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ARAL SEA BASIN PROGRAM**

**Water and Environment Management Project
Sub-component A1
National and Regional Water and Salt Management Plans**

**NATIONAL REPORT 1
By NWG of Kyrgyzstan**

**NATIONAL WATER DEMANDS AND
OPTIONS FOR DEMAND MANAGEMENT
Volume II
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6	Participants	K.Beishekeev, A. Bekenov, A. Jamgyrchiev, L. Gossu, A. Sizintsev, G. Cheban, U. Yakimansky
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Report prepared by

R. Apasov	Resume, introduction, section 3
B. Kovalenko	Introduction, sections 2.1, 3, 4, 5, 6

A. Jamgyrchiev	Section 5
L. Gossu	Section 5.1, 5.2.1, 5.2.2, 5.6, 6.3
B. Ponomarev	Section 2
A. Sizintcev	Sections 5.2.3, 5.2.4, 5.2.5, 5.3, 6.6, 6.7
G. Cheban	Section 4.3.2, 4.3.3, 4.2.6, 6.8
U. Yakimansky	Section 2.1

The report checked _____

APPROVED:

K. Beishkeev

Team Leader of Kyrgyz National
Working Group on Sub-component
A-1, GEF Project

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RESUME

1. The National report #1 is prepared in accordance with the requirements of ToR on implementation of Sub-component A – 1, directive letters on preparation of the National report #1 and instructions of RWG mission at the end of August 2001.
2. The aim of the National report #1 is to elaborate the preliminary national plan for water use, power production, water conservation and salt management based on revealed quantitative and qualitative water characteristics of the Kyrgyz part of the Aral Sea Basin, Planning Zone Analysis, recommended development scenarios.
3. The reports N3/3, N5/5, N6/1, N7/7, General provisions (conceptions) of National Water Strategy as well as National Energy Program were taken as an initial material. The research on “Rational and efficient use of energy resources in Central Asia”, prepared within the framework of SPECA program, was also used. It is clear that the National report is oriented to the Complex Basis for Development of the Kyrgyz Republic up to 2025.
4. Scenarios were developed separately by branches of the economy of Kyrgyzstan (domestic and rural water supply, agriculture, industry and energy), as well as by 7 planning zones, which belong to the Kyrgyz part of Aral Sea basin. (Zones of Upstream Naryn; Mid-stream, Northern Fergana, Chatcal, Kampyr-Ravat, Southern Fergana and Alay).
5. The following was used as a basis for determining the required development rates of sectors of economy based on planning zones and region (Kyrgyz part of Aral Sea Basin):
 - current social and economic status of population;
 - its actual quantity;
 - expected rates of population growth and its requirements for agricultural food products and raw material for industry for the period of 2001-2010-2025.
6. It is determined that river salinity in Kyrgyzstan is not high and varies within a small range. Two periods are typical for annual salinity regime. They are minimal and maximal. Minimal salinity volume is recorded during the flood wave, while the maximum salinity volume takes place at the end of low water period, preceding to the beginning of high water. The same opposite (reverse) dependence of salinity on flow is also typical for multi-years regime: high water years are distinguished by low salinity, and low water years - by higher salinity.
7. It is noted that at present in water resources management sphere a great number of ministries and departments are dealing with water resources management issues. Moreover, water is a common resource, ground and surface waters have direct relation and they must be managed jointly. When developing institutional issues the possibility of maximal concentration of functions on water resources management at a republican level is to be considered. All it should be in one department with respective status, which would not depend on water users and deal with issues of state regulation of water relations, not interfering in the activity of other institutions.

It is required again to introduce licensing for right to water use and assign this right to a certain water institution.

To give the right for fixing tariffs for irrigation water supply from legislative back to executive authority.

8. Power industry analysis shows that currently the issue of having common Central Asian market of resources and services, which can be called water and energy market, is at the stage of actual implementation. At the moment, the issue of creating the Energy-pool or electric energy and capacity exchange unit for five countries based on UDC "Energy" is under consideration. There is a proposal to create of interstate corporations and consortiums, which ensure balanced development of fuel and energy complex under conditions of forming the demand and offer balance in the electric energy market.
9. It is also clear that unfortunately the existing interstate Declarations and Conventions on use of transboundary watercourses (Dublin Declaration of 1992, Helsinki Convention on transboundary watercourses of 1992, UN Convention on non-navigational uses of international watercourses and others) do not very much reflect specific features of using the watercourses of Central Asian region. Existing Declarations and Conventions so far insufficient to help in solving disputable interstate water problems. They contain (mainly declare) generally correct and acceptable, but only very general provisions, which reflect little the specificity of problems of interstate water sharing and use of scarce water resources of Central Asian region, and above all do not include mechanisms (methods) of practical implementation of recommended provisions. Interstate Agreements in the region so far are not always equally satisfactory for all contracting parties.
10. According to the 1999 census, the total number of population of the Kyrgyz Republic reached 4852,4 thousand people, 2220,17 of which are in the Kyrgyz part of the Aral Sea Basin. It is supposed that the expected growth of population number in the area concerned will be 2713,3 thousand people by 2010, and 3501,9 people by 2025.
11. In order to provide the increasing population with food and provide industry with raw materials, the irrigated agriculture will be widely developed. The perspectives of irrigated agriculture development are considered in 3 scenarios. The first scenario of minimum changes stipulates only maintaining the agriculture in sufficient level and its development based on improvement of agricultural production and water use, not developing any additional land and water resources. The organisational activities are important not only from the point of view of improving the organisation (ordering) of rehabilitation processes and development of agricultural production, but they themselves are an essential element in increasing the efficiency of these processes, and above all their implementation does not require much expenses. The report on subtask N6/1 provides detailed analysis of 7 of such activities, including one of the main ones is modification of economic (market) relations between the state, national water management systems and water users and proved payment system for water use. The recommended principles of paid water use are expounded.

The second scenario of low-level development envisages restoration (rehabilitation) of agricultural production facilities by increasing their productivity and profitability from the current level up to a level not below than earlier achieved (1990-1991 period) without developing additional land and water resources (1990-1991 period). The volumes of their consumption will remain at the level of 1990-1991 period. The report on subtask N6/1 covers five activities of such nature, including those related to implementation of Irrigation Rehabilitation Project (IRP) and On-Farm Irrigation Project (OFIP), which are

currently being implemented in the Republic (and in the planning zones concerned that are financed by the World Bank and the Government of the Kyrgyz Republic.

The third scenario of high-level development envisages development of additional land and water resources to provide the population of the whole region by 2010 - 2025 with foodstuffs and agricultural raw materials in the volumes not below that required by norms. Implementation of this scenario will be performed based on already implemented first and second scenarios, i.e. on the basis of improved organisation of agricultural production and rehabilitated (restored) water facilities. The calculations have shown, that it will require to develop additionally by the year 2010 about 26.5 thousand hectares, including about 20 thousand ha of irrigated land; by the year 2025 about 76.5 thousand ha, including about 56.5 thousand ha of irrigated land.

12. It is determined that the discharge of collector-drainage waters in most of collectors goes to irrigation canals, reservoirs and rivers of the Aral Sea Basin and is used further for irrigation, i.e. these waters are additional source for irrigation purposes.

The total annual salt export on collector-drainage system in four oblasts of the Kyrgyz part of the Aral Sea Basin does not exceed 175 000 tons (1999), that is considerably lower than data given in the report NR 7/3, which is 680-960 thousand tons per year.

13. In accordance with the Preliminary national plan (for medium-term and long-term periods), national water demands to irrigate new lands by the year 2010 are evaluated as 206 million cubic meters per year and 594 million cubic meter per year by 2025. To increase water supply of existing irrigated lands up to the level of 1990 in order to increase crop yield by 10 % by 2010 and by 15 % by 2025, the additional water volume is required, which is approximately equal to 576,8 million cubic meters per year.

In total by 2025, the water intake volume in the Kyrgyz part of the Aral Sea Basin will be 6010 mln. cubic meters, of which the water intake at 1990 level is equal to 4633 million cubic meters, the additional water intake is 576,8 million cubic meters; and the perspective water intake for irrigation of new 76,5 thousand ha is 800 million cubic meters.

14. Total water consumption for domestic and household needs of the population will make up:
 - 85,1 million cubic meter per annum in rural areas by 2010, 139,5 thousand cubic meter per annum by 2025;
 - 18,1 million cubic meter per annum in urban areas by 2010, 30,2 million cubic meter per annum by 2025;
 - in total for the Kyrgyz part of the Aral Sea Basin it is equal to 103,2 and 169,7 respectively.

In addition, it is envisaged that by 2010, 70 % of rural population, 75 % of urban population will use tap water, and by the year 2025 it will reach 90 % and 95% respectively.

15. The expected growth of production in mining industry, machine building, petrochemistry will not result in essential growth of industrial water using. The main increase of water using will take place at the enterprises of local and processing industry. We have focused

on three scenarios of development of industry and industrial water using based on planning zones. Table below shows the summarised figures of expected water using for industrial needs in the region at a level of 2001-2010-2025 period.

Development scenarios	Volume of water consumption, million m ³ per annum		
	2001	2010	2025
1. of minimal changes	16,72	16,86	18,32
2. of low-level development		54,62	65,11
3. of high-level development		98,14	196,26

It is expected that volumes of diverted polluting substances into the surface water facilities will grow slightly, which is explained by proposed reconstruction of existing treating facilities, construction of new ones, introduction of low-waste and wasteless productions.

16. In the medium-term plan, a new tariff policy based on principles of elimination of cross financing between various consumer groups will be implemented within the framework of implementation of the Law of Kyrgyz Republic “On energy supply”.
17. As for irrigation sector of medium-term perspectives, on the whole for the Republic the investments are envisaged within the framework of projects “Irrigation Rehabilitation Project” (48,8 million USD), “On-Farm Irrigation” (29 million USD). 20 % out of them will be used for the first project, about 40-50 % of all sum will be used for the second project.

In the potable water supply sphere, investments in the amount 51 million USD are attracted within the framework of projects “Provision of infrastructure services at a level of rural settlements” and “Water supply and sanitation”

As for hydro-energy system, the Government of the Kyrgyz Republic concluded a Protocol on Intentions on completion of construction of Kambar-Ata HPS-1 and HPS-2 and on search of investors with a Turkish enterprise “Entes-Kanalet”. Negotiations are ongoing with Uzbekistan and Kazakhstan.

The potential financing sources of construction of small HPSs can be;

- attraction of share capital;
- local and foreign investments, technical credits;
- state credits;
- share holding of state, enterprises, organizations, commercial structures.

When selecting the investment projects the priority will be given to projects which:

- correspond to the strategic aims of Complex Basis of Development of the Kyrgyz Republic;
- domestic profit rate not less 12 % and economic profitability level not less 10%;
- simple in implementation;
- environmentally friendly;
- have low investment risk;

When making investments, the emphasis will be transferred from state ones to direct foreign investments, as they produce new capital, technologies, management practice, and open new markets abroad.

18. As for the institutional changes

1. In the medium-term plan it is envisaged (till 2010) to create normative-legal framework of new generation by improving the Law of the Kyrgyz Republic "On Water" adopted in 1994, by development and introducing the National Water Strategy, Water Code, documents that promote development of Water Users Associations, interstate water use and water sharing, licensing.

The laws and regulations on differentiation of tariffs for irrigation and potable water delivery services and for industry, on methodic of price formation in water use, on institution of rights for water and etc., will be elaborated and adopted.

The functions of state management institutions (MAWR and PI, Department of Water Resources, Department of Rural Water Supply and their regional divisions, local administrations, local self-governing bodies) will be reformed with the view of adaptation to the new market conditions. First of all, in the direction of decentralisation (deconcentration) of functions and separation of management, monitoring, political functions from administrative ones. The Government and its institutions (MAWR and PI and others) initiate the reforms, provide budgetary financing, put legal acts into effect, regulate interstate water use, bear responsibility for strategy elaboration and implementation in water sector. Water institutions (in the form of joint stock companies or other organisations) relatively independently (state possess control part of shares) carry out specific functions, set forth in the laws and regulations. The Republican Association "Kyrgyz-Ayil-Su" will be privatised. The process of widespread establishment of Water Users Associations (WUA), both voluntary public farmer's associations, farms and other private water users, which will be responsible for joint operation and maintenance of leased on-farm systems, water supply networks, economic use of water, implementation of environmental, land improvement activities will be initiated in non-governmental water sector. It is proposed to cover approximately 120-200 thousand ha of irrigated lands. Of them 40-50 % of given area is in the Kyrgyz part of the Aral Sea Basin.

2. In the long-term it is envisaged (till 2025) to carry on creation, improvement and modification of normative and legal base of water sector (this process is permanent).

The process of decentralization (deconcentrating) the state management institutions is to be completed, followed by coordination activities both in horizontal and vertical directions within all the institutions of water resources management, as well as with economic enterprises, non-governmental organizations (WUA).

19. The financing of water sector will be constituted by adjustment of the partnership contribution of state and water users.

The State's share of costs can be variable. In the medium-term period, in its first half (2001-2005 period), when the economy of water users is still weak, the state share should be 60-80% of the total amount. As the water users' economy strengthen, their share should increase, while the state's share should decrease and in the long-term (till 2025) -

down to zero. But at the same time the state increases capital investments in new construction of large water systems, science, and land reclamation, flood and mud protection works. It also concerns not only the republican budget but the local ones of the regions as well.

20. The first scenario – it is supposed that tariffs for water delivering service will be increased starting from 2002 that will enable to direct 175,6 million soms at operation and maintenance of inter-farm irrigation facilities or to satisfy designed demand for 44 % together with budgetary financing.

Second scenario – it is assumed to increase O&M costs to designed demand – 399 million soms (without depreciation charges).

The third scenario. According to this scenario it is assumed additionally to expenditures in the second scenario including depreciation charges for reconstruction of basic funds which will be the source of financing of rehabilitation works of irrigation structures.

21. With regard to issues of interstate water use the following is envisaged in the medium-term:

- to abolish the existing Soviet principles of water sharing on the grounds of approval of market-based National water strategy;
- to conclude an agreement with neighboring countries, consumers of water resources of Kyrgyzstan on sharing the O&M costs of water facilities of interstate use, located on the territory of Kyrgyzstan. At that certain privileges are observed, i.e. no payment is made for water as commodity and for benefits of Kyrgyzstan gained as a result of providing the water and services to neighboring countries;
- to work out and agree the methods on defining the cost and keep records of all the expenses incurred and damages caused to Kyrgyzstan regarding all the interstate water facilities;
- to work out and agree the method of sharing these costs and damages between the water user countries, and sharing the proportionally to gained profits as a result of using these water facilities and resources.

