow quality through reduction of collector and drainage water (CDW) discharges from the right bank of the Amudarya river. The first stage in a general program of interventions is the recently commenced “Drainage, Irrigation and Wetlands Improvement Project” in Southern Karakalpakstan, funded by a WB credit/loan (see Chapter 2). On the left bank of the Amudarya river middle reaches, Turkmenistan is also carrying out large scale interventions to divert collector waters. Completion of these projects is planned for 2012. However, this complex of measures can not completely eliminate the growing pollution of the Amudarya river flow, and aggravation of the socio-economic and ecological situation. Until measures are taken to prevent, and reduce pollution of water sources and precise mechanisms are established to regulate the quality of water for drinking, irrigation and ecological needs, the current problems of river flow contamination and conflicts between the upper and lower river reaches will go on, threatening people’s security and the integrity of ecosystems,

As was mentioned in Chapter 2, all water users and the natural ecosystems of river basins suffered from an unprecedented shortage of water in 2000–2001. The water users of the lower reaches of the Amudarya river (Khorezm and the Republic of Karakalpakstan), and the Dashkhowuz veloyat of Turkmenistan were most badly effected. The northern zone of Karakalpakstan experienced the

The Additional Reservoirs and Compensations

Even with the Toktogul reservoir operating in a mutually agreed and stable mode for instance, 5.5 km³ and 6 km³ of water releases in winter and summer respectively) about 2 – 3km³ should be released through the Chardara dam without being used for economic purposes. At the same time, the Kyrgyz Republic uses water resources for generating cheap electric energy, 80% of which is being sold in the internal market. However, over recent years the Kyrgyz Republic, as well as Tajikistan and Kazakhstan have directed their efforts at expanding the foreign energy market (Box 4.6).

Since construction of additional dams on the main course of the Naryn and Syrdarya river middle reaches is impossible, Uzbekistan is creating an additional reservoir in the Fergana valley (Box 2.1), and is also considering options for more rational use of water in the Chirchik and Akhanga-

most severe impacts, where apart from large agricultural losses huge environmental damage was caused to the Amudarya river delta and the Aral Sea littoral zone. Over the years of water shortage practically all water bodies including natural lakes dried up, most of the fish population perished, and flora and fauna was almost at the point of vanishing. In fact, the entire Aral Sea littoral zone was facing a new disaster.

All the above mentioned problems caused by water shortages entail serious threats and expense (Chapter 1). The expected revival of agricultural production in Northern Afghanistan and the respective growth of water consumption in this region may lead to a reduction in the already scarce supply of fresh water in the Amudarya river basin. There are several “hot spots” in water resources management which could cause catastrophes of regional importance. In particular, the breakthrough of the natural dam of Sarez lake in Tajikistan may lead to destructive floods endangering the lives of millions of people throughout the Amudarya river basin.

Therefore, without compromise and mutually beneficial cooperation in the area of joint use of water and energy resources, the socio-economic and environmental situation in the Central Asian republics will deteriorate further bringing new threats to the life and health of the population, and the viability of the natural ecosystems.

ran rivers. Such an increase in the regulation of the Syrdarya river tributaries may be more effective if the operational regime of the Toktogul reservoir, which has changed over the last decade, will be compensated. To some extent, a change in the operational rules of the Kairakkum and Chardara reservoirs may help to overcome this problem, but this issue requires study. Implementation of such projects includes part of the costs associated with the change in the operational mode of the Toktogul reservoir, and this should be accepted by all countries [62].

The Republic of Kazakhstan is also carrying out studies on the use of the Koksarai depressions downstream from the Chardara reservoir for retention of the excessive winter flow that can be used for irrigation and ecological purposes. There will be no need for such a reservoir if the opera-



tion of the Naryn-Syrdarya system can be stabilised. Apart from this, this reservoir would bring additional losses due to evaporation (0.4 km³). At the same time, the various options for creating additional reservoirs would not ease the problem in the short-term. It is extremely important that the regional institutions strengthen coordination of direct negotiations and multilateral consultations with all key Parties, with involvement of the regional and international communities in order to achieve a joint agreement on the sustainable use of the Toktogul reservoir.

