Report on
SPECIAL SESSION ON ARAL SEA BASIN

Varna, Bulgaria
19 May 1994

INTERNATIONAL COMMISSION ON IRRIGATION AND DRAINAGE

ICID·CIID

L to R : Mr. John Hennessy, President Hon., ICID; H.E. A.A. Jalolov, First Deputy Minister, Uzbekistan; Mr. Shahrizaila bin Abdullah, President, ICID; Prof. V. Dukhovny, Head, Information Scientific Centre, ICWC.

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Compiled and prepared by
S.P. Goyal, Deputy Secretary, ICID

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Foreword

The International Commission on Irrigation and Drainage (ICID) is established as a scientific and technical non-governmental organization, dedicated inter alia to improve water and land management to enhance the worldwide supply of food and fibre for all people. It draws together the persons of diverse disciplines and professionals involved in the planning, design, operation and management of irrigation, drainage and flood control works throughout the world. The Commission also provides an international platform for discussions on technical, social, economic, environmental and managerial issues associated with the development of irrigation, drainage and flood control to facilitate the evolution of the right type of solutions and actions.

The problem of management of water and land in the Aral Sea Basin has been a difficult one. A protocol was signed in September 1993 by H.E. Rim A. Giniyatullin, Minister of Melioration and Water Management, Uzbekistan and the then ICID President John Hennessy on the water deficit and consequent environmental degradation problem in Aral Sea Basin. According to the protocol ICID has inter alia agreed to shoulder the following responsibilities :

.forming of common opinion around the problem and publications of principal reviews and report on this problem;

.consideration of the Aral Basin as a pilot world exercise for working out measures for water deficit prevention and for optimal solutions in the context of the intertwined socio-economic and ecological problems of development under the conditions of demographic pressure;

In pursuance of the agreement, a Special Session on Aral Sea Basin was organized by ICID in Varna (Bulgaria) on 19th May 1994 in conjunction with the 45th meeting of its International Executive Council to discuss the problem of Aral Sea Basin. Many experts participated. The present report covers all the presentations made at that session and the outcome of the deliberations that followed.

The United Nations Environment Program, the World Bank, and other governmental and non-governmental national and international organizations and the national governments in the basin are all making efforts to tackle the Aral Sea Region's problems. At its annual Executive Council meeting held at Varna on 22 May 1994 ICID has decided to cooperate with them in their endeavours and also to pursue the different technical and scientific aspects of the problem through its own workbodies.

In this context, it has to be rembered that as a response to Agenda 21 of UNCED in June 1992, ICID has already produced and released in September 1993 an

environmental checklist to help identify the possible issues that ought out to be looked into when irrigation, drainage and flood control projects are undertaken or managed. ICID has also launched water saving program in 1994 for securing savings in the use of water in agriculture, without in any way affecting the productivity or sustainability of agriculture adversely. Further, The Hague ICID Declaration has already announced that ICID will promote internatlional cooperation in the management of international river basins. Any further work on the specific problems of the Aral Sea Basin will therefore be a natural corollary to the various other steps that ICID has already taken.

The role of ICID in regard to the Aral Basin's problem will be unique because of the expertise available in the National Committees of the ICID's member countries. ICID's professionals have encountered some similar problems before elsewhere also, such as the problems of salinity, pollution and shrinking water availability. Providing assistance to the Aral Sea region in its search for a solution will be one of the important activities of ICID in the years to come. ICID have recently appointed a special work team of ICID's expert representatives to pursue the problem further in a scientific and coherent manner under the chairmanship of President Shahrizaila bin Abdullah. ICID would like to facilitate consideration and detailing of the appropriate measures to develop a sustainable arrangement that enhances the lives of those who depend on the waters of Amudarya and Sydarya systems and also those who in some way depend on the Aral Sea also. The release of this report on the Special Session held at Varna is a modest step in that direction.