In long-term perspectives

- shift to real market-based interstate water-economic relations when using the water facilities and water resources of Kyrgyzstan, which are of interstate importance, by introducing the full payment for water as commodity and scarce natural resource, that has a considerable consuming value, bringing the benefit to Kyrgyzstan as a result of providing other countries with water and services;
- joint implementation of regional programs, which are of mutual interest and so on.

1 INTRODUCTION

1.1 Project Aims and Structure

1. Sub-component A1 of the Water and Environmental Management Project (WEMP) has the overall objective of developing water and salt management plans for the Aral Sea Basin. One of the tasks is to provide a consistent set of policies, strategies and action programs for the Basin relating to:

- water resources conservation and reduction of soil salinity;
- rehabilitation and improvement of irrigation and drainage infrastructure; and
- improvement of the operation and maintenance of main and on-farm irrigation and drainage systems.

2. A further task is to develop a framework that will enable interstate cooperation in water and salt management, and will allow for the preparation of international agreements relating to:

- water sharing mechanisms and river salinity standards,
- investment in national and regional water infrastructure, and
- funding of the Basin agencies in charge of water resources and infrastructure.

3. The team of Sub-component A1 comprises the Regional Working Group (RWG), which is a core group with a Basin-wide perspective, together with National Working Groups (NWGs) from the five Central Asian republics that address the issues of salt and water management from the viewpoints of the individual nations. This report has been prepared by the NWG for(country). Similar reports dealing with the same topics and issues are to be prepared by the other four NWGs.

4. There are several phases in Sub-component A1. Phases I and II have already been completed, and the outcomes of work are described respectively in Joint Report No. 1 (Inception Report) and Regional Report 1 (Principles and Guidelines for Regional and National Planning). This current report describes Phase IV, which comprises Tasks N2, N3, N4, N5, N6 and N7, as they relate to (country).

5. Next phase, Phase III, which comprises a number of RWG tasks, has been concurrent with Phase IV. The RWG tasks are in most cases related to the NWG tasks in Phase IV and depend on basic data these tasks.

6. In the next phases water and salt balances are to be finalised and draft regional and national policies, strategies and action programs is to be prepared.

1.2 Phase IV Tasks

7. The original terms of reference for the project envisages execution of the following tasks:

<i>Task</i>	<i>Description</i>
N2	Participation of Beneficiaries in the Planning Process
N3	Assessment of National Water Resources
N5	Assessment of National Water Infrastructure and Management
N6	Elaboration of Development Scenarios of the Irrigation Sector
N7	Assessment of Salinity Trends, Associated Costs and Standards

8. The development of a detailed framework of the project in Phase I, and definition in of basic principles and political guidelines Phase II, resulted in some changes in the scope of the work required in the course of Phase IV. These changes were made as a result of the necessity that energy issues had to be taken into account. Subsequently Task N4 – Energy Issues was defined and scoped.

9. The terms of reference for the various tasks as finally executed are presented in the following sections.

Task N2- Participation of Beneficiaries in the Planning Process

10. The Terms of Reference demanded from the Consultant to design organise and carry out a participation plan to support the planning process. However, it was agreed during Phase I (see Inception Report) that this work would be transferred to the WEMP Component B team because its activities already embrace this type of activity and the team is trained to implement it. The NWGs therefore have not been involved in the participation process.

Task N3 - Assessment of National Water Resources

11. The Terms of Reference identified two objectives for Task N3 and the respective RWG task, Task R4. The first objective was to identify and designate the transboundary waters to be managed under a regional program. This objective was addressed in Phase II (see Regional Report 1), and it was subsequently agreed that such an objective was inappropriate at this stage pending further consideration of a water-sharing framework for the Basin. The concept of transboundary waters was therefore not pursued further in this report.

12. The second objective of this task is to study the quantitative and qualitative characteristics of all significant waters in the Basin, including groundwaters and return flows. The study should include a critical analysis of the adequacy of the existing data, and is to provide an accurate assessment of all available water resources. Precipitation records and patterns and other climatic factors are to be studied. Then opinion concerning long-term changes in both local and general climatic conditions is to be expressed.

Task N4 – Energy Issues

13. The integrated nature of water and energy management arising from the use of large volumes of water in the Basin for both hydropower generation and irrigation was noted in an addendum to joint Report No. 1. The inclusion of energy issues in Phase IV has resulted due to the need of development an optimisation model, integrating the water and energy systems of the Basin by the RWG. In Task N4, the NWGs are to collect and present information on the power generation and transmission systems of each country to use in the modelling and associated researches.

Task N5 – Assessment of National Water Infrastructure and Management

14. This task requires an overall assessment of the current condition and performance of the national water infrastructure and the quality of the operational management of this infrastructure in each country, taking into account a long-term perspective and also the expected operation and maintenance standards at different stages of rehabilitation. It is necessary to test and justify various stages of rehabilitation and improvement of the system from the economic point of view. Existing operation and maintenance standards should be examined to see whether they are still valid or need to be revised.

15. The corresponding Task R5 requires the RWG to assess the Basin water resources infrastructure in a similar fashion.

Task N6 – Elaboration of Development Scenarios for the Irrigation Sector

16. The NWGs are required by the Terms of Reference to develop, in cooperation with the relevant government agencies, several scenarios to describe the possible future development of the irrigation sector. These are to be based on assumptions regarding investment plans for the irrigation sector during the next 25 years.

17. Three possible scenarios were originally specified in the Terms of Reference. During Phase II, the guidelines for the scenarios were expanded to include energy issues and economic, social and environmental considerations (see Regional Report 1), and the fourth possible scenario was included.

Task N7 - Assessment of Salinity Trends, Associated Costs and Standards

18. The overall objective of this task is to prepare an outline strategy and action plan on salinity management to use as a guide the follow-up tasks in subsequent phases. Specific objectives are:

- assessment and description of the current and future salinity problems and processes and identifying a limited number of critical areas for more detailed studies;
- determining the economic costs of different levels of soil and river salinity;
- evaluation of promising options for salinity management in the identified critical areas; and
- preparation of an appropriate draft strategy for salinity management in detail to guide further work on national and Basin-wide water and salinity management strategies.

19. In the corresponding Task R7, the RWG is to consider the Basin-wide aspects of salinity.

1.3 Interaction between Regional and National Working Groups

20. There has been interaction between the RWG and the NWGs during all phases of the project. To ensure consistency in standards and presentation, the NWGs have

followed a series of standard procedures developed by RWG, including procedures for the production, review and amendment of reports.

21. Standardised formats prepared by the RWG have been used in the collection and presentation of data in a number of categories including water resources, salinity regimes, assessment of infrastructure, and energy aspects.

22. Similarly, guidelines prepared by the RWG have been followed in:

- calculation of economic costs for (i) agriculture, and (ii) irrigation and other infrastructure
- scenario development,
- estimating irrigation requirements,
- estimating economic commodity prices and benefits,
- interpreting local soil and water salinity data

23. RWG members have made visits to the NWG on several occasions to explain the process of cost and benefit estimation and scenario development and to discuss the detailed terms of reference, standards of report presentation, and the content of draft reports.

1.4 Purpose and the content of this Report

24. The purpose of this report is to describe the methodologies and results of Phase IV, and following from this to present the baseline information for the tasks to be undertaken in the subsequent phases.

25. The report gives data on availability of water resources in the Kyrgyz part of Aral Sea Basin, their quantitative and qualitative variability, their current and perspective requirements in domestic sector, agriculture, industry, energy. The requirements are considered within 3 development scenarios of the region's economy (Kyrgyz part of Aral Sea Basin), based on region in general and separately based on its 7 Planning Zones: 1st zone – the Upper Naryn (Ak-Talaa, At-Bashy, Jungal and Naryn administrative rayons); 2nd zone – the Mid Naryn (Toguz-Toroo and Toktogul rayons); 3rd zone – North-Fergana (Ala-Buka, Bazar-Kurgan, Ak-Sy, Nooke, Suzak rayons); 4th zone – Chatkal (Chatkal rayon); 5th zone – Kampyr-Ravat (Kara-Kulja and Uzgen rayons); 6th zone – South-Fergana (Alay, Aravan, Nookat, Kara-Su, Batken, Laylak and Kadamjay rayons); 7th zone – Alay (Chong-Alay).

2 WATER RESOURCES

2.1 Stream flows (surface water resources) of the Kyrgyz part of the Aral Sea Basin

More than 30 rivers are constituted in the Kyrgyz part of Aral Sea Basin. All of them belong to the basins of Syr Darya and Amu Darya rivers. The main watercourses are Naryn, Karadarya, Sokh, Chatkal and Kyzyl Suu rivers.

Characteristics of summarized flow generated in Kyrgyzstan in Syr-Darya and Amu-Darya basins are given in the Table 1.

Table 1

Basin	average flow \hat{m}^3			Maximum monthly		minimum Monthly	
	average	max	min	Volume \hat{m}^3	year, month	volume	year, month
Syr Darya	27,6	45,0 1969 ä.	18,9 1982ä.	8,18	1969ä July	0,71	1974 February
Amu Darya	1,93	1,55 1994ä.	0,96 1982ä.	0,24	1966 June	0,049	1982 February

Data on river flow of the Kyrgyz Republic is mainly taken from materials collected as a result of observations of Hydrometereologic Department, "Kyrgyzhydromet" since 1992), published in Water Cadasters, Hydrometereological year-books (since 1992 are in hand-written form).

Taking into account series of observations of the rivers, mainly for 50-60 years and more, as well as relatively low values of river water flow variation coefficient, from 0.10 up to 0.50, the average quadratic error of counting the flow rate does not exceed 5-6%.

2.2 Groundwater resources

Fresh groundwater resources of the main basins of groundwater flow in the Kyrgyz part of Aral Sea are characterized by following values, m^3/s .

Alabuga- Naryn basin	0,6
Sysamyr	14,5
Jungal	8,8
Toktogul	34,0
Song-Kol	1,1
Upper-Naryn	11,4
Toguz-Torou	12,2
Atbashy	23,5
Bolgart	7,7
Arpa	11,5
Fergana	26,0
Chatkal	26,0
Alay	5,7

In total within the territory of Kyrgyzstan which belongs to the Aral Sea Basin, the fresh groundwater resources amount to $183,4 m^3/sec$ or $1,584,760 m^3/day$.

The analysis of regime observations shows that variations of groundwater levels from the long-term and seasonal point of view amount to not more than 1-3 % of thickness of water-bearing horizons that enables to conclude that fresh groundwater resources of the Kyrgyz territory are very stable.

Hydrological basins of Kyrgyzstan that refer to the Aral Sea Basin are structurally-closed, i.e. the groundwater resources, generated within its boundaries are unloaded at the same place. Actually, all area concerned is an area of surface flow formation. The second largest river in Central Asia - Syr Darya generates its water, mainly, within the limits of the Kyrgyz part of Tyan-Shan due to its main constituting rivers - Naryn and Karadarya. The ground waters play an important role in feeding the rivers. The winter flow of the rivers almost completely receives supply from ground waters, where this source of feeding is quite stable.

2.3 River salinity regimes

River salinity of both constituting Syr Darya and small tributaries is not high and vary within small ranges. Two periods are typical for annual salinity regime. They are minimal and maximal. Minimal salinity is recorded during the flood wave, while the maximum salinity takes place at the end of low water in months, preceding the beginning of high water. The same opposite salinity dependence on flow is typical also for longstanding regime: high water years are distinguished by low salinity, and low water years - by high salinity.

Salinity of the Naryn river in high water years (according to the observations before construction of Toktogul hydrosystem) is relatively not large and is somewhere from 235 mg/l in high water period to 402 mg/l in low water period. Change of salinity degree is about the same in average water years. The highest salinity degree varying from 310 to 526 mg/l in high water and low water periods is typical for years with minimal flow.

In Karadarya river (before construction of Kampyr-Ravat water storage) in high-water years as well in Naryn river, the minimal salinity is recorded, ranging in high water and low water periods from 227.9 to 475.2 mg/l, in low water years – from 427 to 393,8. In average water years, reduction is observed comparing to low water years up to 266 mg/l in high water period and up to 417.3 mg/l in low water period.

Salinity in high-water years in Isphayramsay river is 197.5-371.8 mg/l, in low-water - 252.1-383.4 and in moderate - 219.8-412.7.

The salinity of Kassansay river at Kyzyltokoy village in high-water years varies from 168.2-312 mg/l, in low-water years – 154-352 mg/l, in average – 146.1-303.1 mg/l.

Smooth transition from maximal value in low water period to minimal one in high water period, especially in average water years is typical for annual salinity regime of Sokh river at Sarykanda village. Amplitude of fluctuation of salinity value is not high and varies from 203.1-271.1 in high water, 144.9-277.8 in low water and 161.7-188.7 mg/l in average water years.

The flow of Khodjabakirgan river near Andarkhan village in high water year is characterised by salinity from 188.6 to 341.2, in low water – 348.9 – 560.9 and in average water year – 238.5 – 326.7 mg/l in high and low water periods, respectively.

2.4 Sources of salt entry into surface water

The enrichment of surface and ground waters during the process of their formation and filtration by natural salts from surrounding rocks, i.e. the dilution and leaching processes are the main sources of salt entry. As the rocks are basically presented with hard rocks, the enrichment of surface and ground waters occurs to a slight extent. The variability of salinity both in multi-year and in seasonal profiles are not large and is described in Item 2.3. Man's impact on salinity level of surface waters is absent.

Due to hypsometric location of Kyrgyzstan, no watercourse flows into its territory. Hence, the Republic doesn't depend on its neighbors neither by quantity nor by quality of water resources, except the climate fluctuation in the region.

2.5 Water Resources Management – legal, institutional, interstate and financial aspects

The "Law About Water" of the Kyrgyz Republic, adopted and put into force in 1994, the "Law about interstate use of water schemes, water resources and water facilities of the Kyrgyz Republic" (July 23, 2001), as well as the governmental and departmental Regulations, which define the structural system of regulating the use protection of water, as well as the competence of Parliament, Government, local state administrations, financial and economic interrelations, etc.

The interstate water relations are covered by ratified regional Agreements on status of organizations of International Fund for Saving the Aral Sea, Kyrgyz-Kazakh interstate Agreement on joint use of water resources and water facilities of Chu river and Talas river basins.

At the institutional level, the Parliament (hereinafter referred to as "Jogorku Kenesh"), the Government of the Kyrgyz Republic, regional authorities, Ministry of Agriculture and Water Resources and Processing Industry (MAWR&PP) through Department of Water Resources (DWR), State Agency on Geology and Natural Resources through the Kyrgyz Complex Hydro-geological Institute, Ministry of Environment and Emergency along with its divisions, including "Gidrometsluzhba". (i.e. Hydrometeorological division) deal with the issues of water resources management and regulation of water relations between different economic sectors.