According to the WEMP assessment (2002), the next ten years will see a transition from compensation for electrical energy to its free marketing with monetary clearing-off. It is expected that establishment of corporations in the energy sector of all countries will accelerate. During this transition period various energy companies will remain under governmental control, and stakeholders

4.2.2. Monitoring and Water Use Control Issues

Observation and Monitoring of Water Resources

According to assessments by GEF (2001), et alia, a serious deterioration of the water resources observation and monitoring system is evident in all the Central Asian countries (Box 4.3) [55,92]. Due to deterioration of the technical equipment, instruments, and other elements of the infrastructure there has been a steady reduction in the hydrological and meteorological stations network and the volume of observations... The situation with snow cover observations in the mountains has worsened. Only some of the gage stations on lakes and reservoirs, which are not always representational, have remain in operation. The Kairakkum observatory in Tajikistan has ceased its activities as a scientific and methodological center. Its role has been reduced to that of a standard lake station.

As a result, large areas (some river basins or groups of basins, slopes of mountain ridges, and high elevation zones) have remained insufficiently covered by hydrological, meteorological and snow cover observations. A particularly bad situation regarding observations has developed on small rivers 10-25 km long. Serious gaps in the observation series and lack of data (as a result of reconstruction and/or replacement of stations) are hampering studies and evaluation of long-term

from the irrigation sector will be able to make agreements with these companies for the purchase of energy from Kyrgyzstan during the summer.

In the future, when free market principles and mechanisms will dominate, water and energy resulting from the use of hydropower resources, will presumably, be more and more separated both in the energy and agriculture sectors. Export/import of electrical energy will be separated from water delivery services. Energy companies will search for ways to maximize the level of services to their customers and, at the same time, to maximize their profits. In the agricultural sector this will strengthen the water user associations, which will further improve methods of water use, for instance, through the introduction of charges for water delivery services.

Box 4.3

Observation Network in the Aral Sea Basin

Before 1991, 400 meteorological stations, 475 hydrological posts and a large number of aerological, actinometric and agro-meteorological stations simultaneously operated within the Aral Sea basin. Observations on snow cover and accumulation in the mountains were carried out at 239 ground snow-depth gages and 988 gages of airborne observations, 6 water balance stations for observations on evaporation from open water surfaces. There were 11 points of observations on the Aral Sea regime, 49 posts and 6 stations for observations on lakes, and around 70 water gage stations on reservoirs. A wide spectrum of studies on reservoir banks transformation, sediment transfer, thermal and ice regimes, etc. was carried out (Uzhydromet, 2001).

river flow dynamics and forecasting. Along with this reduction in the water bodies monitoring network, snow cover surveys in mountains and observations with total precipitation gauges have been almost abandoned. This means that ambiguity in the hydrological calculations and forecasts remains a significant problem despite the introduction of computer technology, and access to remote sensing data, etc.



Water Use Control and Decision Support Systems

One of the main problems in water resources management is the poor equipping of the BVOs infrastructure with modern equipment and metering devices for measurement and calculation of water resources. The low level of automation and dispatching of the control structures and objects limits the information communication system, data processing and storage, and accuracy of river flow control along its course. The other limiting factor is the lack of accounting of the available underground and return water, and poor control and monitoring of river beds. There is still a lack of knowledge and experience, and well trained staff at all levels of management, which restrains introduction of the new technologies and management tools. All these gaps impede accuracy of water accounting, distribution, and operational decision making, especially in emergency situations.

Development of information systems in the Aral Sea basin (WARMIS, WUFMAS) began in 1996, within the framework of the ASBP with technical assistance from EC-Tacis. Development of models and DSS was conducted later on with support from USAID, GEF/WB, and others. As a result a flexible set of interrelated simulation and optimization models was created (Box 4. 4).

Introduction of decision support systems, such as ASBOM, into management practice is held back by technical, economic, and institutional limitations. Measures to overcome these barriers should focus mainly on strengthening the coordination, relationships, and cooperation amongst the regional management structures and responsible monitoring services, as well as creating favorable conditions for their integration into regional and global networks.

There is a need for international technical assistance and investment in modernizing the worn-out equipment, and automating and dispatching the BVOs infrastructure (head intakes, dispatch centers, and river gauge stations, etc.) with the introduction of SCADA systems. Capacity building and awareness improvement through the establishment of training centers, extension services, and distribution of decision support tools is also necessary.