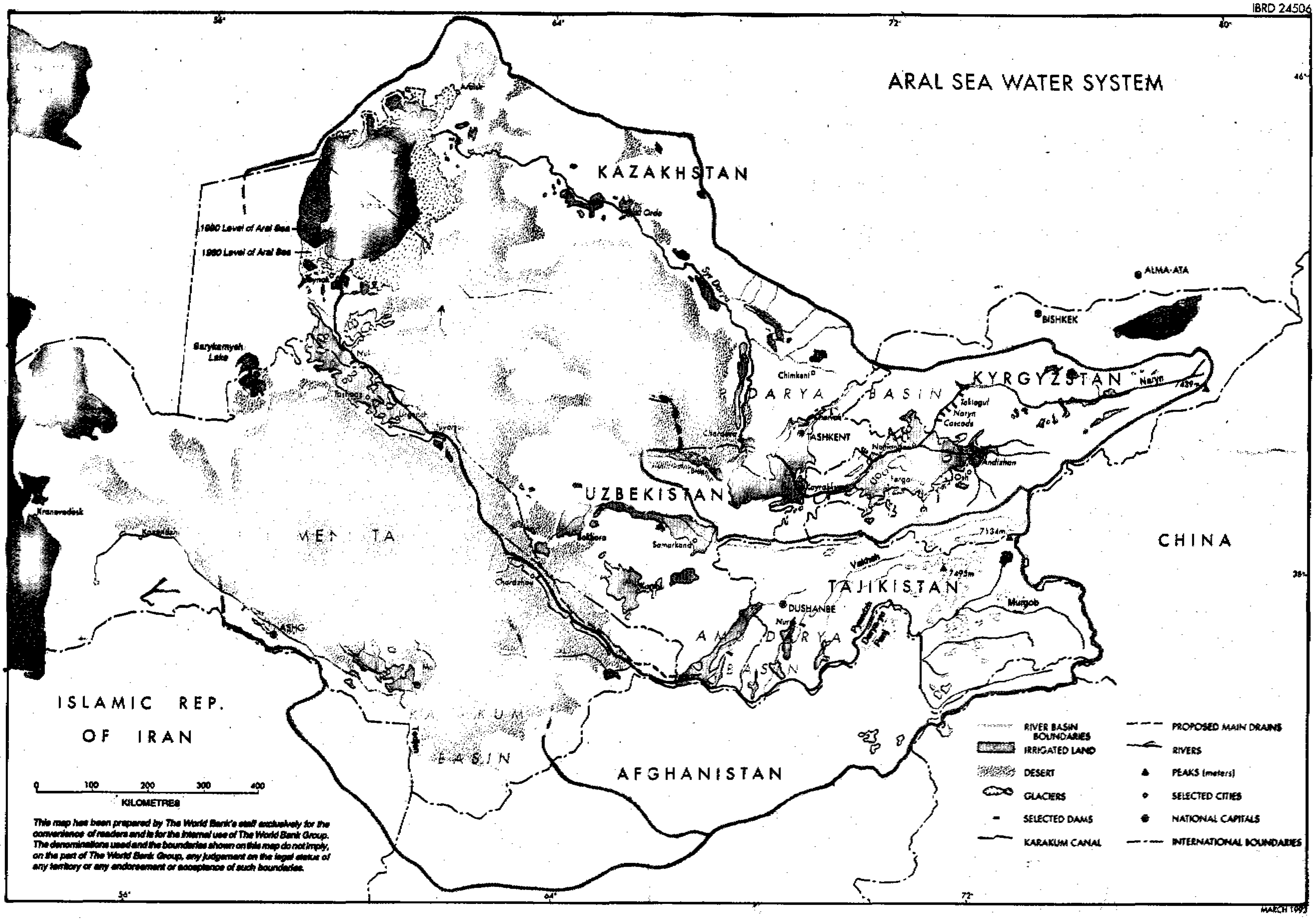
New Delhi
10 June 1994

M.A. Chitale
Secetary General

SPECIAL SESSION ON ARAL SEA BASIN
Varna, Bulgaria, 19 May 1994

Program

09.00 - 10.30	Inaugural Session . Welcome address by President, ICID . Keynote address on 'Prospects and issues in the International Aral Sea Program' by Mr. Guy LeMoigne, Senior Advisor, World Bank. . Presentation on 'The further improvement of water resources control in connection with the problem of Aral Sea and role of International Organizations', by H.E. A.A. Jalolov, First Deputy Minister of Irrigation and Water Economy, Uzbekistan. . Vote of thanks by President, ICID.
10.30 - 11.00	Tea-break
11.00 - 12.30	Technical Session (I) Address and presentation on 'The concept for the solution of Aral Sea problem and measures of the five States for improvement of ecological situation in the basin' by Prof. V. Dukhovny, Interstate Coordinator, Water Commission. Paper on 'Our actions towards the rehabilitation of the Aral Sea', by Dr. Yoshihiro Takano, GIF, Japan.
12.30 - 14.00	Lunch-break
14.00 - 15.00	Technical Session (II) : Open Forum. Discussion on the problem of Aral Sea Basin.
15.00 - 15.30	Concluding Session Presentation of general remarks and conclusions by Dr. I. Ijjas, Chairman of the Review Committee. Concluding remarks by President, ICID.


IBRD 24506
ARAL SEA WATER SYSTEM
KAZAKHSTAN
UZBEKISTAN
KYRGYZSTAN
TAJIKISTAN
CHINA
AFGHANISTAN
ISLAMIC REP. OF IRAN
1960 Level of Aral Sea
1990 Level of Aral Sea
Sarykamysh Lake
ALMA-ATA
BISHKEK
TASHKENT
DUSHANBE
Chimkent
Samarkand
Bukhara
Chardzhou
Andizhan
Naryn
Toktogul
Naryn Cascade
Murgab
Vakhsh
Krasnovodsk
7134m
7495m
DARYA BASIN
AMU DARYA BASIN
KARAKUM BASIN
0 100 200 300 400
KILOMETRES
RIVER BASIN BOUNDARIES
IRRIGATED LAND
DESERT
GLACIERS
SELECTED DAMS
KARAKUM CANAL
PROPOSED MAIN DRAINS
RIVERS
PEAKS (meters)
SELECTED CITIES
NATIONAL CAPITALS
INTERNATIONAL BOUNDARIES
This map has been prepared by The World Bank's staff exclusively for the convenience of readers and is for the internal use of The World Bank Group. The denominations used and the boundaries shown on this map do not imply, on the part of The World Bank Group, any judgement on the legal status of any territory or any endorsement or acceptance of such boundaries.