Until July, 2001 the JSC "Kyrgyzenergo" operated the water facilities for energy purposes, mainly, the cascade of HPS of Naryn river, including Toktogul reservoir and Uch-Kurgan hydrosystem, consisting of headworks of interstate canals such as Grand Namangan and Left-bank Naryn. Plans on regime of water release from regulated flow of Naryn river are implemented based on interstate agreements, and direct regulation of water releases are carried out by services of JSC "Kyrgyzenergo".

"Kyrgyzjylcommunsoyuz" provides operation of water-supply systems in urban areas and district centers.

The newly established Department of Rural Water Supply under the Ministry of Agriculture and Water Resources and Processing Industry operates independently from any water supply organisation and does not interfere in their production and financial activity. The rights for operation of rural water supply pipelines are given to local administrations. The republican unit "Kyrgyz Ayil Suu" (rural water supply department) has to hand over the head intake structures to local administrations before January 1, 2003. The privatisation of enterprises of "Kyrgyz Ayil Suu" is to be completed until January 1, 2003.

The Department of Water Resources under MAWR and PI is the main state executive agency of water resources management, and the General Director chairs it. It is headed by a General Director. The number of personnel is 38. Each oblast has its Division on basin water resources management (BWRM). Each rayon has its regional management division. The number of personnel of basin water resources management varies from 35 to 113. There are 4 BWRM divisions (Osh, Jalal-Abad, Batken, Naryn) in the Kyrgyz part of Aral Sea Basin, however their service area correspond to administrative boundaries of oblast, but not river basins.

The financing of Department of Water Resources (DWR) is as follows. The Central apparatus of DWR and apparatus of Division on basin water resources management are financed by state budget through MAWR and PI. Regional water resources management

divisions are financed from two sources – state budget and water users funds, received for water delivery services. All regional water resources management divisions make contracts with each water user of rayon and deliver a bill for payment according to fixed tariffs. The text of the contracts is typical, approved by decree of the Government, the tariff is fixed by the Parliament. About 50 % of actual operation and maintenance costs are covered by state budget and 50 % by payments for water delivery services.

In the Decree of the President of the Kyrgyz Republic of 6.10.1997 “On basis of foreign policy of the Kyrgyz Republic in the sphere of rivers water resources use, generated in Kyrgyzstan and flowing into the territories of neighboring countries” a special attention is paid to solving the problems on interstate water use, necessity in acceleration of new strategy elaboration for water distribution and economic instruments of management in the sphere of water conservation and use of water and energy resources. Solving these complex tasks is possible only based on fair consideration of interests both the Kyrgyz Republic and other interested countries by having negotiations and concluding respective interstate treaties, based on peculiarities of water use on each watercourse, flowing out of the Kyrgyz Republic.

The adopted in July 2001 Law of the Kyrgyz Republic “On interstate use of water objects, water resources and water facilities of the Kyrgyz republic”, confirmed legislatively the basic principles of cooperation of Kyrgyzstan with other countries in the field of water relations.

3. ELECTRICAL ENERGY

3.1 Capacities of Hydro Power Stations

The Kyrgyz Republic has rich and cheap hydropower resources in its disposal. The potential amounts to 12 billion kWh per year, but it is used only for 10 %.

Energy sector plays an important role in the economy of modern Kyrgyzstan, amounting in average to 14-16 % of the total volume of gross domestic product of industrial sector. According to the data for the year 2000, 17 electric power stations with total capacity of 3586.6 MW, including 15 HPSs (2948.5 MW) and 2 thermal power stations (638 MW) are operated within the unified Kyrgyz energy grid. Thermal power stations – Bishkek TPS (588 MW) and Osh TPS (50 MW) provide Bishkek and Osh with heat and generate 120 GWh of electric energy per year. In total, the share of HPS in the Kyrgyz energy grid amounts to 82 % of fixed capacity, 97 % of which is concentrated in lower Naryn cascade, regulated by Toktogul reservoir of multi-year regulation. All HPSs of Kyrgyz energy grid are designated for multi-use – for energy and irrigation purposes.

5 large HPSs of Lower-Naryn cascade, as well At-Bashy HPS, located in the tributary of Naryn river (At-Bashy river) belong to Syr Darya river basin. Besides, two Kambar-Ata HPSs are under construction in this area. The basic parameters of mentioned HPS are shown in the Table 2

Table 2

Name	Unit	Functioning						Under construction	
		Toktogul HPS	Kurpsay HPS	Tash-Kumyr HPS	Shamaldy-Say HPS	Uch-Kurgan HPS	At-Bashy HPS	Kambar-Ata HPS - 1	Kambar-Ata HPS - 2
Installed capacity	ï W	1200	800	450	240	180	40	1900	360
Average annual power generation for many years	GW _h	4100	2630	1555	902	820	150	5114	11481
Average long-term water discharge	m ³ /s	359	391	439	438	429	32,8	317	317
Typical heads									
- Maximum	m	180	106	58,5	31	36	74	235	54,8
- Minimum	m	110	90,5	40	25,2	18,5	2,3	136,8	45
- Designed	m	140	91,5	53	26	29	70,4	166,5	42,5
Net reservoir volume	Billi on. ï ₃	14000	35	10	5,42	20,9	6,5	3430	8
Dam height	ï	215	113	75	37	56	79	275	60
Surface area (NSL)	êm ²	248,3	12,0	7,8	2,4	4,0	1,0	56	3,3
Regulation pattern		Multi-year	weekly	weekly	weekly	dayly	weekly	seasonal	weekly

The rest HPSs with total capacity of 40 MW and total energy generation of 120 GWh per year have no dams (derivation type) and are located in Chui oblast.
All power stations and electric networks of the republic work parallel with unified energy grid of Central Asia.

3.2 Power transportation facilities

Power transmission facilities of Kyrgyzstan include:

- transmission lines with voltage 0.4-500 kV – 65.600 km
- transformation substations with voltage 35-500 kV – 513 pc.
with voltage 0.4 – 10 kV – 19048 pieces.

The great part of this equipment is worn out and requires complete repair and reconstruction:

- HVL 0.4 – 0.6 kV- more than 10.500 km (36.6 % of total length)
- HVL 10 kV – more than 6.600 km (22,5 %)
- HVL 35 kV – 0.600 km (14.1 %).

Required capital investments for reconstruction of high voltage lines amount to about 365,5 million USD.

3.3 Control, management and administration in energy sector of Kyrgyzstan

State Agency on Energy under the Government of the Kyrgyz Republic is a body that carries out state management, administration of fuel and energy sector and reliability, security control of its work without interfering with economic activity of enterprises.
State inspection on energy and gas under the State Agency on Energy carries out direct control.

In accordance with article 10 of the “Law On energy of the Kyrgyz Republic“ the State agency on energy carries out its functions through Executive Board, members of which are appointed by the Prime-Minister and confirmed by the President of the Kyrgyz Republic as well as by qualified administrative staff.

Decisions of State energy agency are not subject to change by other official bodies, with the exception of the Government, in case if their consequences deteriorate the social and economic situation in the republic.

The JSC “Kyrgyzenergo”, JSC “Kyrgyzgas”, JSC “Kyrgyzneftegas” are in the list of companies, associations and organizations, regulated by State agency on energy without interfering in their production and economic activity.

In accordance with the Privatization Program of JSC “Kyrgyzenergo”, in order to provide effective management and operation of sector, the JSC “Kyrgyzenergo” was reorganized by its separation into independent JSC “Electric stations” generating electric and heat energy, JSC on distribution and operation of electric power lines with voltage up to 35 kV, JSC “Bishkekteploset” distributing a thermal energy of Bishkek city, JSC “National electrical network” on electrical energy transportation from 110 kV and over, as well lines with 35 kV of republican and export significance.

3.4 Marketing and costs in energy sector

Mutual deliveries of electric energy and energy resources between Kyrgyzstan, Kazakhstan and Uzbekistan are carried out according to the scheme “water and electric energy of Naryn cascade of hydrosystems of Kyrgyzstan” in exchange, in equivalent by

cost, for organic fuel from Kazakhstan and Uzbekistan in volumes, determined by annually concluded Interstate Agreements. The prices of energy resources (electric energy, coal, gas, oil products) and mutual payments for their deliveries are determined in Agreements. The water is delivered free of charge so far!

But still the agreements are executed unsatisfactory. As of November 1, 2000, Uzbekistan has delivered to Kyrgyzstan 252,9 million cubic meters of natural gas, out of stipulated 652 million cubic meters, 25.5 thousand tons of fuel oil - out of stipulated 60 thousand tons.

The issue on creating of common Central Asian market of resources and services, which could be correctly considered as water and energy market, is so far under consideration stage.

Actual showings of electric and energy balance of the Kyrgyz Republic for the period of 1995-2000 are shown in Table 3.

Table 3

Name	Unit	Fact							
		1995	1996	1997	1998	1999	2000		
1	2	3	4	5	6	7	8		
1. Electric energy consumption	GWh	10,9	11,6	10,9	10,9	11,4	11,4		
2. Energy generation, total	GWh	12,3	13,7	12,6	11,6	13,1	14,3		
3. Energy generation by TPS	GWh	1,17	1,43	1,66	1,63	0,98	1,17		
4. Energy generation by Naryn cascade of HPS	GWh	10,9	12,0	10,7	11,9	11,9	12,9		
5. Energy generation by small HPS	GWh	0,26	0,24	0,22	0,24	0,24	0,24		
6. Energy export	GWh	1,71	2,07	2,33	1,56	1,56	2,49		
7. Volumes of Toktogul reservoir									
As of January 1	billion.m ³	17,7	13,9	13,1	10,2	13,6	14,5		
As of April 1	billion.m ³	14,2	10,4	9,8	7,2	10,3	11,0		

Prime cost of 1 kWh of energy in 2000 amounted to 27.4 tyiyns when the average internal selling tariff was 30,52 tyiyns, and taking into account the export – 56.37 tyiyns per kWh (Exchange rate of 1 US cent in 2000 = 48 tyiyns).

Data of table 3 indicate that energy supply of the country depends mainly on annual fluctuations of water flow in Naryn river. Due to limited potentials required to increase the energy generation by thermal stations and small HPSs in northern region, the aforesaid tendency will remain until putting the new energy facilities into operation, first of all Kambar-Ata HPSs.

The tendency to use the Toktogul reservoir in energy generation mode, i.e. with increased water releases in fall-winter period is inevitable without putting into operation the new generating facilities and energy generation increase at thermal electric stations of the republic. Persistency of this tendency and necessity to keep the required releases in vegetation periods will result in depletion of accumulated capacities of Naryn cascade down to dead storage, that will disastrously affect both the energy sector and the territories of Uzbekistan and Kazakhstan related to Syr-Darya basin as well as the areas of Jalal-Abad oblast of Kyrgyzstan, adjacent to the lower reaches of Naryn river.

4. DEVELOPMENT SCENARIOS

4.1 Scenario description

Development of scenarios for development of economy branches in the Kyrgyz part of the Aral Sea Basin is carried out in accordance with the requirements of initial (December, 2000) Terms of Reference. The results of development are given in the Report of Kyrgyz NWG on subtask N6/1 “Development of scenarios”. According to the ToR the following definitions of scenarios are accepted: first scenario – of minimum changes, second – low-level scenario and the third – high-level scenario. The latest definition (decline scenario, consolidation scenario and revitalization scenario), given in the Regional Report #1 (March, 2001) is less clear, and the main thing is that it doesn’t correspond with the conditions of modern Kyrgyzstan.

According to ToR, the existing status (as of 2001) of branches of the economy should be the initial point to elaborate development scenarios of sectors of the economy.

The following conditions have been formed in Kyrgyzstan by now:

- a) Self-supporting (later market) relations of water organizations with water users began to develop already since 1972, when as an experiment the fee for water use was introduced in some systems (including in the Aral Sea Basin). When USSR collapsed in 1990, the fee water use was suspended, but starting from 1995 it was introduced again in the republic.

Tariffs used for water delivery service to agricultural water users, tyiyn per 1 m³

Table 4

Year of Tariff introduction	Non-vegetation period		Vegetation period	
	Usual areas	Areas with adverse conditions	Usual areas	Areas with adverse conditions
1995	0,5	0,1	1,5	0,5
1999	1,0	0,2	3,0	1,0

- b) Privatization of agricultural lands in the republic was also practically completed already in 1994 (according to the Decree of the Government of the Kyrgyz Republic #632 of August 22, 1994). The moratorium for buying and selling the land is abolished in 2001. Hence all the lands (with the exception of its small part that is under jurisdiction of state institutions and local village authorities) is in private property. It is sold and purchased and can be leased, pledged and so on.
- c) Works on rehabilitation of objects of agriculture and water sector are carried out in the republic, including the Kyrgyz part of Aral Sea Basin. In particular, three large projects on rehabilitation of irrigation systems and on-farm irrigation, are carried out, financed by the World Bank and the Government Kyrgyz Republic.
- d) Starting from 1996-1997 the increase of agricultural economy was defined in the republic – increase of water consumption, areas of used lands, crop yield (see Tables 15, 17, 21 in the report on subtask N6/1).

Hence, at the moment consideration (in particular, development) of scenario on “decline” in which the following is stipulated: “No economic reforms are undertaken, further increase of private farms have no place, introduction of fee for water and drainage

services is not envisaged, and as a result, salinity of land will continue, crop capacity and income will go down and so on” - is already late and obviously is out of place.

Same with “consolidation” scenario, which stipulates “some economic reforms will take place, along with further land privatization and some progress on free market economy. But prices for water will not be introduced” and so on.

Avoiding the situation that development of similar scenarios in Kyrgyzstan might be incorrectly interpreted, i.e. understood as a development of scenario of regress in conducting agricultural and water reforms in the republic, the definitions and descriptions of scenarios in report on subtask N6/1 and in this report are accepted as it is stipulated in the initial Terms of References.

1. Scenario of minimum changes, which stipulates only keeping the region’s economy at the current level (Agriculture, energy and industry practically do not develop and do not require additional water resources. The required investments are directed only for keeping the water systems from further degradation and collapse. Some growth is stipulated only in domestic water supply, proportionally to growth of population).
2. Scenario of low-level development that stipulates the recovery (rehabilitation) of economy with its increase from current level up to the level of not lower than 1991 level. The increase of water consumption volumes (more than in 1991) is envisaged in domestic water supply sector of the region (proportionally to the increase of population), remaining sectors (agriculture, energy, industry) are developed mainly only due to the increase of their efficiency (increase of efficiency of irrigation systems, watering technique, improvement of farming techniques, land reclamation, selection and crop yield increase, reduction of water discharge per produced industrial product, energy) without making considerable demands for increasing the volumes of consuming the additional land and water resources of the region.
3. Scenario of high-level development of the region’s economy that stipulates maximum possible increase of population welfare in the region (growth of GDP and revenues per capita which is increasing in number) as opposed to 1991. And of course, the possible attraction of available land, water and other natural resources in the region is to be envisaged as well.