Special attention should be given to the development of a joint action plan for optimizing the observation network and improving the forecasts and flow calculations provided by the BVOs gauge stations. There is also a need for “on-line” communication of information, creation of an early warning system for drought, protection from floods and pollution, and the introduction of a state of emergency in extreme situations. All countries should also to work on expanding the single information system and GIS/RS database, improving the system of indicators and regulating the disposal of pollutants into water courses, etc. Implementation of these measures would ensure operativeness, continuity and reliability of monitoring, and would allow precise control over the volume and quality of water at all levels of management.

Experience of the developed countries shows that ensuring free exchange of and access to information is the main precondition for the development of cooperation based on the principle of hydro-solidarity and mutual confidence, and taking into account the interests and needs of all countries and the region as a whole.

Box 4.4

Decision Support System of GEF/WB WEMP, 2002

The ASBOM optimization model of the GEF project combines technical, economic, ecological and agricultural aspects into a single logically coherent system. ASBOM is a useful tool for assessment of the benefits from various compromise situations, which may include electric power and/or water cross-flow between the countries or compensatory payments, as well as formulation of the general system for direct negotiation between countries and river reaches for water/energy issues.

The management model for the Aral Sea basin (ASB-MM) comprises the hydrological and socio-economic modules and includes two versions: ASB-MM – for increasing public understanding of the problems and threats faced by the region ; and ASB-MM-expert - for increasing understanding among politicians of various strategies and their impact. The model takes into account various patterns population growth, reforms in the economy and climate change. The Model of the Aral Sea basin salinization was developed for prediction of ground, underground, and drainage water mineralization. This model allows selecting and decision making under various hydro-geological conditions and alternative water management scenarios.

4.3. Regional Cooperation Issues and Perspectives

4.3.1. Regional Cooperation Issues

Despite the various views and opinions of the Parties, cooperation in transboundary water resource management in Central Asia has made significant steps forward over the last ten years [99]. A certain consensus on the principle of reasonable and equitable sharing of water in accordance with the adopted regional agreements has already been achieved. However, there is still a lack of coordination and inconsistency in water use priorities that lead to losses of the limited water resources, aggravation of tension and threat of conflict. Difficulties in coordinating interventions in the water and energy sectors significantly restrain the implementation of measures aimed at protecting transboundary water courses and implementing the national programs and plans for saving water and other resources. More efficient and rational water use at the national level would ensure reduction of tension and achievement of stability in the region. According to UNDP assessments (2005) it is impossible to determine the total cost of the lack of cooperation, but when it does exist the annual benefits are estimated at 5% of GDP on average. The corresponding figure for the upstream countries is twice as high.

Reaching mutually beneficial decisions and achieving compromise on the issues associated with water and energy resources use is difficult due to insufficient coordination of joint actions and lack of proper management mechanisms at the regional level. According to recent external assessments water resources management still suffers from control “from the top”, inherited from Soviet times [70]. The ICWC did not take into account the changing political and economic relationships. Today the ICWC is a relatively closed intergovernmental body dealing almost exclusively with water sharing, and it does not interact enough with the ISDC. There are no representatives of water users/consumers from agriculture, industry, the energy sector, or NGOs in this body. The Joint Dispatch Center “Energy” have no power or ability to ensure precise observance of intergovernmental agreements. There are almost no consultations on the majority of projects dealing with the expansion of irrigated areas or the construction of reservoirs and artificial lakes in the countries. This increases mutual suspicion.

Analysis of numerous discussions shows that the adoption and/or update of the bilateral and mul-

tilateral agreements listed below may stimulate constructive dialog and cooperation between the Parties [82]:

- “On the joint use of water and energy resources of the Aral Sea basin’s rivers and the mechanism for realization of the mutual supply of water and hydropower resources and energy carriers.” It is proposed to prolong the current agreement of 17.03.1998, with relevant amendments on the mechanisms of realization, or to adopt a new one, taking into account regional and world experience;
- “On the legal status and operational regime of the interstate water and energy resources management body, executive organizations of the international bodies and their managing staff”;
- “On the legal status of water management and energy objects of interstate importance, and also the Aral Sea and its littoral zone”;
- “On the procedure and scope of observations on hydrological and hydrochemical indices of the transboundary water courses and on conveyance of the agreed flow volumes at the gauge stations on national boundaries”;
- “On information exchange about the quantitative and qualitative conditions of the transboundary water resources, as well as operational regimes and conditions of water management and hydropower facilities”;
- “On financing interstate organizations, joint activities on operation and maintenance of the interstate water management and hydropower facilities, interstate research, design and scientific work, as well as work on environment protection, etc”.