ARAL SEA BASIN : FACTS AT A GLANCE

The Past

- Aral Sea was the fourth largest inland sea in the world until recent times
- Aral Sea Basin's area (Syrdarya and Amudarya water sheds together) — 690,000 km^2
- Historical volume of Aral Sea — 1000 km^3
- Average water resources of the basin — 120 km^3
- Historically stablised surface area of Aral Sea (Between levels 50.5/53) in 1960 — 66 km^2
- Evaporation from historical Aral Sea — 60 km^3
- Historical level of Aral Sea — 54 m

The Present

- Present level of Aral Sea — 36-37 m
  Currently water flow to Aral Sea — 9 km^3/year
- Exposed salty area after sinking of Aral Sea — 2 million ha
- Mineral content of Aral Sea water — 28/30 gr/litre

The Target

- Targetted water flows to Aral Sea
  by 2000 — 16-18 km^3
  by 2010 — 22-25 km^3
- Targetted savings in use of total Irrigation water — 3km^3
- Irrigation area in Aral Basin — 7.2 million ha
- Irrigation usage in the basin was reduced from 18.3 km^3 in 1980 to 13.7 km^3 by 1992

The Means

- 18 Projects have been identified by common consent.
  For these :
  1. Funds required for completion of feasibility studies — US $ 41 mill.
  2. Investment for the 18 projects — US $ 200 mill.
  3. Cost of capacity building programme — US $ 250 mill.
  4. Foreign Exchange involved — US $ 9 mill.

CHRONOLOGY OF IMPORTANT DEVELOPMENTS

1974	Problems of water resources management in Aral Sea Basin attracted attention
1986	Aral Sea and Aral Coast were recognised as direct water consumers and progressive increase of water supply to them was planned
1991	New independent Republics came into being in the Aral Basin
October 1991	1st GIF international conference in Attanta USA : It decided to give the highest priority to Aral problems
February 1992	A water agreement was signed between the Aral Basin States
July 1992	The Aral Basin States by a resolution agreed on joint measure for solutions of the problems of the Aral Sea and the Aral Sea region. Interstate coordination water economic commission (ICWC) was established
July 1992	Report by international experts appointed by UNEP was issued under the title 'Diagnostic study for the development of an action plan for the Aral Sea'
Aug/Sept. 1992	UNEP organised a meeting of experts at Geneva
September 1992	A joint mission of World Bank, UNDP and UNEP visited Aral Sea Region
March 1993	Inter-State Council on Aral Basin was established by a joint agreement of the Heads of States of the five basin countries. International Aral Salvation Fund was established
April 1993	Conference at Washington attended by Donors and concerned organizations
May 1993	Joint mission by World Bank, UNDP, UNEP developed a "needs list"
Sept. 1993	Uzbekistan Minister made a presentation on Aral Basins problems at the World Congress on Irrigation and Drainage at The Hague, The Netherlands
16 Sept. 1993	Protocol signed between President ICID and Minister, Uzbekistan
11 January 1994	Heads of five basin states met at Nukus - Uzbekistan and approved a programme of actions
Feb/March 1994	World Bank's mission visited Aral Sea region for developing an Aral Sea programme
19 May 1994	A special session on Aral Sea organised in conjunction with the annual meeting of the International Executive Council of ICID

SUGGESTED REMEDIAL MEASURES IN WATER AND LAND MANAGEMENT
(Target figures are for year 2000)

1. Introduction of drip and underground irrigation - on 2 million ha.
2. Promoting crop growing in green houses
3. Use of polyethylene film lining for mulching
4. Development of irrigated pastures in delta areas
5. Diversion of all city /industrial drains to separate local evaporation basins
6. Recycling of water used in industries
7. Reduction in irrigation area by change of cropping and improved agronomy
8. Improved drainage system
9. Reuse of drainage water 1 million ha
10. Development of shallow lakes (55,000-60,000 ha x 3 m deep) in /around delta region for fisheries
11. Development of well-defined polder areas by constructing polder dams strengthened by rows of plantings
12. Automatisation of river regulation
13. Introduction of enhanced water fees to reflect the value of water and reduce wastage

SEVEN MAIN PROGRAMMES

(Contained in the plan of action approved by the Heads of five Aral Basin States)
11 January 1994