4.2 Basis for assessment of perspective water consumption

4.2.1 Social and economic development demands of the region

The following was used as a basis for determining the required paces of development of economy branches by planning zones and the region (Kyrgyz part of Aral Sea Basin):

- current social and economic status of population;
- its actual quantity;
- expected growth rates of the population and its demands in agricultural food products and raw material for the perspective of 2001-2010-2025 period.

Analysis of consumer's budget value, conducted by various sociologists in the republic, shows that it is growing every year because of price increase for foodstuff, nonfoods, municipal and other services as well as due to inflation. At 2001 level, it equals to 1200 soms (25\$ USD) per month per capita. Including the share of food cost – more than 68%, nonfoods – about 16 %, public and other services – 14 %, taxes – 2 %.

The most part of poor (with income less than 20 \$ per capita a year) population of Kyrgyzstan lives in Naryn, Talas, Osh (+Batken) and Jalal-Abad oblasts i.e. mainly, in the Kyrgyz part of Aral Sea Basin and especially in rural area of the region.

The following main problems that contribute to the increase of poverty were revealed as a result of sociological poll, conducted in the mentioned areas:

1. Shortage of arable lands, in particular, irrigated ones. Lots of land, allocated to every family member during the organization of farms and cooperative farms in 1993-1994 amounted to 20 - 30 hundred parts (depending on availability of land and number of needy in rayon). Nowadays, due to growth of population, it amounts to 15-20 hundred parts per family member.
2. Problems of population employment. Shortage of land, water, livestock, machinery, collapse and complete absence of other (non-agricultural) productions in a number of rayons results in mass unemployment of the population in rural areas. Of people who are able to work which is about 50 % of the population, only 5-8% work for wage. Unemployment is wide spread amongst the young people.

Over the last 10 years since the 1989 census, the population of the Kyrgyz Republic has increased by 562 000 people, or by 13.1 %. Peak of population increase falls to 1939-1970 period when the number of population increased for 45-41 % from the previous number that was stipulated by both high birth rate and inflow of population to Kyrgyzstan. Starting from 1990, the population growth rates are sharply dropping. The main reason is emigration of Russian-speaking population from Kyrgyzstan.

The population number by Planning Zones of Kyrgyz part of Aral Sea Basin in 1989-1999 period and its expected growth rates for the perspective of 2001-2010-2025 period are shown in Table 5

Table 5

Planning Zones	Population number, thousand people		1999 ã. in % by 1989	Expected growth rate, % for 10 years	Expected population number, thousand people		
	1989	1999			2001	2010	2025
	1. The Upper Naryn	196,3			196,02	99,8	6-7
2. The Mid current	90,1	100,7	111,8	12-13	102,0	114,0	138,0
3. North-Fergana	446,2	557,9	129,5	20	600,0	720,0	950,0
4. Chatkal	18,8	19,6	104,3	7-8	19,9	21,3	23,5
5. Kampyr-Ravat	213,7	274,1	128,2	20	285,0	342,0	450,0
6. South-Fergana	796,0	1030,1	129,4	20	1070,0	1280,0	1690,0
7. Alai	14,6	21,8	149,2	20	22,7	27,2	35,7
Total in basin	1775,8	2220,2	129,0	18	2298	2713	3502
Incl. in urban areas	230,6	222,8	96,6	11-12	230	266	333
in rural areas	1545,2	1997,4	129,3	19	2068	2447	3169

4.2.2 Development perspectives of irrigated agriculture and crop water demand

The perspectives are considered for 3 aforementioned development scenarios of the region's economy.

According to first scenario, the agriculture and water sector develop and (restored) only based on improvement of organisation of production management, without development of additional land and water resources. Required investments are directed only at keeping water system from its further degradation and collapse. The organisational activities are important not only from the point of view of improving the organisation (putting into order) of the process of rehabilitation and development of agricultural production, but they themselves are also an essential component in increasing the efficiency of these

processes, and the most important thing is that their implementation does not incur much expenses. There is detailed analysis of 7 such activities in the report N6/1, including one of the main ones which is the modification of economic (market) relations between the states, national water management systems and water users, and the justified system of payment for water use.

According to second scenario, the recovery (rehabilitation) of economy of agricultural production is envisaged with its raising from current level up to a level not below than earlier achieved (1990-1991 period). At the same time, no development of additional land and water resources is envisaged. Their volumes will remain at the level of 1990-1991 period. Possible investments to agriculture and water sector will be directed, mainly, at rehabilitation of working capacity (designed performance measures, efficiency, sustainability) of irrigation systems, watering technique, improvement of farming practices, selection and crop yield increase, land-reclamation of used lands.

Third scenario stipulates a high-level development of agricultural production in the region considered (Kyrgyz part of Aral Sea Basin). According to this scenario all the population of the region by 2010-2025 is to be supplied by food and agricultural raw materials in a quantity not lower than required by minimum medical standards.

And of course, it will require involvement of additional land and water resources in the volumes more than maximum earlier used (1990) into agriculture of the region.

Summary of indicators of development scenarios of irrigated agriculture and agricultural water consumption in the Kyrgyz part of Aral Sea Basin is shown in Table 6.

Table 6

Showings of development	Development scenario		
	First	second	third
1. Areas of irrigated lands, thousand ha	415,24	416	493
2. Water diversion/water consumption			
Total, mln m ³ /year	4275/3557	4633/3778	6141/4952
including, developed lands	4275/3557	4633/3778	4633/3778
increase of supply			708/580
irrigation of new lands			800/594

4.2.3 Perspectives of water consumption in domestic sector

According to the provisions of the Constitution and Law of the Kyrgyz Republic "On water", the domestic water supply for population is now and in perspective should remain as one of the most priority aspects. Based on this the perspectives of development of domestic and rural water supply are considered within one scenario, which will ensure in the future, as far as possible, the normative satisfaction of needs of the growing population number. In general, here, the perspective needs in water for domestic and household needs of population in the region amounts to 85.1 million m³ per year by 2010; and 139.5 million m³ per year by 2025.

4.2.4 Perspectives of industrial water consumption

Stabilization of production is recorded over the last years (1998-2000 period) in industrial sector of region's economy, namely at the functioning enterprises as well as increase of production rates at the newly created and modernized enterprises, including small and medium enterprises.

The expected production increase in the mining industry, machine building, petrochemistry will not result in considerable growth of industrial water use. The main increase of water use is expected at the enterprises of local and processing industry. We have focused on three scenarios of development of industry and industrial water use per planning zones. The overall indices of expected water use for industrial needs in the region at the level of 2001-2010-2025 are shown in the Table below.

Table 7

Development scenarios		Volume of water consumption, million m ³ per annum		
		2001	2010	2025
1	of minimum changes	16.72	16.86	18,32
2	low-level development		54,62	65,11
3	high-level development		98,14	196,26

It is expected that volumes of pollutants diverted into the surface water facilities will grow slightly, which is explained by proposed reconstruction of existing treatment facilities, construction of new ones, introduction of low-wasted and wasteless productions.

4.2.5 Development of hydropower industry

The nearest perspectives of development in Kyrgyzstan energy sector are reflected in the National Program "Complex Development Bases of the Kyrgyz Republic". One of the priority tasks of the program is reforming of fuel and energy complex. Based on special strategic importance, the Naryn cascade of HPSs, high-voltage power transmission lines and substations remain in state ownership.

After the collapse of the USSR, because of the weakening of interstate relations, introduction of national currencies, increase of price for energy resources and transportation, coal and gas deliveries decreased in Kyrgyzstan that radically affected the change of structure of fuel and energy balance of the republic. Operating mode of Naryn cascade had to shift from irrigation to energy mode, which affected the whole water situation in Syr-Darya Basin. By the beginning of vegetation period of 1998 the water reserves in Toktogul water storage reduced down to 7.2 billion ÷³ (dead storage capacity - 5.5 billion ÷³). The calculations show that discharge of Toktogul water storage down to dead storage may occur in the nearest future, which will result in serious consequences both for energy of Kyrgyzstan and for water use of neighbouring republics. (See item 3.4 and Table 3).

In order to change (improve) the current situation in energy balance of Kyrgyzstan, to maintain the filling process of Toktogul water storage, to provide the irrigation water discharge to Kazakhstan and Uzbekistan, it is required to speed up the raising of power capacities of the Kyrgyz Republic. Kyrgyzstan has all the required reserves for achieving this purpose (by completing the construction of Tash-Kumyr, Shamaldy-Say, Kambar-Ata HPSs and building the new one - Ala-Buka hydrosystem with HPS with capacity of approximately 500 thousand kW and reservoir storage capacity of about 9.5 billion ÷³).

The newly introduced reservoir volumes and HPS capacities can be used for flow regulation based on energy generation schedule. In addition, Toktogul hydrostructure can be used for regulation of flow and operate mainly in irrigation mode. As a result, both the needs of Kyrgyzstan in power resources and needs of Kazakhstan and Uzbekistan in irrigation water will be satisfied. Not only Kyrgyzstan, but both Kazakhstan and

Uzbekistan should be interested in the soonest putting into operation of aforementioned hydrostructures. It is essential for Kazakhstan and Uzbekistan to render assistance and economic support to Kyrgyzstan in the soonest construction of new hydropower structures in Naryn Basin.

The construction and development of new hydropower facilities is not caused by any increase of water consumption in Kyrgyzstan.

4.2.6 Water resource conservation plans and water demands for environment purposes

Due to large variety of landscapes and microclimate, the Kyrgyz Republic is very rich with ecosystem variety, variety of animals and plants.

More than 500 kinds of vertebrates, including 83 kinds of mammal, 368 – birds, 28 kinds of reptile, 3 kinds of amphibiotic, 75 kinds of fishes and so on, live in the republic. About 10 % of mammals and 10 % of birds that live in the republic are in the Red Book.

The reserves, wildlife areas and national parks were created for conservation of the nature, its restoration and conducting scientific researches.

There is a national park “Kyrgyz-Ata” (Osh oblast) in the Kyrgyz part of Aral Sea Basin, resided by 26 kinds of animals, 160 kinds of birds, 600 kinds of plants. Created the national reserves: “Naryn” (in Naryn oblast), “Besh-Aral” (in Jalal-Abad oblast), “Sary-Chelek” (Jalal-Abad oblast), “Karatal-Japyryk” (Naryn oblast).

Special environmental reserves were created to conserve the unique, rare, endemic animals and plants at water schemes: river ecosystem in Gulcha river (Osh oblast), ecosystem of Baidostol river (Naryn oblast), ecosystem of Chatkal valley (Jalal-Abad oblast), water-grass ecosystem of Yassy river (Jalal-Abad oblast).

The on-going disappearance of biotope and absence of effective protective measures in protected areas are the main problems of preservation of ecological systems.

13 rivers in Kyrgyz part of Aral Sea Basin perform ecological functions besides sanitary ones. They are: Naryn, Suusamy, Sokh, Ak-Bura, Maili-Su, Khodjabakirgan, Kara-Darya, Kogart, Isphayramsay, Shakhimardan, Isphara, Kara-Ungur-Sai, Kyzyl-Suu. Along the banks of mentioned rivers reed is conserved, and various kinds of birds and small animals reside as well.

Naryn, (Upper stream), Suusamy, Mayli-Suu, Kyzyl-Suu belong to the least degraded rivers. The rivers Sokh, Khodjabakirgan, Shakhimardan, Isphara are not studied enough with regard to flora and fauna.

Naryn river (Lower stream), Ak-Bura, Kogart (lower stream), Kara-Ungur-Say belong to heavily degraded water schemes. Degradation of water systems is associated with high farming, with maximum use of river water for irrigation.

In order to keep stable development of ecosystems, it is necessary to reduce impact of human activity on the aforementioned water systems, to provide sanitation releases in the volume of 15 - 20 % of river flow all year round. Upon performance of the given requirements, the ecological demands will be satisfied, and the flora and fauna in the basins of Aral Sea rivers will be protected.

4.2 Future Investments

Amounts of required future (for 2001-2010, 2011-2025 periods) investments in the irrigation of Kyrgyzstan by Planning Zones in the Aral Sea Basin, as well as their development scenarios and sources of financing are shown in Table 8. Given amounts include costs of rehabilitation, new construction, operation and maintenance of irrigation systems. Justification and calculations of given amounts are shown in the report on subtask N5/5.