However, in order to fully implement these agreements the countries involved must have confidence in each other and be prepared to compromise both in the area of their own interests and in the regulation of water relations and compliance with the social and environmental needs of the region. Regional legislation and the legal system should become for the key to the resolution of conflicts between the upper water shed and dis-



semination zones, and between all water users and the environment. Creation of a strong regional legal basis is a laborious process requiring the involvement of highly qualified specialists, national experts, the general public and politicians.

To consolidate the efforts to achieve understanding amongst the countries, the responsibilities, authority and capacity of the regional management structures need to be strengthened. The regional institutions should fulfill their obligations and commitments to the participating countries and be responsible to the regional community. They should be able to coordinate joint activities on developing regional solutions and reaching agreements between the countries on the basis of equality and mutuality. They should also monitor the execution of these agreements, and implement the relevant legal, economic and financial measures aimed at ensuring equitable water sharing and protection of transboundary waters.

The numerous contradictions at regional and national levels should be solved through the use of the legal mechanisms of joint water resources management. Currently all countries of the Aral Sea basin urgently need assistance and support from intergovernmental and international organizations to harmonize their national water law with international legal norms. This process should be based on the experience and achievements of developed countries in integrated water and energy resources management.

The Central Asian countries place great hopes in the establishment of the International Water and Energy Consortium (Box 4.5).

Consortium will operate in accordance with the framework agreement. Within the scope of this agreement second level agreements on water use, operation of reservoirs, the system for electric power transmission and marketing, and mechanisms for their execution will be developed¹⁵.

Until adoption of the agreed concept for the Consortium within the framework of the organization for Central Asian Cooperation (CAC), countries should continue to be guided by the Framework agreement of 17 March, 1998, and the annual intergovernmental agreements on use of water and energy resources of the Toktogul hydropower complex.

The Special UN Program for Central Asia (SPECA) presents a great opportunity for strategic planning and development of regional cooperation. One important SPECA output is the development of a Cooperation Strategy on rational and effective use of water and energy resources in Central Asia. This has already been approved at different levels by the Governments of Kyrgyzstan, Kazakhstan, Tajikistan and Uzbekistan. This Strategy is a political platform for effective cooperation between the countries of Central Asia, and includes several guiding principles for such activity [104]. Now all stakeholders are considering how to ensure connectivity between this strategy and the national policies and action plans.

Box 4.5

Draft Concept for Establishment of the International Water and Energy Consortium

The Consortium envisages: (i) coordination of the current activities of its Entities within the power provided to the members of the Consortium, including preparation of international agreements and coordination of feasibility studies of regional projects funded from internal and external sources; (ii) ensuring harmonization of the relevant legislation and improvement of the international legal basis of the participating countries; (iii) ensuring interaction with international organizations and other concerned structures; (iv) development of measures for prevention of damage to the participating countries as a result of the activities of the Consortium entities; and (v) monitoring of practical implementation of the international agreements in the area of rational and efficient use of water, energy, and fuel resources by the Parties. The Consortium will also be responsible for other tasks, specified by the international agreements.

¹⁵Meeting of the intersectoral working group heads of the member states of the organization for "Central Asian Cooperation" with the representatives of the International Bank for Reconstruction and Development on the concept for establishment of the International Water and Energy Consortium, (Almaty, 30 July, 2004), Protocol of the Meeting.

4.3.2. Electrical Energy Export Perspectives

According to WB assessments (2004), the annual surplus of electrical energy in Central Asia in 2015, will be an estimated 43,663 GWh, with around 65% of this occurring during the summer. Kyrgyzstan and Tajikistan have the greatest potential for the export of electrical energy to neighboring countries. The bilateral agreements between the Kyrgyz Republic and the Republic of Tajikistan on the transmission of electric power through the Batken – Kanibodom line, and also between the Kyrgyz Republic and the Republic of Kazakhstan on the export of electrical energy from Kyrgyzstan to Russia have already been signed. Access to new markets in Pakistan and Iran is also beneficial for Kyrgyzstan and Tajikistan. Electrical energy demand from China comes mainly from its distant eastern regions and would require significant investment in power transmission lines (Box 4.6).