All costs in US $

Sl. No.	Programmes	Preparation Phase cost	Final Program cost
1.	Preparing a general strategy of water usages and protection of water resources in the Aral Sea Basin	375,000	5 million
2.	To prepare and introduce a unified system of water availability and consumption measurement for the individual countries as well as a regional system of environmental monitoring	2.5 million	30 million
3.	To work out principles of improving the water quality and limiting pollution	415,000	15 million
4.	The preparation of projects and creation of artificial landscape ecosystems in the deltas of the Amudarya and Syrdarya Rivers and on the exposed Aral Sea bed	1.7 million	100 million
5.	Preparation and implementation of intergovernmental plan on clean water and health	8.25 million	More than 100 million
6.	Integrated land and water management in upper watershed	200,000	2 million
7.	Creation of automatic control system for water management of Syrdarya and Amudarya Rivers	4 million	183 million

REPORT

1. Introduction

1.1 The Problem

As a result of the large scale irrigation for farm lands (covering 7.2 million ha) introduced in the basin by drawing water from the Amudarya and Syrdarya rivers that both drain into the Aral Sea, the Aral Sea started shrinking in the 1970s. Salinity of Aral Sea rose. Eco-system around the lake and in the deltas was seriously affected. The occurrence of illness among the local residents rose because of the rising of the salt and dust particles.

It has been estimated that if no remedial measures are taken in both the Amudarya and Syrdarya basins, down stream areas would face further serious water shortages and continued degradation in the coming decades. The annual flow entering the Aral Sea from two rivers is projected to average 3.5 km^3 from 1990 to 2000, 3.0 km^3 from 2000 to 2010, and 2.5 km^3 from 2010 to 2020, with a continuing downward trend. The Aral Sea's surface area would decrease from the 1987 level of 41 km^2 to 9.5 km^2 in 2015 with further drop in its water level to 27 meters as shown in the Figure 1.*

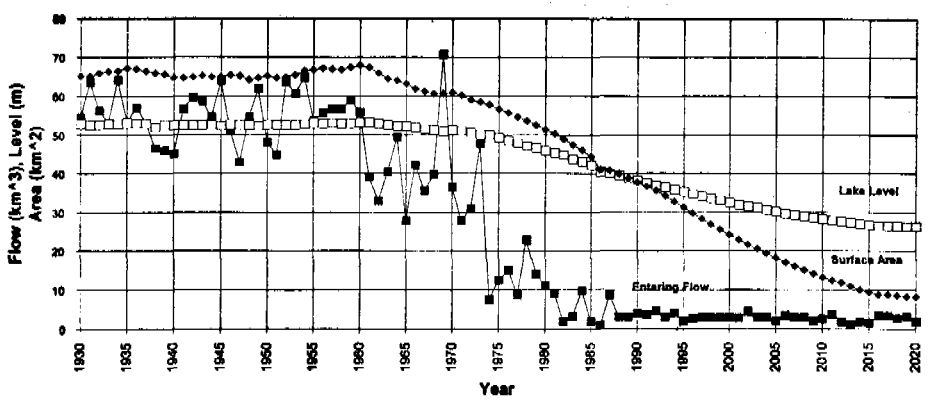


Figure 1. Aral Sea Projection, 1930-2020 (business-as-usual case)

1.2 Basin States Cooperation

The states lying in the Aral Sea Basin and dependent on the waters of Amudarya and Syrdarya and their tributaries are Kazakhstan, Tajikistan, Turkmenistan, Kyrghyzstan and Uzbekistan.

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* Source: Paper "Integrated water planning: The case of the Aral Sea", by Dr. Zhongping ZHU, presented at the Seminar on the Aral Crisis on Friday, 10 December 1993, at UNU Headquarters, Tokyo.

These five states have realized that many of the Aral Sea problems are too formidable to be addressed unilaterally by any state. They have signed a water agreement in February 1992 and in a further resolution of July 1992 they have also agreed on joint measures for the solution of the problems of Aral Sea and Aral Sea region.

1.3 Objectives

The main objectives of the solution of the problems of Aral Sea and Aral Sea region are:

- Reduction in the negative consequences of water usage.
- Forming a congenial and economically stable profile of the land water system.
- Establishing sustainable utilization levels of water and land resources of the basin.

1.4 Efforts made so far

Recognizing the crucial need to save Aral Sea and provide an overall perspective to the problem, UNEP appointed a group of experts to prepare a study of the region. The report of the group was issued in July 1992. In September 1992, a joint mission of the World Bank, UNDP and UNEP visited the Aral Sea Region and made several proposals for action for stabilizing the Aral Sea.

In March 1993 the Heads of States of the five basin countries confirmed their commitment to cooperate and create the institutional framework to take action. In April 1993 a conference of concerned organizations and donors was held in Washington which endorsed the approach developed by the joint mission and the Heads of States. A second joint mission in May 1993 developed a "need list".

In January 1994 the Heads of States of the five basin countries met at Nukus, Uzbekistan, and approved a programme of action.