Required investments in development of irrigation of the Kyrgyz part of the Aral Sea Basin (million USD)

Table 8

Planning Zones Sources of Financing	1-st development scenario			2-nd development scenario			3-rd development scenario		
	Sum in periods		total 2001-2025	Sum in periods		total 2001-2025	Sum in periods		total 2001-2025
	2001-10	2011-25		2001-10	2011-25		2001-10	2011-25	
1	2	3	4	5	6	7	8	9	10
1. the Upper Naryn. Total	14.514	21.771	36.285	33.982	50.973	84.955	64.064	96.096	160.16
Central state budget	5.042	7.563	12.605	9.039	13.559	22.598	12.806	19.209	32.015
Credits	3.05	4.575	7.625	9.237	13.855	23.092	18.858	28.287	47.145
Water user funds	6.422	9.633	16.055	15.706	23.559	39.265	32.4	48.6	81
2. the Mid Naryn. Total	4.351	6.527	10.878	8.231	12.347	20.578	15.981	23.972	39.953
Central state budget	1.484	2.226	3.71	2.171	3.257	5.428	3.193	4.79	7.983
Credits	1.024	1.536	2.56	2.379	3.569	5.948	4.782	7.173	11.955
Water user funds	1.843	2.765	4.608	3.681	5.521	9.202	8.006	12.009	20.015
3. Kampyr-Ravat. Total	3.988	5.982	9.97	10.235	15.353	25.588	21.554	32.331	53.885
Central state budget	1.403	2.105	3.508	2.75	4.125	6.875	4.36	6.464	10.824
Credits	0.768	1.152	1.92	2.562	3.843	6.405	5.154	7.731	12.885
Water user funds	1.817	2.725	4.542	4.923	7.385	12.308	12.04	18.06	30.1
4. Chatkal. Total	0.167	0.25	0.417	0.75	1.125	1.875	1.155	1.733	2.888
Central state budget	0.064	0.096	0.16	0.186	0.279	0.465	0.229	0.344	0.573
Credits	0.011	0.016	0.027	0.307	0.461	0.768	0.617	0.925	1.542
Water user funds	0.092	0.138	0.23	0.257	0.385	0.642	0.309	0.464	0.773
5. North-Fergana. Total;	17.199	25.799	42.998	39.782	59.673	99.455	79.899	119.849	199.748
Central state budget	5.832	8.478	14.31	10.385	15.582	25.967	15.149	22.724	37.873
Credits	4.192	6.288	10.48	12.267	18.401	30.668	24.87	37.305	62.175
Water user funds	7.175	10.763	17.938	17.13	25.725	42.855	39.88	59.82	99.7
6. South-Fergana. Total	42.4	63.6	106	92.567	138.851	231.418	222.003	333.005	555.008
Central state budget	13.32	19.98	33.3	23.414	35.121	58.535	41.701	62.552	104.253
Credits	14.56	21.84	36.4	34.833	52.249	87.082	69.802	104.703	174.505

1	2	3	4	5	6	7	8	9	10
Water user funds	14.52	21.78	36.3	34.32	51.481	85.801	110.5	165.75	276.25
7. Alay. Total	1.184	1.776	2.96	2.975	4.463	7.438	3.871	5.807	9.678
Central state budget	0.466	0.699	1.165	0.831	1.246	2.077	1.039	1.559	2.598
Credits	0.029	0.044	0.073	0.487	0.731	1.218	0.973	1.46	2.433
Water user funds	0.689	1.033	1.722	1.657	2.486	4.143	1.859	2.788	4.647
Total in Aral	83.803	125.705	209.508	188.522	282.783	471.305	408.525	612.788	1021.313
Central state budget	27.619	41.429	69.048	48.783	73.175	121.958	78.429	117.644	196.073
Credits	23.624	35.436	59.06	62.069	93.103	155.172	125.106	187.659	312.765
Water user funds	32.56	48.84	81.4	77.67	116.505	194.175	204.99	307.485	512.475

5 PLANNING ZONE ANALYSIS

The information, given in the reports N3/14, N5/2, N5/4, N5/5, N6/1, N7/2, N7/3, N7/4 was used in the analysis of Planning Zones.

5.1 Objectives

The objective of this section is to briefly summarise the available information by Planning Zones of the Kyrgyz part of Aral Sea Basin. The following issues are considered:

- assessments of meliorative condition of irrigated lands, irrigation and drainage systems, operation and management, stimulation and institutional framework;
- measures to keep stability in water resources, salt and energy management;
- water consumption by sectors of the economy (domestic, industrial, environmental and agricultural);
- water and salt balances;

5.2 Assessments

5.2.1 Meliorative assessment of irrigated lands

Meliorative assessment of irrigated lands is done based on salinity of upper one-meter soil layer, ground water tables and their salinity. Table 9 gives the data of these parameters. At that, saline lands include areas with gradation according to the salinity degree: slight, moderate, severe and very severe; areas with shallow groundwater tables include areas with gradation: up to 1 m, 1-1.5 m, 1,5-2 m and 2-3 m; areas with saline groundwater include areas with gradation: 1-3 g/l and more than 3 g/l. Areas with unsatisfactory meliorative conditions include the total amount of areas; from moderate up to very severely saline; with shallow groundwater tables of from 0 up to 3 m and with groundwater salinity of more than 3 g/l.

Table 9

**Meliorative description of irrigated lands by PZ of KR
of the Aral Sea Basin as of January 1, 2000**

PZ	Irrigated area		including the areas (ha)				
			Saline	with groundwater		with unsatisfactory conditions	
	ha	%			up to 3 m	<1 g/l	ha
1. the Upper Naryn	92,742	21,89	12,144	470	0	7,813	8,42
2. the Mid Naryn	17,691	4,17	0	670	0	145	0,82
3. North-Fergana	104,388	24,64	2,865	8,522	0,089	3,380	3,24
4. Chatkal	7,061	1,66	0	0	0	0	0
5. Kampyr-Ravat	27,865	6,58	0,900	3,270	0	1,335	4,79
6. South-Fergana	158,285	37,36	5,211	8,768	7,294	5,713	3,61
7. Alay	15,686	3,70	0	0	0	0	0
Total in basin	423,718	100	21,120	21,700	7,383	18,386	4,34

Given data shows the following:

- areas of saline lands amount to 21,12 00 ha, located in planning zones -1, 3, 5, 6;
- areas with shallow groundwater tables amount to 21,700 ha and occur in all Planning Zones, besides the seventh; at that the largest distribution is observed in Planning Zones 3, 5 and 6;
- areas with saline groundwater amount to 738300 ha, and are distributed primarily in 6th Planning Zone;
- areas with unsatisfactory meliorative condition amount to 18,386 00 ha and are distributed in 5 out of 7 Planning Zones; at that 8,42 % of total area of lands under irrigation in 1st zone falls to the share of such lands, in 3rd zone respectively – 3,24%, in 5th zone – 4,79 % and in 6th zone – 3,61 %.

In the irrigated lands with unsatisfactory meliorative conditions (saline, with shallow groundwater table and saline groundwater) it is required to undertake set of measures aimed at their improvement in order to receive stable crop yields. They include provision of systematic drainage (horizontal, vertical or combined types of drainage), leaching of saline lands and preventive irrigations.

5.2.2 Critical areas according to salinity, mineralization and ecology

The analysis and brief conclusions on critical zones by salinity and mineralization are given based on the report N 7/3 “ Identification of typical areas of high salt export”.

The criteria for selecting the critical areas are presence of soil salinity, shallow saline groundwater table, difficulty of groundwater outflow, presence of groundwater pressure, use of saline collector-drainage waters for irrigation purposes. Two rayons meet these conditions to a great extent. First is located in 1st zone - the Upper Naryn and second in the zone 6 – South-Fergana, which sharply differ from each other. It is confirmed by the data of Table 9 since the most part of saline lands are in 1st and 6th Planning Zones. As for areas with shallow groundwater table and saline groundwater the 6th zone takes first place. Some massifs are considered as an example.

For the 1st planning zone – it is massif of Kulanak valley with an area of 11,432 00 ha, located in Ak-Talaa rayon. This area has the favourable conditions for outflow of deep groundwater table and automorphic type of sulphate-chloride and chloride-sulphate salinity of light-brown soils. Therefore, when leaching the saline lands, construction of the drainage system is not required. But leaching itself is to be performed in autumn by basins with leaching norm of net, which is calculated according to the formula of V. Volobuev with the index of salt return, determined by experimental way.

For 6th planning zone – it is a massif of Ispahara-Lyakkan depression, located in Batken rayon, this area has unfavourable conditions due to both soil salinity and shallow saline groundwater table and due to use of saline collector-drainage water for irrigation. Existing horizontal and vertical drainage does not ensure the required reduction of groundwater that results in secondary salinity of irrigated lands. Reconstruction of systematic horizontal drainage and equipping vertical drainage wells with required facilities are the basic activities on improvement of meliorative conditions of irrigated lands, because out of 58 wells only 24 are in working condition. Besides it is necessary to leach moderately and severely saline lands, as well as introduction of water-desalinating irrigation regime.

5.2.3 Infrastructure, condition and productivity of irrigation and drainage systems of the Kyrgyz part of the Aral Sea basin.

◆ **Infrastructure:**

- Length of main canals amounts to 446.2 km, of which 51 % is lined and 49% - unlined canals.
- Length of inter-farm canals – 2076.3 km, of which 47 % is lined and 63% - unlined canals;
- Length of on-farm canals –12400.8 km, of which 69.4 % - lined canal, 19,1% is lined, 10,4% with chutes, 1,1% with pipes;
- Length of inter-farm open collectors – 42 km;
- Length of on-farm collector-drainage network amounts to 1154,5 km, including 88 % of open and 12 % of subsurface types;
- There are 149 pump stations, of which 44 are inter-farm and 105 – on-farm;
- There are 383 wells and 64 vertical drainage well for the irrigation purposes;
- There are 9 inter-farm reservoirs (without Toktogul reservoir) and 29 on-farm ones to regulate and gather water for irrigation purposes.

The characteristics of irrigation infrastructure by Planing Zones are shown in Table 10.

Table 10

Name		Number in all zones km-pc	including by Planing Zones							
			The Upper Naryn	The mid Naryn	Kampyr-Ravat	Chatkal	South-Fergana	North-Fergana	Alay	
Canals	Main	unlined	217.4	81.4	0	0	0	78.9	57.1	0
		lined	228.8	36.9	0	0	0	136.5	55.4	0
	Inter-farm	unlined	1315.2	336.3	44.6	307.8	23	432.3	171.2	0
		lined	761.1	126.7	63.9	33.6	8	361.3	167.6	0
	On-farm	unlined	8610.3	2191.8	719.7	613.4	58.6	2697.6	2079.2	250
		lined	2367.8	347.3	149.3	10.2	0	1421.2	429.5	10.3
		chutes pipes	1291.1 131.6	183 46.2	15.5 0	30 0	8 0	833.5 85.4	221.1 0	0 0
Pump stations	Inter-farm	44	11	8	2	0	15	8	0	
	On-farm	105	3	0	8	0	78	16	0	
CDF	Inter-farm open		42	0	0	8	0	30	4	0
	On-farm	open	1017	2.5	8.1	132.7	0	659.2	214.5	0
		subsurface	137.5	8.2	22.1	3.6	0	81.5	22.1	0
		wells	64	0	0	0	0	64	0	0
Irrigation canals		383	41	0	86	0	74	182	0	
Reservoirs	Main	9	5	0	0	0	3	1	0	
	on-farm	29	26	0	0	0	2	1	0	
The main facilities on rivers		90	7	10	23	2	29	18	1	

◆ **Condition:**

The length of non-operating canals due to their damaged condition amounts to:

- main and inter-farm – 52.5 km, or 2.1% of their total area;
- on-farm – 80,9 km or 0.7% of their total area;

The length of canals in poor condition (loss of working capacity from 61% up to 80%) amounts to:

- main and inter-farm – 539.1 km or 21.4 % of their total area;
- on-farm - 3562.4 km or 28.7 % of their total area;

The length of canals that are in satisfactory condition (loss of working capacity from 26% up to 60 %) amounts to:

- main and inter-farm – 1930.9 km or 76.5 of their total area;
- on-farm – 8708.7 or 70.2 %.

Out of 44 pump stations, 9 are in poor condition, 35 - in satisfactory condition. Out of 105 on-farm pump stations, 81 are in poor condition and 24 – in satisfactory.

Out of total length of collector-drainage network 66 % are in satisfactory condition, 33.7% - in poor and 0.3 % are non-operational.

Out of 383 irrigation wells 202 are in satisfactory condition, 95 in poor, 86 are in out-of-operation condition.

Wells of vertical drainage are in satisfactory condition. Out of 9 main reservoirs, 6 – in good condition, 3 - in satisfactory.

◆ **Brief description of negative effects of these systems**

In general, the existing technical condition of irrigation and drainage systems should be characterised as inadequate according to the majority of indices most areas.

The great part of irrigation infrastructure is at the breaking point of physical deterioration. After 1991, the current and rehabilitation works were carried out in extremely limited scopes (on average the work scopes reduced 5-6 times), which resulted everywhere in destruction of canal lining, damage of metal and reinforced concrete constructions, water facilities, as well as degradation of infrastructure (roads, power transmission and communication lines).

Discharge capacity of canals reduced for 15-25 %. Actual productivity of pumping stations also reduced in average for 20 % due to extreme deterioration of equipment.

Up to 50 % of regulating structures in the irrigation network are completely or partially destroyed. As a consequence, reduction of irrigated lands use, degradation of their meliorative condition are recorded, as well as reduction of efficiency of water resources use with certain damage to available land and environment.

5.2.4 Operation and management of irrigation systems

◆ **Brief description of operation and management of irrigation, including involved organisations**

In order to maintain irrigation infrastructure of the state in a working condition in each district division of irrigation system and also reservoir management divisions there are experienced personnel, which can skilfully solve the issues of their technical operation and manage the processes of water resources distribution and use.

Maintenance, including cleaning of network and major repairs is executed both by own funds of district water agencies and as well as with involvement of contractors based on bidding.

The privatised former construction organisations of water sector are involved, which execute the works under the contracts as independent private contractors with payment for works based on agreed and market prices.

The operation of state irrigation infrastructure is carried out at the expense of two sources of financing – state budget and water user funds. Water users pay for water delivery services of water agencies according to fixed tariff. Tariff is approved by the Jogorku Kenesh as a single tariff for all regions of the republic, which does not consider peculiarities of each irrigation system and prime cost of water delivery.

In 2000 actual operation costs were covered for 50% from state budget and for 50% from water users funds. But one should note that in general, normative fund demand for operation of state irrigation infrastructure is covered only for 20-25 %.

Economic entities, including Water User Associations carry out operation of irrigation and drainage network that are in their balance. The expenses are included in prime cost of agricultural crops produced.

Maintenance is carried out with their own funds, as well as on a contractual basis with water agencies (regional agencies on water resources management) and with independent private contractors. The scopes of work, carried out by independent contractors are increasing.

Water users independently fix the operational costs for their own network are. They also define the internal water delivery tariffs. However, actual costs of water user funds for operation of their own network are far from normative requirement, as in the case of operation of irrigation infrastructure by the state.

◆ **Description of advantages and disadvantages of existing operation system**

Advantages:

- implementation of maintenance works by independent contractors based on bidding increases the quality of implemented works and reduces the duration of implementation.
- due to introduction of payment for water delivery services tendency on reduction of water consumption is observed;
- the records of delivered water has improved due to the fact that water users pay for its delivery from their own pocket:

Disadvantages:

- the cost of maintenance works performed by independent private contractors is considerably higher than implementation of similar works by their own efforts and funds. The quality of works implemented by their own efforts and funds is worse to a great extent.
- remuneration of labour in state water organisations is lower than at contractors' companies, the same applies to qualification of personnel.

5.2.5 Incentive and institutional frameworks

◆ **Brief description of current institutional framework of water sector**

Under existing conditions, 7 Planning Zones of the Kyrgyz part of the Aral Sea Basin are located territorially in 4 oblasts. Every oblast has one Basin water resources management division that regulates the activity of rayon agencies on water resource management within its territory, management of inter-rayon canals and reservoirs in the area of distribution and use of water resources, as well as operation of irrigation systems.

These agencies are responsible for operation and maintenance of state irrigation system and collectors with structures and respective infrastructure.