Kyrgyzstan, with help from Kazakhstan, is planning to construct an energy corridor that will link both countries with Russia and Pakistan. Kazakhstan is showing great interest in the energy sector of Kyrgyzstan, including the construction of the Kambarata hydropower stations and development of the hydropower capacity of the upper and middle reaches of the Naryn river. Nuclear power stations are planned in Kazakhstan, but Kyrgyzstan proposes to solve the problem of electrical energy supply by cheaper means. Energy transmission to Iran will be via Afghanistan, Turkmenistan, and Uzbekistan after the relevant agreements are concluded

The first phase of electrical energy marketing, coordinated by the WB¹⁶, will include the import of 1,000 MW from the Republic of Tajikistan to Pakistan through Afghanistan and the creation of the necessary infrastructure. Surplus electrical energy from Kyrgyzstan Republic may be transmit-

Box 4.6

Planned Export of Electrical Energy from Central Asia

The Kyrgyz Republic is currently planning the construction of the Kambarata Hydropower Station - 1 (400 MW) and Hydropower Station-2 (1,200 MW) at a total cost of \$2.5-2.9 billion. The Decrees of the Government "On organization of the investment tender for construction of the transformer substation 500/220 kV "Datka" and reconstruction of the electric power transmission line EPTL - 220 kV for southern Kyrgyzstan", and "On construction of the hydropower stations cascade on the Sary-Djaz river" (Issyk Kul oblast) with a minimum total installed capacity of 750 MW, have been signed. China is intended as the main consumer of electrical energy generated by this cascade. Total estimated cost of this project is \$2.5-3 billion. According to calculations, Kyrgyzstan will be able to sell electrical energy worth around \$300 million annually. The ADB has allocated \$0.8 billion to a feasibility study of supplying Afghanistan with electrical energy from Kyrgyzstan. The selling price of electrical energy supplied to Kabul is approximately 5-6 cents per kWh.

On 21 February, 2006 the heads of the energy bodies of Tajikistan, Iran, and Afghanistan signed a trilateral agreement on the construction of a 1,100 km long high-voltage transmission line from the Sangtuda to Meshkhed. This agreement also covers the transit of electrical energy from Tajikistan to these and other Asian countries. Another bilateral agreement was signed by Tajikistan and Afghanistan on the all-year-round supply of Tajik electrical energy, and on cooperation in the gas sector, as well as the realization of a joint project to construct a hydropower station on the river Pyandj. Currently, 120 thousand kWh per day of electrical energy is exported to Afghanistan.

The capacity of the Fuel and Energy sector of Kazakhstan is attracting the largest American and European multinational corporations, China, and India. Practically all the generating assets in the country have been privatized, and the high capacity hydropower stations handed over for concessions. To strengthen the connection between the energy-rich north and the energy-deficient south, construction of the second electric power transmission line North-South and EPTL from northern Kazakhstan to Aktyubinsk oblast is planned to be completed by 2008-2010. This will ensure Kazakhstan's energy independence. A project to create an energy bridge between Kazakhstan and China with a total cost of \$9.5 billion is at the stage of pre-feasibility study development. This energy bridge will be supported by the construction of a new State Rayon Electric Power Station with a capacity of 7,200 MW and a 3,800-4,200 km long electric power line extending to the center of China. Implementation of this project will significantly increase the capacity of Kazakhstan to export power to China (more than 6,000 MW). (From the review of the energy sector status, Institute of Strategic Research of the Ruz, 2006)

¹⁶"The Times of Central Asia", 1.07.2006; "Asia Analytics", 2.07.2006. The Project is planned to be implemented in three stages. During the first stage an electric power line (EPL-220 KV) will be constructed from Tajikistan to Afghanistan. During the second stage another line (EPL -500 KV) will be constructed from the border of Kazakhstan through Kyrgyzstan, Tajikistan and Afghanistan to Pakistan, During the third stage two new hydropower stations in Tajikistan will be constructed. (D. Perri, Regional Director of the "AES" Corporation for Kazakhstan, Russia, and the Central Asia).



ted through these lines by installation of the new lines. Completion of this project, with a total cost of around \$1 billion, is expected by 2010.