2. Role of ICID

ICID has been keeping track of the problems of water management in the Aral Sea Basin. H.E. Rim A. Giniyatullin, Minister of Melioration and Water Management, Uzbekistan was good enough to participate in the World Irrigation Congress on Irrigation and Drainage organized at The Hague by ICID in September 1993 and made a presentation on Aral Sea problem before the international experts gathered at the Congress. On his request the then President Hennessy visited Uzbekistan immediately after the Congress and

acquainted himself with the activities of the Ministry of Land Reclamation and Water Management of Uzbekistan Interstate Coordination Water Commission (ICWC), SPA SANIIRI and BWO Syrdarya. At the conclusion of his visit, a protocol (given in appendix 1 at page 37) was signed in September 1993 by H.E. Rim A. Giniyatullin, Minister of Melioration and Water Management, Uzbekistan and the then ICID President John Hennessy on the water deficit and consequent environmental degradation problem in Aral Sea Basin, for initiating appropriative collaborative actions by ICID and the Aral Basin countries.

Lately, ICID has been pursuing the Aral Sea Basin countries to become members of ICID so that ICID's experts and ICID's international platform can be fully utilized for the resolution of the problem. Uzbekistan applied for the membership in February 1994 and has been admitted as a member at the ICID Executive Council's Meeting at Varna, Bulgaria, in May 1994.

2.1 Glimpse of Special Session

In pursuance of the protocol, a Special Session on Aral Sea Basin was organized in Varna, Bulgaria, on 19 May 1994 during the 45th meeting of the International Executive Council of ICID to discuss the problems of Aral Sea Basin. Mr. Shahrizaila bin Abdullah, President, ICID opened the inaugural session and delivered the welcome address. The President introduced to the audience the Review Committee, established by the ICID for this special session -- Dr. Istvan Ijjas as the Chairman of the Committee and Mr. Aly M. Shady and Mr. S.P. Goyal as members.

Mr. Guy LeMoigne, Senior Advisor, World Bank, delivered a keynote address on "Prospects and issues in the international Aral Sea program". H.E. Jalolov, Deputy Minister for Land Reclamation and Water Management, Uzbekistan presented a paper on "The future improvement of water resources control in connection with the problems of the Aral Sea and the role of international organizations". It was followed by a presentation from Prof. V. Dukhovny, Interstate Coordinator, Water Commission on "The concept for the solution of Aral Sea problem and the measures of five states for improvement of ecological situation in the Basin". A presentation was also made by Dr. Takano, Global Infrastructure Fund, Research Foundation, Japan, on "Our actions towards the rehabilitation of the Aral Sea".

Open forum discussion on the problems of Aral Sea Basin followed thereafter. In the discussion, many senior experts on irrigation and drainage from the ICID's participating countries including the Deputy Minister of Russia took active part, sought additional clarifications and made their comments and suggestions also. Deputy Minister of Uzbekistan replied to the questions raised by the audience and clarified that the operation of reservoirs in cascades in the Syrdarya and Amudarya basins require a comprehensive optimization approach based on

proper understanding of the requirements of irrigation and the production of hydro power. He further added that improving the efficiency in the operation of the reservoirs would have to be one of the important objectives for the management of the Amudarya and Syrdarya basins. In addition, rehabilitation of the canal systems and their automatization would be necessary to improve the technical status of irrigation water management infrastructure so as to meet with the operational requirements of a more demanding situation.

In these discussions that followed the main presentation, an apprehension was expressed whether savings in the use of water effected in the Aral Sea Basin would at all be finally available for recharge of the Aral Sea. The basin states under the pressure of growing population might tend to divert the savings to expand irrigation. It was therefore suggested that appropriate preventive measures against such a possibility would have to be included in the programme strategy.

The session was also informed that the representatives of the Russian Federation take part in the work of the five Basin states' Inter-State Water Commission on Aral Sea Basin and that Russia also provides technical assistance for the solution of the Aral Sea problem under a special agreement with the Inter-State Water Commission.

From the discussions it also emerged that the International Program for Technology Research in Irrigation and Drainage (IPTRID), a joint effort of the World Bank, UNDP and ICID might be able to contribute to the studies in the Aral Sea Basin particularly on the salinity issue. When the details of IPTRID's further phases of work are drawn up the requirements of the Aral Sea Basin will have to be kept in view.

2.2 The Participants

The session had the benefit of participation by H.E. Jalolov, First Deputy Minister of Irrigation and Water Economy, Uzbekistan; H.E. Alexander Kolganov, Deputy Irrigation Minister, Russia; Mr. Guy LeMoigne, Senior Advisor, World Bank; Prof. V. Dukhovny, Head of the Information Scientific Centre of ICWC (Established at SANIIRI); and Dr. Takano of GIF.