Water User Associations as public non-profit organisations are created on a voluntary basis to organise operation and maintenance of the irrigation and drainage network properly that belonged to former kolkhozs and sovkhozs. Their basic, and one might say, the only objective is to provide WUA members with irrigation water in required volume and in a needed time.

◆ **Description of incentive for efficient water use**

Efficiency of water use is a complicated concept. But all components of this concept must be based on a reliable record of the water delivered. The introduced system of payment for volume of delivered water gave positive results both in putting in order its reliable record and as well as its efficient use.

The main incentive of a farmer is to pay less of his means for water use while retaining and increasing the reached indexes on yield and production of agricultural crops in irrigated lands. This incentive is not sufficiently efficient if the tariff for water use is low. Under existing conditions, the tariff for water delivery service is fixed, which equals to 15-20 % of its prime cost. Water delivery service tariff is to be within the prime cost of

its delivery. If we want to help water users, we need to do it in other way, for instance, by centralised purchase of products at the prices higher than market or through taxation system.

5.3 Measures to achieve sustainability in water resource, salt and energy management

5.3.1 Efficient maintenance system of complex infrastructure used

In the future it is expected that volumes of repair-and-renewal and precommissioning works, carried out by the farm themselves gradually will decrease while simultaneously scopes of work performed by contractors will increase.

The orders for implementation of these works, as well as supply of materials, machines and equipment for these purposes, should be placed among the contractors based on bidding system.

The contractors' activities should be regulated by State authorities that should provide the following:

- priority of three basic parameters (duration, quality and agreed prices for implementation of these works) when selecting the contractor;
- publicity and transparency of tenders, excluding discrimination with regard to bidding contractors;
- attraction of representatives of public organisations, bodies of local government and environmental protection bodies to participate in work of bidding commission.
- improvement of procedure of controlling the implementation of contract works to prevent financial violations, also violation of construction norms and regulations.

5.3.2 Efficient and transparent water resources management

On one hand, the water fund is a component of global ecosphere that is subject to conservation and protection, on the other hand, it is a sphere of economical activity to satisfy overall requirements of society. Based on these conditions, it is advisable to concentrate functions of management and control in the framework of two basic administrative departments, including the water agency and environmental protection agency. The role of other ministries and departments in regulation of water relations is limited to implementation of narrow functional powers, fixed by the Government of the Kyrgyz Republic.

There is a need for an independent republican agency in short-term perspective for centralised water resources management (State Water Administration) that must be created on the basis of the existing Water Resources Department under Ministry of Agriculture and Water Resources.

The Ministry of Ecology and Emergency is a Republican Agency on environmental protection.

Management of use and conservation of water resources must be carried out not on the base of administrative-territorial boundaries, but by hydro-geographic boundaries of main river basins.

In short-term perspective, the management functions of water resources use and operation and maintenance functions of irrigation systems should be separated at oblast and rayon levels, and in a long-term perspectives, i.e. beyond 2010 - at republican level too. Reforming process of water sector has started. The Government of the Kyrgyz Republic took a decision on creating State Water Inspection under Water Resource Department that takes the main functions with regard to water resource management

from oblast and rayon water organisations responsible for operation, including issuing license for water use and implementation of state control over water resources use. Development of water relations in conditions of market economy requires the water users to take active part in management of water infrastructure. To this end, it is required to carry out measures aimed at the following:

- adaptation of water users to market economy conditions;
- protection of water users rights;
- incentive of creation of public water user associations;
- gradual transfer of majority of basic water system assets into ownership (or lease) to be managed by water users or their public associations;
- rendering assistance to water users by giving credits and grants, rendering technical and methodical assistance, providing with information, assisting in organisation, construction, repair and rehabilitation works.

In order to regulate water resources use and involve water users in water resource management creation of public water users' associations, i.e. Water User Federations, is planned.

5.3.3 Rationalisation of methods of production and consumption of various resources

The improvement of organisation of production (development) and consumption process is primary basis for increasing the efficiency of using the agricultural resources (water, land).

The basic organisational activities include the following:

- improvement of water and agricultural sector management systems. In particular, the existing at the moment water distribution and water use management system in the Kyrgyz Republic preserved its structure and functions from the former Soviet Union. It poorly meets the present conditions of market relations, private ownership of lands, diversity of agricultural water users.
- propaganda and all the possible assistance in unification of small water users (farms and co-operative farms) into associations, co-operatives, unions for the purpose of joint overcoming of their difficulties, joining of their efforts and funds, prevention of degradation and soonest recovery of fertility of their lands, improvement of water resources use, introduction of advanced methods of agricultural techniques, development of crop rotations, pasture rotations, increasing the efficiency of agricultural production, struggle against poverty.
- teaching the farmers the basis of legal, economic and agricultural production knowledge. Before carrying out any economic and technical activities, developing the new land and water resources, the farmers need to be taught to use the existing ones properly and efficiently, without polluting and exhausting, without causing damage to environment, themselves, children and grandchildren!
- Reestablishment of divisions in the regional agencies on water resources responsible for land improvement, the task of which should include the following:
 - annual monitoring of quantity and quality of land and water resources, used in the region with compulsory mapping of the most critical and liable to degradation areas;

- conducting special researches with regard to forecasting and studying of degradation processes of land and water resources that exist in the given area, development of set of measures on prevention and control over their degradation.
- long-term renting or granting of all their inter-farm irrigation (water-distributing, collector-drainage and over-flow) networks for its rehabilitation (modernisation), sustainable maintenance, operation and management of inter-farm water distribution to unions established in rayons, agricultural co-operative farms and associations.
- organisation of regional self-supporting experimental stations. They should include:
 - scientific and productive subdivision with testing area on research and propaganda, applicable to local conditions, advanced methods of farming techniques, crop cultivation, techniques and technologies of irrigation, land reclamation, on control over meliorative status of lands in the region;
 - technical center on testing and propagation of new technique, systems and equipment, their demonstration, renting, sale, maintenance, provision with fuel and lubricants, and spare parts;
 - information center on collection, processing and offering to farmers the required agricultural and meteorological information, data on delivery and availability of conditioned seeds, fertilisers, pesticides and so on.
 - training room for fee-based and free-of-charge (at the expense of the State) training of farmers, teaching the advanced methods of farming techniques and land reclamation, water use.
- Improvement of economic interrelations between state, state water systems and water users that promote rationalisation and increase of efficiency of land and water resources use, nature conservation, increasing efficiency of agricultural production within the Republic.

Market relations widely used in world practice must be assumed as a basis of these mutual relations. But when agricultural water users are economically weak and unable to take responsibility for complete operation and maintenance of water systems without considerable detriment to their own economy, they need economic support.

In accordance with the Law on Water of the Kyrgyz Republic currently in force, the water use is fee-based. The payment is collected from all water users regardless of their departmental status, citizenship, types and forms of ownership, except for the cases, fixed by special legislation of the republic (health, recreation, sport, rest and so on). Procedure, conditions and values of payment for use of water facilities and water resources are different for various water users and determined by special legislation of the republic. Agricultural water users are charged only for services of water delivery from state water systems. The existing tariffs for water delivery to agricultural water users in the republic are given in item 4.1, Table 4.

But such low tariffs have small incentive for water users to save the water when using it, to reduce losses of irrigation water, to invest money in improvement of water systems and watering technique.

The policy of pricing the payment for water services should pursue the objective of making the prices for service closer to their actual prime cost. The State should participate in economic support of water systems and water users through financing the development of water systems and through compensation of part of water users' expenses paid for water use. Compensation of water users' expenses must not be directly by cash, but indirectly, i.e. by means of reducing the taxes for used irrigated lands and by centralised purchase of water users' products for overpriced (above market) prices. These issues are set forth in detail in the report on subtask N6/1.

5.4 Water consumption forecast

Forecast of water consumption of domestic water supply, agriculture, industry, environmental protection by Planning Zones in the Kyrgyz part of Aral Sea Basin at a current stage, for medium-term (10 years) and long-term perspectives (up to 2025) is given above in Section 4 when considering the development scenarios of economy branches of the given region.

5.5 Perspective energy demands by Planning Zones

Perspective energy demands for operation and maintenance needs of water systems by PZ of the Kyrgyz part of Aral Sea Basin are shown in Table 11.

Table 11

PZ	Development scenario	Designed year	Designed energy consumption GWh/year	Designed cost of energy thousand \$ per year
1. the Upper Naryn	first	2001	17,2	108,2
	second	2010	23,3	147,0
	third	2025	30,8	194,0
2. the Mid Naryn	first	2001	7,8	49,0
	second	2010	10,7	67,4
	third	2025	14,0	88,0
3. North Naryn	first	2001	38,2	240,8
	second	2010	53,5	336,7
	third	2025	69,4	437,0
4. Chatkal	first	2001	0,13	0,82
	second	2010	0,32	2,0
	third	2025	0,46	2,9
5. Kampyr-Ravat	first	2001	0,81	5,10
	second	2010	1,10	6,90
	third	2025	1,43	9,00
6. South Fergana	first	2001	44,4	279,6
	second	2010	61,9	389,8
	third	2025	80,3	506,0
7. Total	first	2001	0,10	0,61
	second	2010	0,32	2,00
	third	2025	0,43	2,70
Total	First	2001	108,6	684,2
	Second	2010	151,1	951,8
	Third	2025	196,8	1239,6

Perspective demands of energy consumption are determined in Table 11: the 1st scenario – based on actual power consumption in 2000, 2nd scenario – based on actual power consumption in 1990, 3rd scenario is accepted with increase of power consumption proportionally to increase of estimated water consumption while switching from 2nd to 3rd scenario of development of irrigated agriculture (see Section 4 and reports on subtasks N5/5 and N6/1). Average tariff for consumed electric energy (2000) amounts to 30 tyiyn (0,63 US cent) per kWh.

5.6 Water and salt balances

5.6.1 Objective

The objective is to show the main recourses of salt entry by Planning Zones of the Kyrgyz part of Aral Sea Basin. Data, presented in reports on subtask N7/1, N7/2, N7/3, N7/4 and N 7/5, as well as basic provisions, set forth in reports of Kh. Yakubov, A. Usmanov on R 7/5 and R7/3 (June 2001) were analysed and summarised to achieve this objective.

5.6.2 Basic provisions

The information on distribution of irrigated lands was used taking into account the following parameters to solve the given task: salinity degree 0-1 meter of soil layer, groundwater table, groundwater salinity, existence of systematic drainage (horizontal and vertical), total discharge of collector-drainage water to irrigation sources and rivers, their salinity (weighted average one) annual salt export by return collector-drainage waters. These parameters were used to determine certain critical areas according to salinity of land and river flow, which belong to 1st (the Upper Naryn) and 6th planning zones (South-Fergana).

5.6.3 Description of return collector-drainage water

Records of return waters, discharged to rivers, reservoirs and irrigation canals, are kept in those Planning Zones where there is systematic horizontal drainage in place. Below there are data according to some parameters of return waters of KR Planning Zones of Aral Sea Basin for 1999.

- total discharge of collector-drainage water amounted to 363,4 million m³, and the largest flow is recorded in the following Planning Zones in % of total flow: 27,5 – in North-Fergana; 13,6 – in Kampyr-Ravat, 57,5 - in South-Fergana;
- weighted average salinity of return collector-drainage waters amounts to 1,152 g/l, and weighted average values by Planning Zones varies in the following manner: in 1st and 2nd zones - up to 0,25 g/l; in 3rd zone - 0,493 g/l; in 5th zone - 0,63 g/l and in 6th zone - 1,612 g/l; the largest salinity of return waters is recorded in Batken rayon (6th zone) and amounts to 2,241 g/l;
- total salt export by return waters per year amounts to 418,800 tons, part of which goes to rivers and reservoirs (58,2%) and part - to irrigation canals (41,8 %); the largest salt export is observed in the following Planning Zones, in % of total salt export: 3rd zone – 11,8; 5th zone – 7,4; 6th zone – 80,5;
- the largest salt export up to 262,500 tons that amounts to 62,7 % of total salt flow of return waters of the Kyrgyz Republic of Aral Sea Basin is observed in Batken rayon..

Description of collector-drainage flow by PZ for the moment and for perspective (See Table 14) is given in Section 6.3 below.

6. PRELIMINARY NATIONAL PLAN FOR WATER RESOURCES USE, WATER SAVING AND SALT MANAGEMENT

6.1 Availability of water resources and water demands in the Kyrgyz part of the Aral Sea Basin

Average annual values of availability and consumption of water resources in the basins of the Aral Sea rivers which are generated on the territory of Kyrgyzstan are shown in Table 12

Table 12

Basin	Average annual flow in basin, km^3	Including ones that formed on the territory of Kyrgyzstan km^3	Water intake/water consumption of Kyrgyzstan			
			Fact 2000	Perspective till 2025		
				1 development scenario	2 development scenario	3 development scenario
Syr Darya river	46,04	27,40	4,3/3,5	4,3/3,5	4,6/3,7	6,3/5,1
Amu Darya river	93,42	1,93	0,06/0,04	0,06/0,04	0,07/0,05	0,09/0,06

Decoding of water consumption by sectors (agriculture, domestic sector, industry and others) are shown above, in section 4 (4.2).

As it is clear from the given data, Kyrgyzstan has rich reserves of water resource for planned development of water consumption. But it is to be noted that use of these reserves, in particular, for the development of irrigated agriculture, is extremely difficult in the republic. The major part of water reserves flow in the stems of the largest and medium rivers of Kyrgyzstan: the Naryn, Aksai, Kyzyl-Suu, located in hard-to-reach mountainous areas, where actually there are not much lands, suitable for development of irrigated agriculture. Use of this flow is associated with necessity of creating expensive hydraulic facilities on diversion of flow and pumping irrigation.

Owing to natural geographic, climatic and relief conditions in the Kyrgyz part of the Aral Sea Basin, mainly, flow of small rivers-tributaries of the Naryn and the Syr-Darya is used for irrigation. At the moment, the flow of these (small) rivers is slightly regulated. Under surplus of water resources in this region of Kyrgyzstan (more than 29 km^3 per year) and the current water consumption rate of about $3,5 \text{ km}^3$ (less than 12 %), the agriculture of the region is already suffering from lack of water. Increasing efficiency of irrigation systems and water consumption, regulation of flow of already used small rivers for the purpose of using for irrigation of their autumn-winter and early spring flow is the main realistic way of increasing the water supply to currently irrigated lands and development of new ones.

6.2 Irrigated areas

Areas of irrigated lands by Planning Zones, the anticipated perspectives of their increase during the period till 2025 and the sowing structure of the main crops in the Kyrgyz part of the Aral Sea Basin are given in the Table 13.