However, according to the UNDP assessments (2005), the export of energy faces a number of limitations associated with the inability of Afghanistan to pay, the need to construct electrical power transmission lines, uncertainty of pricing for power transmission, and, especially threats associated with political instability and security. Therefore, the expected growth of electrical energy

sales beyond Central Asia will have some negative effects both on the exporting countries and transit states, and limit the development of mutually beneficial regional cooperation. To minimize the possible risks and prevent future threats to security, there needs to be an intensification of the activities of the key partners aimed at ensuring the effective coordination and development of mechanisms for joint energy and water resources management in the short- and long-term.

4.3.3. Commitments to Integration into the IWRM

In the Nukus Declaration of 20 September, 1995, the Heads of the Central Asian countries affirmed their support for the Convention on transboundary waters and emphasized the necessity for establishment of an International convention on sustainable development of the Aral Sea basin. The protocol of the ICWC meeting in Almaty (14-15 June, 2002) indicated: *“Members of ICWC should consider the issue on submission of proposals in accordance with the established procedure to their respective governments on the possibility for ratification of the Convention on protection and use of the transboundary water courses and international lakes* (Helsinki, 1992). There are also a number of other statements, and declarations of the Heads of the Central Asian countries which reflect the political objectives and willingness to further strengthen interstate cooperation.

Although as of now only Kazakhstan (2000) has acceded to the *Convention on protection and use of the transboundary water courses and international lakes*, all the Central Asian countries are parties to the UN Rio Conventions and have adopted explicit commitments for rational use of natural resources and protection of the environment. The possible synergy between these Conventions will allow more rational, efficient, and economical use of their tools and mechanisms for harmonized water resources management with observance of the main principles of the international water courses use, namely:

- Water resources are common property and the basis for future development, and their volumes are extremely limited;
- Water resources exist irrespective of state boundaries;

- The main objective of water resource management is the common welfare of people and countries;
- The interests of the whole basin should have precedence over particular interests, including those of the countries using the water resources;
- Observance of the principle of equitable and rational water resource use and the damage prevention rule should be obligatory.

The current efforts and contributions of Uzbekistan, as well as the other Central Asian republics, confirm its commitment to the observance of the main provisions on the equitable and rational use of the international water courses in regard to other upstream and downstream countries. In previous chapters it was mentioned that the urgent measures being undertaken by Uzbekistan to overcome the negative impacts of water deficiency and environment degradation will bring positive benefits at the national and regional levels.

It is well-known that the world summit on sustainable development in Johannesburg (2002) called on all countries to develop integrated water resource management and efficiency plans by 2005. The summit recommended that countries *“develop and implement the national and regional strategies, plans and programs for the integrated management of river basins, watersheds, and underground waters; improve efficiency of water resource use and ensure their distribution in such a way that gives priority to the daily wants of people and achievement of a balance between the requirements for conservation and restoration of ecosystems, especially vulnerable ones, and municipal,*

industrial, and agricultural demands, including guaranteeing the quality of drinking water". In a broad sense integrated water resource management (IWRM) involves integration of the three fundamental parameters: economic development, environmental sustainability, and social requirements in the political context.