The participants also included ICID's present and past Office Bearers - President Mr. Shahrizaila bin Abdullah; Presidents Hon. Mr. W.R. Rangeley (Great Britain), Dr. M.E. Jensen (USA), Mr. John Hennessy (Great Britain); current Vice Presidents Mr. Marcel Bitoun (USA), Dr. Safwat Abdel-Dayem (Egypt), Prof. C. Fasso (Italy), Dr. B. Maticic (Slovenia), Mr. Henri Tardieu (France); and Vice Presidents Hon. Dr. H.M. Hill (Canada), Mr. Aly M. Shady (Canada), Dr. M. Abu-Zeid (Egypt), Dr. I. Ijjas (Hungary), Dr. M.S. Reddy

(India), Prof. P.L. Romita (Italy), Dr. M.G. Bos (Netherlands), Dr. Bart Schultz (Netherlands), Dr. M. Nakahara (Japan), Mr. C.I. Barrett (USA); Chairmen/ Members of ICID Committees/Working Groups like Dr. K. Sanmuganathan (Great Britain), Dr. W.O. Deason (USA), Dr. D. Zimmer (France), Dr. W. Dirksen (Germany), Dr. C. Madramootoo (Canada), Mr. C.E. Lovegrove (Canada), Mr. J. Cothenet (France), Mr. J. Goussard (France), Mr. W.P. Field (Great Britain), Mr. F. Ligetvari (Hungary), Mr. B.N. Navalawala (India), Dr. M.A. Chitale, Secretary General and Mr. S.P. Goyal, Deputy Secretary (ICID). IIMI was represented at the session by Mr. Khalid Mohtadullah, Deputy Director General.

2.3 Summary of Papers Presented

(i) 'Prospects and Issues in the International Aral Sea Program' - keynote address by Mr. Guy LeMoigne, Senior Advisor, World Bank

After giving a background of the efforts made in the past, and about the role of the World Bank in developing an international program for the Aral Sea, Mr. Guy LeMoigne highlighted in his keynote address major issues in the Aral Sea Program. He also indicated the role that the professional associations such as ICID would have to play in the solution of the Aral problem. In the end he stressed that the enormous challenges of the Aral Sea would only be met with inspired and energetic leadership from individuals in the basin states and with the continuing cooperation of the states themselves. The international community must also continue to unite and cooperate to preserve and improve this great resource.

(ii) 'The Further Improvement of Water Resources Control in Connection with the Problem of Aral Sea and Role of International Organizations', by H.E. A.A. Jalolov, First Deputy Minister of Irrigation and Water Economy, Uzbekistan

In his presentation on "The further improvement of water resources control in connection with the problem of Aral Sea and role of International Organizations", H.E. Jalolov, First Deputy Minister of Irrigation and Water Economy, Uzbekistan stressed the point that inspite of acquisition of sovereignty by the Central Asian states, it was necessary for all of them together to bear in mind that the people living in the Central Asia as a historical community had equal rights and responsibility for the guarantee of rational use and protection of water resources. He particularly laid emphasis on preparing the water consumers, i.e. the peasants/farmers to adopt the latest irrigation techniques to conserve water and thereby reduce wastages. Adoption of automatized control for the water resources in the basin was also suggested by him.

(iii) 'The Concept for the Solution of Aral Sea Problem and Measures of the Five States for Improvement of Ecological Situation in the Basin' by Prof. Viktor Dukhovny of SANIIRI

Prof. Dukhovny described the goals which were crucial in the framework of the concept for solution of Aral Sea problem keeping in view the framework as confirmed on 11 January 1994 at the Nukus Conference by the Heads of five central Asian states. These goals comprise improvement of Aral Sea environment accompanied by the creation of opportunities for socio-economic progress of all the five states, formation of new ecologically stable profile of changed system of water-land protected landscape in the drying bed of Aral Sea, enforcement of measures for reduction of negative consequences of water uses. The requirements regarding enhancement of the quality of water in the rivers Syr and Amu and for the groundwater were also highlighted by him in the context of the general strategy of water use and protection of water resources in the Aral Basin.

(iv) 'Our Actions Towards the Rehabilitation of the Aral Sea', by Dr. Takano of GIF, Japan

Dr. Takano brought home the point that the cause of Aral Sea crisis was apparent and its countermeasures were technically attainable. We should not therefore fail to solve the environmental crisis of Aral Sea and we must solve the crisis in its universal context to alleviate the sufferings of the human beings. He expressed the determination of GIF to dedicate efforts and to contribute further towards the environmental rehabilitation of the Aral Sea in cooperation with the global community of researchers and organizations both in Japan and abroad.

2.4 Appointment of a Special Team on Aral Sea Basin and Its Terms of Reference

The outcome of the session was reported at the meeting of the Permanent Committee on Technical Activities and in turn at the meeting of International Executive Council of ICID on 22 May 1994. The Council empowered the President to appoint a Special Team on Aral Sea Basin and take further suitable measures to pursue the resolution of the problem.