Table 13

Planning Zones	Area of irrigated lands, thousand ha				The main growing crops
	Fact 2000	Perspective till 2025			
		1st scenario	2 nd scenario	3 rd scenario	
1. the Upper Naryn	90,53	90,53	90,6	108,0	Cereals, potato, vegetables, grasses
2. the Mid Naryn	12,75	12,75	12,8	15,0	Cereals, maize, potato, vegetables, grasses
3. North-Fergana	103,92	103,92	104,0	123,0	Cereals, maize, rice, cotton, tobacco, oil-plants, vegetables, melons and gourds, fruits, grasses
4. Chatkal	7,06	7,06	7,2	8,5	Cereals, potato, vegetables, grasses
5. Kampyr-Ravat	27,87	27,87	27,9	33,0	Cereals, rice, tobacco, oil-plants, potato, vegetables, fruits, grasses
6. South-Fergana	157,45	157,45	157,8	187,0	Cereals, maize, rice, cotton, tobacco, oil-plants, potato, vegetables, melons and gourds, fruits, grasses
7. Alai	15,66	15,66	15,7	18,5	Cereals, potato, grasses
Total in Kyrgyz part of the Aral Sea Basin	415,24	415,24	416	493	

The extension of areas for production of more valuable competitive agricultural products not only in domestic market, but outside of the republic such as fruits, berries, nuts, melons and gourds, vegetables and development of appropriate processing industry is a primary strategy of recovery development of the agricultural production and development of new irrigated lands in the given region of Kyrgyzstan.

6.3 Perspective return flows and salt loads

The detailed analysis of return flow and salt load of rivers by Planning Zones is given in the reports on subtasks N3/1, N5/4, N7/2, N7/3 and N7/4.

Record of return flow discharged into rivers, reservoirs and irrigation canals is kept in those Planning Zones, where there is a systematic horizontal drainage. Collector-drainage network is located in five Planning Zones and is mostly developed in three PZ: North-Fergana (Nookan and Suzak rayons), Kampyr-Ravat (Uzgen rayon) and South-Fergana (Aravan, Nookat and Batken rayons).

Summarized discharge of collector-drainage water in 1999 amounted to 363,4 million cubic meters. The largest flow is recorded in the following Planning Zones in % of total flow: North-Fergana – 27,5, Kampyr-Ravat – 13,6, South-Fergana – 57,5.

The weighted average salinity of return collector-drainage waters amounts to 1,152 g/l. The weighted average salinity values per PZ varies in the following way: 1-st and 2-nd zones up to 0,25 g/l, 3-rd zone – 0,493 g/l, 5-th zone – 0,63 g/l, 6-th zone - from 1,612 g/l. The largest salinity of return waters is recorded in Batken rayon, the territory of which belong to 6-th zone, and amounts to 2,241 g/l.

Summarized salt export by return water flow during the year amounts to 418,8 thousand tons, part of which is brought to rivers and reservoirs (58,2 %) and part - to irrigation

canals (41,8 %). The largest salt export is recorded in the following Planning Zones, in % of total salt export: 3-rd zone – 11,8; 5-th zone – 7,4; 6-th zone – 80,5. The largest salt export up to 262,500 tons is observed in Batken rayon that amounts to 62,7 % of total salt flow of return waters of the Aral Sea Basin.

How drainage flow and its salinity will vary in the future, depends first of all on conditions in water sector and raising of water use standards, improving the efficiency of canals (on-farm, inter-farm and main), the status of collector-drainage network itself and availability of water gauging facilities it it.

For the perspective, the increase of collector-drainage flow volumes is taken proportionally to the increase of designed water delivery.

Table 14

Characteristics of return waters by PZ of the Kyrgyz Republic of the Aral Sea for 1999 and for the perspective

Planning Zones	1999				In perspective (designed) 2025			
	Water delivery	CDW flow	Salinity, g/l	Salt export, thousand tons	Water delivery	CDW flow	Salinity g/l	Salt export, Thousand tons
	million m ³				million m ³			
1. the Upper Naryn	298	0,558	0,25	0,140	448	0,839	0,25	0,210
2. the Mid Naryn	83,5.	4,335	0,25	1,084	150	7,787	0,25	1,947
3. North-Fergana	667	100,026	0,493	49,332	1352	202,75 1	0,493	99,956
4. Chatkal	22,4	0	0	0	43	0	0	0
5. Kampyr-Ravat	234	49,447	0,63	31,158	337	71,212	0,63	44,864
á. South-Fergana	1224	209,09	1,612	337,145	2072	353,95 0	1,612	570,320
7. Alai	33,1	0	0	0	75	0	0	0
<i>Total</i>	2562	363,456	1,152	418,859	4477	635,12	1,128	716,596

6.4 Interaction between water and energy sectors

As it was mentioned above, operation of existing, construction and introduction of new hydropower facilities in the Kyrgyz part of the Aral Sea Basin is not caused by any increase of water consumption. It is not caused by restriction of irrigation water use in this (Kyrgyz) zone either. Respectively, the separate systems of managing the agricultural and energy production, their water consumption and water use has shaped in the Kyrgyz Republic. In agriculture – Ministry of Agriculture, Water Resources and Processing Industry with Water Resources Department. In energy – State Energy Agency under the Government of the Kyrgyz Republic. The principles of their interaction within the republic in the given region and for perspective are not elaborated so far.

However interstate interaction (coordination of water use) of energy sector of Kyrgyzstan with agricultural water consumption in downstream Uzbekistan and Kazakhstan is of

great importance both for Kyrgyzstan and Uzbekistan, Kazakhstan both nowadays and in particular, in perspective.

Such an approved strategy of internal and interstate use of water resources in the Kyrgyz Republic is still absent. It is now under elaboration stage. So far, only the Constitution, Water Law, respective Decrees of the President of the Republic, as well as international Declarations, Conventions and Agreements are the main guiding documents with regard to water strategy and policy issues.

The adopted in the Kyrgyz Republic legislative regulations on water resource use, in particular, at the international level, are being so far implemented unsatisfactory. In practice, we are still under influence of old Soviet regulations, elaborated and efficiently used when currently sovereign Kazakhstan, Kyrgyzstan, Uzbekistan and Tadjikistan were the republics of the former USSR, when the maximum replenishment of all-union budget was the criteria of optimality to use the restricted water resources of the region. The planned uniform distribution of all-union budget provided the maximum replenishment of republican budgets. The water distribution and water use principles used, in a different extent, had been satisfying all republics of the former USSR. Nowadays they do not satisfy them.

The existing international Conventions and Declarations on conservation and use of transboundary watercourses, environmental protection are also so far insufficient to help in solving disputable interstate water problems. Generally they contain (mainly declare) regular and acceptable, but only general provisions, which reflect little the specifics of problems of interstate water distribution and use in water scarce regions, and the main thing they do not include mechanism (methods) of practical implementation of recommended regulations.

The governments of Kazakhstan, Kyrgyzstan, Uzbekistan and Tadjikistan make attempts to settle existing disputes by negotiations, elaborating and approving special interstate agreements. But even these Agreements are not always equally satisfactory for all contracting parties.

Generally, the International agreements on rationalizing the use of water and energy resources of Syr Darya basin, that are being concluded since 1995, do not settle the problem. Seasonal redistribution of water resources for energy and irrigation needs without comprehensive approach steadily leads to reduction of water reserves in Toktogul reservoir. So, since 1995 by the beginning of vegetation period of 1998, the water reserves in the reservoir have reduced down to 7.2 billion m³ (dead storage capacity - 5.5 billion m³). Incomplete fulfilment of earlier reached agreements by parties has promoted this as well. Incomplete fulfilment of parties' engagements and unbalanced use of water resources of Naryn river in long-term plan inevitably will result in serious consequences both for energy of Kyrgyzstan and water use of the neighbouring countries. It is to be taken into account here, that if during 1995-1999 years the average inflow to Toktogul reservoir amounted to 12.9 billion m³ per year and exceeded the average annual values for 1.6 billion m³, then one can not rely on the same favourable hydrological conditions in future. Due to this fact, in forthcoming years, the water and energy situation in the basin may essentially be aggravated that may affect the possibility of participation of Toktogul hydrosystem both in covering of energy loads and in ensuring of irrigation releases.

Besides the issues of the water resource use regime in Naryn - Syr-Darya rivers, the issue of ensuring safety of dams, especially with high heads, which have higher rate of risk while operating in conditions of entirely destroyed former centralized system of controlling the hydraulic facilities is also a crucial issue both for some countries and the region in general.

Clause 1 of the Agreement between the Governments of Kazakhstan, Kyrgyzstan and Uzbekistan on use of fuel and energy and water resources, construction, operation of gas pipelines of Central Asian region (Tashkent, April 5, 1996) clearly determines: “prices for energy resources (electric energy, coal, gas, petroleum products) and delivery settlements are determined by direct contracts between the parties or agencies authorized by them”.

In the agreement there is not a word about the price of water. In fact, water that provides the life and existence of states themselves has no price in this region. It is free of charge! In the next Agreement between the governments of the same countries regarding the use of water and energy resources of Syr-Darya river basin (Bishkek c, March 17, 1998) it is decided (Clause 4):

“Additionally generated electric energy by Naryn-Syr-Darya cascade, bounded with water release mode during the vegetation and multi-year flow regulation in Toktogul reservoir, in excess of needs of the Kyrgyz Republic, is transferred to Kazakhstan and Uzbekistan in equal portions.

It is compensated by (transferred electric energy) delivering to the Kyrgyz Republic the energy resources in equivalent volumes (coal, gas, fuel oil, electric energy), as well as other production or in the form of money, for accumulation of necessary annual and multi-year reserves of water in reservoirs for irrigation needs.

Thus, as a result of current interstate Agreements respect to use of water and energy resources in Aral Sea Basin, the Kyrgyz Republic has no gains (except of heavy losses). To the detriment of itself, Kyrgyzstan annually reduces very much required in the republic power generation by Naryn HPS cascade in winter period saving the water for irrigation purposes for Kazakhstan and Uzbekistan in summer time. Additionally generated electric energy in summer as a result of irrigation releases is transferred to Kazakhstan and Uzbekistan. In exchange, in volume equivalent at cost, Kyrgyzstan should receive energy resources - coal, gas, black oil, so that then to transport them at its own expense and transform into the same electric power, having spent additionally huge material, financial and manpower resources.

As a result of multi-year and seasonal regulation of the flow of Naryn river in Toktogul reservoir according to irrigation schedule, Kazakhstan and Uzbekistan receive water in the required time and in the required and absolutely free-of-charge. As a result, they have developed 400 000 ha of new irrigated lands and increased supply of irrigation for 900 000 ha. The damages of high waters and floods are eliminated.

The indicated effects of Kazakhstan and Uzbekistan under the agreements in force with regard to use of water and energy resources of Syr Darya basin to a great extent are paid by Kyrgyzstan. Kyrgyzstan entirely at its own expenses carries out environmental protection measures in Naryn river basin, keeps record and forecasting of flow, operation of reservoirs. Kyrgyzstan completely bears the damages due to the loss of land and other natural resources in flooded part of Ketmen-Tobo depression; due to the re-settlement of villages from flooded territories, including rayon center; due to necessity of developing the new lands to provide local population with food products; due to necessity of creation and operation of pumping stations to deliver water to newly developed lands.

In conclusion one should note, that development of present Water and Environmental Management Project in the basin is very well-timed and important for elimination of existing interstate conflicts in use of water and energy resources of Aral Sea Basin and for improvement of appropriate interstate Agreements. In particular, its phase VI Sub-component A-1 "The Project of Regional and National Strategies, Policies and Action Programs", elaborated jointly by the representatives of various states of the region, under the guidance and with the assistance of independent foreign consultants.

6.5 Financial alternatives elaborated for agricultural infrastructure

The given alternatives are elaborated and given in details in the report on subtask N5/5. Special methods (according to tasks on Econ-1 and Econ-2) were elaborated for quantitative assessment of required capital investments for rehabilitation and development of irrigation systems, annual expenses for their operation and maintenance.

6.5.1 Required capital investments

According to accepted method the required capital investments for full rehabilitation and new construction of irrigation structures are determined using (taking into account) current unit prices for construction works, high altitude and remote location premiums, taxes. General and specific capital investments for partial rehabilitation of facilities are determined depending on percentage of their actual depreciation.

The quantity of non-operating structures and their components are determined by technical inspection report of Irrigation Rehabilitation Project (IRP), financed by the World Bank.

The following is accepted as development scenarios of rehabilitation works:

- first scenario – top-priority rehabilitation of non-operating schemes, the activities on which have been already started within IRP;
- second scenario – rehabilitation of efficiency and working capacity of facilities that are currently in poor condition, as well as improvement of watering technique and reclamation condition of irrigated lands;
- third scenario – completion of rehabilitation of irrigation systems and putting the new irrigation systems into operation in the area of 20 000 ha by 2010 and another 56,5 000 ha - by 2025.

The data on required capital investments for rehabilitation and development of irrigation infrastructure by PZ in the Kyrgyz part of the Aral Sea Basin on the whole is shown in Table 15. Capital investments are shown in thousand USD, calculated as per year in average for the period of 2001-2025.

Table 15

PZ and financial sources	Rehabilitation			New construction			Total		
	1 st	2 nd	3 rd	1 st	2 nd	3 rd	1 st	2 nd	3 rd
	scenari	scenari	scenari	scenari	scenari	scenari	scenari	scenari	scenari
	0.	0	0	0.	0	0	0.	0	0
1. Upper Naryn. Total	380	764,0	1576	-	390	781	380	1154	2730
including.state budget	76	152,8	315	-	78	156	76	231	546
credits	304	611,2	1261	-	312	625	304	923	2184
water users funds	-	-	-	-	-	--	-	-	-
2. Mid Naryn Total	128	244,0	491	-	53,2	106	128	297	788
including.state budget	25,6	48,8	98	-	10,5	21	25,6	59	157
credits	102,4	195,2	393	-	42,7	85	102,4	238	631
water users funds	-	-	-	-	-	-	-	-	-
3. Kampyr-Ravat. Total	96,0	196,0	402	-	124	248	96,0	320	722
including.state budget	19,2	39,2	80	-	25	50	19,2	64	144
credits	76,8	156,8	322	-	99	198	76,8	256	578
water users funds	-	-	-	-	-	-	-	-	-
4. Chatkal, Total	1,4	2,8	5,9	-	35,5	71	1,4	38,3	44,2
including.state budget	0,3	0,6	1,2	-	7,0	14	0,3	7,6	8,8
credits	1,1	2,2	4,7	-	28,5	57	1,1	30,7	35,4
water users funds	-	-	-	-	-	-	-	-	-
5. North-Fergana. Total;	524,0	1088	2218	-	443	887	524	1531	3749
including.state budget	104.8	217.6	444	-	87	174	104.8	305	749
credits	419.2	870.4	1774	-	356	713	419.2	1226	3000
water users funds	-	-	-	-	-	-	-	-	-
6. South-Fergana Total	1820	3680	7377	-	674	1348	1820	4354	8725
including.state budget	364	736	1475	-	135	270	364	841	1745
credits	1456	2944	5902	-	539	1078	1456	3483	6980
water users funds	-	-	-	-	-	-	-	-	-
7. Alay. Total	3.6	7.6	15.2	-	53.2	106	3.6	60.8	121
including.state budget	0.7	1.5	3.0	-	10.6	21	0.7	12.1	24
credits	2.9	6.1	12.2	-	42.6	85	2.9	48.7	97
water users funds	-	-	-	-	-	-	-	-	-
Total	2953	5982	12085	-	1774	3549	2953	7756	15634
including.state budget	590.6	1196	2417	-	353	706	590.6	1549	3123
credits	2362.4	4786	9668	-	1421	2843	2362.4	6207	12511
water users funds	-	-	-	-	-	-	-	-	-

6.5.2. Operation and Maintenance costs

The required operation and maintenance costs of irrigation systems by Planning Zones and development scenarios of the agriculture in the Kyrgyz part of Aral Sea Basin are shown in the Table 16. Costs are shown in thousand USD per year as a summary of inter-farm and on-farm irrigation systems.