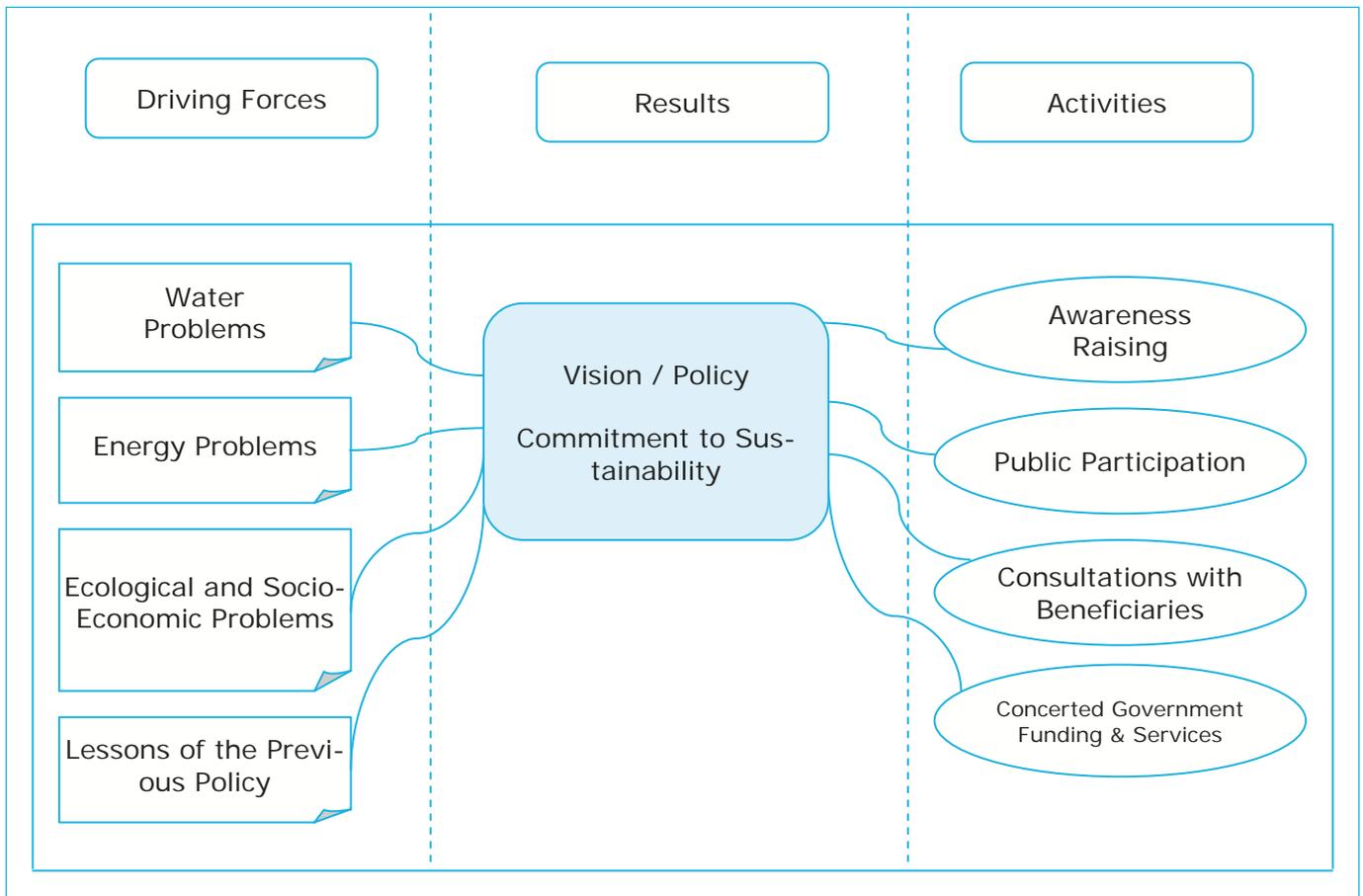
The first step of the Central Asia integration into the IWRM processes has become the "Main provisions of the regional water strategy of the Aral Sea basin countries, developed within the framework of WB ASBP-1 (1997) [105]. As was mentioned above, since 2002, introduction of the IWRM principles and approaches in the five countries of the region has been carried out by the Technical Committee of GWP CACENA. In 2004-2005, development of the National IWRM strategy for Kazakhstan and the main provisions of the National IWRM Plans for the other republics were initiated with financial support from Finland and Norway. For strengthening integration of CA countries into IWRM further international support and assistance in developing national strategies and plans is required in order

to achieve of security and stability in the Aral Sea basin. All national IWRM plans should be closely linked with the ESCAP Cooperation Strategy on rational use of water and energy resources.

Development of Uzbekistan's national IWRM strategy will help overcome the existing barriers and adaptation to the changes in water and land use associated with the expected demographic growth, migration and the growing demands of the population. The strategic vision of IWRM is illustrated in Figure 4.4.

Previous experience world achievements, and lessons learned by the country within the framework of programs and projects carried out with financial support from the international community will become the main preconditions for successful introduction of IWRM in Uzbekistan. The centuries-old history and shared fundamental interests of the Aral Sea region's nations also instill confidence that the declared objectives can be achieved.

Figure 4.4. **IWRM Strategic Vision: Driving Forces, Results and Activities**



Source: GWP (2002) updated by UNDP project team, 2006