The Special Work Team has since been appointed by the President, ICID. It comprises :

1.	Mr. Shahrizaila bin Abdullah (President, ICID)	Malaysia	Chairman
2.	Mr. John Hennessy (President Hon., ICID)	UK	Member (Alternate Chairman)
3.	Dr. Safwat Abdel-Dayem	Egypt	Member
4.	Mr. Jean Cothenet	France	Member

5.	Dr. Wayne O. Deason	USA	Member
6.	Mr. R. Nakamura	Japan	Member
7.	Representative of The World Bank (To be nominated by The World Bank)		Member
8.	Prof. V. Dukhovny	Uzbekistan	Member
9.	Dr. M.A. Chitale	Secretary General, ICID	Member - Secretary

Terms of reference of this team will be :

(a) To assist in organizing and establishing broad based National Committees of ICID in each of the Aral Basin countries.

(b) To obtain and disseminate information on relevant irrigation and drainage problems of the Aral Basin.

(c) To identify areas in other ICID participating countries where similar problems have been dealt with and to obtain and disseminate the relevant information thereof in the Aral Basin countries.

(d) To identify important issues for ICID's detailed consideration within its technical activities structure.

(e) To organize discussions at the international level and at the national level in Aral Basin countries on scientific and technical issues related to irrigation and drainage systems in the Aral Sea Basin.

(f) To promote liaison amongst international bodies on the issues associated with Aral Sea and cooperate with international organizations/agencies in the related activities.

The Special Work Team will soon start working on its mandate.

2.5 ICID's Action Plan on Aral Sea Basin

In this context, some of the immediate activities of ICID kept in view are :

(i) Develop a bibliography of the published articles, reviews and reports on the issues associated with Aral Basin,

(ii) Collect reports prepared by GIF/WB/other international agencies for ICID's central library,

(iii) Develop proposals for setting up of National Institutes in Water and

Land Management, in the Basin countries. They can strengthen field programmes of research that may be developed by SANIIRI,

(iv) Organize through IPTRID, activities/technology research on the critical technical issues faced by the different areas in the basin,

(v) Make available to the National Committees to be established in the Aral Basin countries, model write-ups on the constitution and functioning of the well-organized National Committees existing in other participating countries of ICID, and

(vi) Organize technical workshops on the Aral Sea problem - one in 1994 and two in 1995 in the basin countries.

3. Conclusion

One of the principal objectives of ICID's work will be to assist basin countries in institutional and capacity building efforts towards sustainable water and land management.

Through National Committees of the Aral Sea Basin countries and through ICWC -- ICID will make efforts to evolve a consensus on the way the issues associated with improvements in water and land management in the Aral Basin can be resolved. ICID will also strive to develop a common opinion and approach worldwide on these issues by collaborating with the international bodies active on this problem.

General remarks and conclusions prepared by the Review Committee under the Chairmanship of Dr. Istvan Ijjas as circulated to Permanent Committee on Technical Activities and to International Executive Council are given in appendix 2 page 39.

PRESENTED PAPERS

Prospects and Issues in the International Aral Sea Program

*Keynote Address by Guy LeMoigne**

I would like to begin by thanking Secretary General Chitale and the ICID for inviting me to speak at this special session. In light of the speeches and detailed presentations to come from His Excellency Minister Ilamanov of Turkmenistan and the distinguished representatives of the Aral Sea basin states of Uzbekistan, Tajikistan, Kirgiztan, and Kazakhstan, my task is a daunting one. It is perhaps a bit like trying to describe the menu when the diners are anxious for the food. Yet my institution, the World Bank, has played a substantial role in developing the international program for the Aral Sea, and I would like to discuss the prospects and major issues in the Aral Sea program as I see them. I would also like to touch on the challenges that the Aral Sea presents to irrigation and drainage professionals and to organizations such as the ICID. In speaking on the Aral Sea program, I am indebted to my colleague Mr. Michael Rantham, who led the World Bank's most recent mission on the Aral Sea in February and March of this year, a mission in which I took part. The views I am about to express, however, do not necessarily reflect the World Bank policy.

The dimensions of the environmental and social conditions of the Aral Sea have been and will be well described elsewhere. The Vice-President of the United States, Mr. Al Gore, began his book on the global environment with a description of standing on the deck of a fishing ship capable of processing a fifty-ton catch of fish in the Aral Sea in 1990. Only the ship-and the rest of its fleet-were anchored in a desert of sand dunes.[1] Most of you are already aware of the problems as evidenced by your attendance here at this ICID special session. Serious international efforts are underway to do something to save the Aral Sea. By saving it, I think we no longer mean that it can restored, at least in the short run, to its former healthy condition. But it may be possible to stabilize the level of the Sea at some sustainable level, or to halt further damage. It may be also possible to improve the ecological condition of the lower sea level, and to improve conditions for people who live around what was formerly the fourth-largest island sea in the world.

The five states in the Aral Sea basin have considerable economic potential. They are endowed with huge water and land resources, extensive irrigation systems, high reserves of oil, coal, and gas, a large hydropower base, and a large labor force. Despite this large endowment, most of the states have

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* Senior Advisor on Water Resources in the World Bank's Department of Agriculture and Natural Resources, Washington, D.C.