The following is assumed in the considered development scenarios of operation and maintenance:

- first scenario – some increase (in comparison with the current one) of state budget financing and tariffs for water use that in sum should enable to keep irrigation systems from their further decline;
- second scenario – increase of funding (from budget and water users) for operation and maintenance of irrigation systems up to the level of costs, allocated for these purposes in 1990-1991;
- third scenario – further increase of funding (from budget and water users) to the amount, required for operation and maintenance of existing and new (additionally) introduced systems and ensuring the payment of depreciation charges for rehabilitation (renovation) of all irrigation infrastructure of Planning Zones.

**Annual operation and maintenance costs of irrigation systems,
thousand USD per year**

Table 16

PZ, systems and financial sources	1 development scenario	2 development scenario	3 development scenario
1. Upper Naryn, total	1071,4	2243,7	4049,4
inter-farm systems	585,7	1361,2	2682,0
on-farm systems	485,7	882,5	1367,4
state budget	428,2	673,1	809,4
credits	-	-	-
water users' funds	642,2	1570,6	3240,0
2. Mid Naryn Total	307,1	525,9	1000,7
inter-farm systems	140,6	271,4	502,0
on-farm systems	166,5	254,5	498,7
state budget	122,8	157,8	200,1
credits	-	-	-
water users' funds	184,3	368,1	800,6
3. Kampyr-Ravat Total	302,8	703,3	1504,9
inter-farm systems	160,8	461,2	918,0
on-farm systems	142,0	242,1	586,9
state budget	121,1	211,0	300,9
credits	-	-	-
water users' funds	181,7	492,3	1204,0
4. Chatkal, Total	35,3	66,7	138,6
inter-farm systems	15,3	26,5	48,5
on-farm systems	20,0	40,2	90,1
state budget	6,1	11,0	7,7
credits	-	-	-
water users' funds	29,2	55,7	130,9
5. North-Fergana. Total;	1195,9	2447,0	4884,9
inter-farm systems	934,7	2083,6	4269,0
on-farm systems	261,2	363,4	615,9
state budget	478,4	734,0	896,9
credits	-	-	-
water users' funds	715,5	1713,0	3988,0
6. South-Fergana. Total	2420,0	4902,6	13475,1
inter-farm systems	1781,6	4373,5	10210,0
on-farm systems	638,4	529,1	3265,1
state budget	968,0	1470,6	2425,1
credits	-	-	-
water users' funds	1452,0	3432,0	11050,0
7. Alay . Total	114,8	236,8	265,5

inter-farm systems	20,0	54,2	71,8
on-farm systems	94,8	182,6	193,7
state budget	45,9	71,0	79,6
credits	-	-	-
water users' funds	68,9	165,7	185,9
Total in Aral	5447,3	11126,0	25319,1
inter-farm systems	3638,7	8631,6	18701,3
on-farm systems	1808,6	2494,4	6617,8
state budget	2191,3	3329,0	4720,0
credits	-	-	-
water users' funds	3256,0	7797,0	20599,1

6.6 Institutional framework

6.6.1 Description of expected institutional measures and structures to ensure outcomes, envisaged by plans

It is anticipated that institutional reforms in the water sector of the Kyrgyz Republic will take place, as a result of which development, use and water conservation management structure, as well as operation and maintenance of water systems are to be changed. Division of coordination functions of water resource management of the republic and the implementation functions of the management, operation and maintenance of water systems is expected.

- The republican National Water Council is supposed to be created for overall inter-branch and interstate water resources management and coordination of water relation activities of the ministries, departments and other concerned agencies. The Prime-minister or Vice-prime-minister of the Kyrgyz Republic may be the chairman of this Council. The membership of this Council should be defined by the Government. It should include the leaders of Basin Water Councils. The management of national water resources is to be carried out based on hydro-geographic boundaries of water resources of rivers in Kyrgyzstan.
- The Basin Water Councils will be established in every large water basin or group of basins of small rivers for management and coordination of water relation activities of all the interested bodies which carry out their activities on the territory of water basin. According to the decree of the Republican Water Council, The membership of Basin Council will include the representatives of water users through their associations and federations.
- It is supposed to entrust the basic functions on implementation of management, operation and maintenance of state water schemes, water resources and water systems to a special state agency (state water administration) that has the rights of the Ministry. Such a body can be arranged on the basis of Water Resources Department of the Ministry of Agriculture and Water Resources of the republic.
- The State water administration should have the basin water administrations (basin water resources management, BWRM is available), regional water resource management (also available), management of reservoirs, groups of canals, hydrosystems, (available), State water inspection in its structure.
- State Water Inspection.
 The Kyrgyz Government has already taken decision on creation of State water inspection, which should be retained in the future.

- It is supposed that other republican agencies that have relation to water, namely Ministry of Ecology and Emergency with Hydrometereological Service, State Agency on Geology and Mineral Resources will also function in future.
- The process of establishing the Water User Associations with subsequent formation of Water User Federations will be intensified.

The ultimate aim of institutional reforms is a creation of such an institutional system of water resources management and water economy that would enable all departments of the republic, interested in use of water resources to carry out their activity in co-ordinated manner, conserving the environment and fulfilling the requirements on the interstate water relations at the same time.

6.6.2 Description of strategy and policy for execution of these measures

The necessity in elaboration and adoption of Water Cadastre, the draft of which is already under development has matured in the Kyrgyz Republic.

The Water Code will regulate water relations within the state in the sphere of development, use and conservation of water resources for secure provision of population of the Kyrgyz Republic with water, conserving the environment, strengthening the right of physical and legal entities for water and ensuring the development of water sector at the same time.

The basic provisions that are used in preparation of Water Code are as follows:

- ◆ Institutional changes – stated above.
- ◆ Water User Associations (WUA) are created and will be created, mainly, within the boundaries of the former kolkhozes and sovkhozes. The entire irrigation and drainage network, which serves one WUA, is given free of charge into their ownership.
- ◆ Irrigation canals and other water schemes that serve 2 and more WUA, are currently in state ownership, and in perspective their privatization is not envisaged.
- ◆ Operation of state irrigation infrastructure will be carried out by water organizations responsible for operation at the expense of two financing sources – state budget and water user's funds.
- ◆ Demand for operation funds is to be fixed by State Water Administration and Antimonopoly Commission and approved by National Water Council. Total demand for funds should ensure operation of irrigation systems in a designed mode.
- ◆ Possibility of allocation of subsidies to the water users is envisaged in order to help them to pay the water suppliers for the operation of state irrigation systems.

Such a system of paying subsidies is to be carried out, mainly, through taxation system.

- ◆ Water resources use, including the groundwater as well, should be carried out based on licenses for water use from natural water schemes, issued by the State Water Administration.
- ◆ The license should be given for the period of 15 years.
- ◆ Water use should be chargeable. Water agency is obliged to conclude long-term contracts for water delivery (for the term up to 15 years) and annual contract for water delivery with water user associations at their request.

- ◆ It is planned that payment for water resources use will be fixed individually for various categories of users. Such payments can be subdivided based on types of use, territories and water schemes, the used water volume and terms of use. Jogorku Kenesh (Parliament) should take the decision.

The anticipated institutional changes in water sector of Kyrgyzstan, set forth above, must create the basis for improvement of the existing development, use and water conservation management system.

In addition, the conditions will be created that will allow at a regular basis to implement envisaged plans in the sphere of irrigated agriculture, will ensure efficiency of irrigation and drainage systems in a designed mode.

6.7 Political environment and state regulation, the issues on reorganization of agricultural sector

Reorganisation of agricultural sector is based on Land Code of the Kyrgyz Republic, adopted in 1999, with addendum and changes, # 93 of December 28, 2000 and #4 of January 4, 2001).

The Land Code is aimed at creation of land and market relations under conditions of state, public and private land ownership. The main provisions of the Law in part of ownership and rights for land are as follows:

- The State ownership covers the lands given to state land users, lands of forest and water reserves, lands of specially conserved natural territories, stock lands, lands of frontier zones, lands of Funds on re-distribution of agricultural lands, pastures near rural settlements, pastures in zones of intensive use, as well as distant-pastures and other lands, not transferred to private and public ownership.
- Lands within the boundaries of village councils, as well as within the boundaries of urban areas are referred to public ownership lands, with the exception of lands that are in private and state ownership.
- Land is given to citizens of the Kyrgyz Republic free of charge once within the territory of the Kyrgyz Republic: for construction and servicing of dwelling and keeping individual farm, for summer house construction in accordance with fixed norms, as well as to citizens of the Kyrgyz Republic, which have a right for land lot in size, determined by the Government of the Kyrgyz Republic.
- Land owner or land user is entitled to transfer his right for land completely or partially, to other physical or legal entity without any authorization of state agencies.
- When transferring the right for land by landowner or land user to other physical or legal entity, the size of payment for land is fixed by agreement of the parties.

At present, the considerable part of irrigated lands that are in private ownership, belong to rural population, which cultivate their own plots of lands individually, or collectively, united into different communities of land owners. In the future – it is expected that private landowners will unite into groups of various forms for joint agricultural production.

6.8 Water quality standards

To control surface water quality, “Regulations on conservation of surface water of the Kyrgyz Republic” are applied in the territory of the Kyrgyz Republic, which were approved in 1993 by State Commission on environment of the KR and registered by the Ministry of Justice of KR (index 136 of 13/10/1993). The mentioned regulations regulate diversion of all wastewater, including domestic and industrial ones, rainy and melted and other types of wastewater, into watercourses and reservoirs

The regulations also regulate different kinds of economic activities, which have or may have negative influence on condition of surface waters.

The mentioned Regulations are applied to all watercourses and reservoirs of the Kyrgyz Republic, including lakes and reservoirs.

Standardising of water quality in surface reservoirs stipulates fixing of threshold limit values for indicators of its composition and properties, within which the population health, favourable conditions and ecological well-being of water scheme is safely provided.

The “Regulations” fix the water quality standards of reservoirs and watercourses for drinking, domestic and fishing water use, as well as irrigation water quality standards (Appendix 1-4).

The Maximum permissible concentrations (MPC) of substances in water of water schemes are determined based on Sanitary Regulations and Code (Sanitation and Epidemic Inspection #4630-88). State control over compliance with requirements of specified Rules is carried out by agencies of environmental control. Extract from specified Rules, regulating MPC of the main polluting substances that are typical for Kyrgyz Republic is given in Table 17 below.

Table 17

Extract from Maximum permissible concentration (MPC) of substances in water of water schemes of drinking, domestic and fishing water use

Name	TLC, mg/l	
	for reservoirs of drinking and domestic water use	for reservoirs of fish water use
Biochemical oxygen demand	6,0	3,0
Ammonia	2,0	0,05
Vanadium	0,1	0,001
Wolframium	0,05	0,0008
Iron	0,5	0,05
Cadmium	0,001	0,005
Cobalt	0,1	0,01
Manganese	0,1	0,01
Copper	1,0	0,001
Molybdenum	0,25	0,0004
Oil products	0,3	0,05
Nickel	0,1	0,01
Nitrates	10,0	0,02

Nitrites	1,0	10,0
Sulfates	500	100
Chlorides	350	300

6.9 Resume of benefits obtained in accordance with plans

Defining expected benefits from implementation of plans on development of sectors of economy in the Kyrgyz part of the Aral Sea Basin is very difficult as it depends on many factors, often difficult to predict (on development scenarios being implemented, timeliness and values of financing, prices fixed for produced output, etc.).

The expected benefits from implementation of the first development scenario (minimum changes) are the clearest. This scenario envisages keeping economy of the region from its further decline. It is to be implemented without large capital investments, without requirement for additional land and water resources, and mainly, only due to improvement of production organization, improvement of institutional structure of production management, introduction of new technologies, improvement of economic (market) relations between producers and consumers of produced output. Organizational activities are important not only for improvement (putting in order) of production process. But they themselves are the important element in increasing the efficiency, volumes and effectiveness of these productions, and the main thing that they do not require is large financial costs for this. Thus, in agriculture, without large additional funding, only privatisation of land, creation of water user associations, improvement of payment system for water use should ensure considerable increase of efficiency of land and water resources use, increase of crop yield and production volumes of agricultural products, increase of safety and sustainability of irrigation system operation.

The expected efficiency of implementation of the second and third scenarios on development of water using sector of the economy (Kyrgyz part of the Aral Sea Basin) has two outcomes. Benefits from implementation of these scenarios are undoubtedly large. The implementation of these scenarios is essential, otherwise it will be impossible to rehabilitate and increase the living standards of population of the region. The rehabilitation of water infrastructure of the region will enable to increase its capacity up to earlier (1990-1991 period) reached level (second development scenario). Further growth, with development of additional land and water resources (third scenario) will provide (at 2025 level) all population of the region (the number of which grow annually) with required food (according to minimum medical standards), and provide industry with agricultural raw materials. But it will require large investments (see item 6.5 above), economic efficiency of which with the existing prices for manufactured products, will not be high. Apparently, payback period of investments will go beyond the year of 2025.

The calculation of payback of production costs for additional products in the region with its world prices in this case is incorrect, as only part of this product will be sold for the world prices. The major part is sold within the region, where income of population is significantly low than the world ones. Therefore the population won't be able to purchase products for the world prices yet for very long time.