1. Gore, Al. 1993, Earth in the Balance, New York : Houghton Mifflin. p.19

declining agricultural outputs, substantial unemployment or underemployment, and an increasing degree of health hazards. Many of these problems are the results of decisions made or actions taken when they were part of the former Soviet Union, and in this sense they are inherited problems. These five states have realized that many of the problems are too formidable to be addressed unilaterally by any state; the cooperative effort of all states is required to solve major problems, and the Aral Sea program is an outstanding example of the states' desire to cooperate on water resources. These resources are perhaps the most important element in their individual and joint economic development. Before outlining the Aral Sea program and discussing its prospects and major issues, I would like to briefly discuss the major developments in the last several years regarding the program.

Background of Aral Sea Program

The first signs of the approaching Aral Sea crisis were evident in the sw, and numerous reports and articles on this crisis were written by experts, both national and international in the following years. Rapid desiccation of the sea led to several reports and decrees by the government of the former Soviet Union between 1989 and 1991. The breakup of the Soviet Union in late 1991 left the newly independent Republics to address the crisis on their own. Signing a water agreement in February 1992 was a significant achievement in light of the political difficulties these states faced. In a resolution of July 1992, the states agreed on joint measures for solutions of the problems of the Aral Sea and the Aral Sea region.

As I mentioned, many international experts and organizations have been working on the Aral Sea crisis for some time. The United Nations Environment Program, recognizing the crucial need to save the Aral Sea and provide an overall perspective on the problems, appointed a group of international experts to prepare a study of the region. The report of this group, entitled "Diagnostic Study for the Development of an action Plan for the Aral Sea" was issued in July 1992. Although the report did not recommend a specific action plan, it provided a sound basis for elaboration and analysis of the strategies and action plans of addressing the crisis. In August and September of 1992, the United Nations Environment Program hosted a meeting of in Geneva that was attended by a host of experts from many countries and organizations.

In September 1992, a joint mission of the World Bank, the United Nations Development Program, and the United Nations Environment Program visited the Aral sea region. This mission made several proposals for action and worked with the countries to develop a general framework of activities to

- Stabilize the Aral Sea levels in a sustainable range,

- Rehabilitate and develop the Aral Sea disaster zone, and

- Engage in strategic planning and comprehensive development and management of the water resources of the Aral Sea Basin.

Perhaps the next major milestone was in March 1993, when the heads of state of the five basin countries confirmed their commitment to cooperate and, most importantly, created the institutional framework to take action. In April 1993, a conference of concerned organizations and donors held in Washington D.C., endorsed the general approach developed by the joint mission and the heads of state, and a second joint mission in May of 1993 developed a "needs list." From that list came the program developed by institutions set up by the heads of state and endorsed by them.

The institutional framework is important because the Aral Sea program is something that is being - and must be - developed by all the basin states. I will not discuss at length the institutional structures since according to the tentative program I received, this will be the province of His Excellency Minister Ilamanov. It is necessary, however, to mention the three main institutions that will probably be responsible for implementing the Aral Sea Program. These are :

- The Interstate Council for Addressing the Aral Sea, the main coordinating body,

- The Executive Committee of the Interstate Council, responsible for formulating and implementing policies and programs, and

- The International Fund for the Aral Sea, responsible for coordination, procurement and funding.

This year has so far seen a great deal of progress. The heads of state of the five basin countries met at Nukus, Uzbekistan, in January 1994 and approved a program of actions. The Interstate Council asked the World Bank to take concrete actions on the programs, and the Council identified the organizations that would deal with the most recent Bank-led mission on the approved programs in February and March of this year. Unfortunately our United Nations colleagues could not join us on the mission. The approved by the heads of state are considered part of a phase 1, with a second phase of programs that is to address medium- to long-term issues. Phase 1 is meant to address the pressing immediate needs of the area.

Aral Sea Program - Phase 1

The first of the eight approved programs involves preparing a general strategy of water distribution, rational water use, and protection of water resources in the

Aral Sea basin, and on the basis of this strategy preparing draft intergovernmental legal and normative acts. Preparing and introducing quotas was deemed by the heads of state to be a part of this program.

Second, the heads of state approved a program to prepare and introduce a unified system of water availability and consumption measurement for the individual countries as well as a regional system of environmental monitoring. This covers creating databases and providing the relevant meteorological services wit equipment and special devices.

The third program is to work principles of improving the water quality and limiting pollution. The program calls for taking measures aimed at reducing and stopping the discharge of polluted and mineralized water into the Amu and Syr Rivers, completing and building new facilities for holding and cleaning water, and taking measures to increase the water flow in the Syr River in order to provide an adequate amount of water into the Aral Sea. It also calls for taking appropriate measures to restore and preserve the Smaller Sea.

The deltas of the Amu and Syr rivers and the exposed seabed are the focus of the fourth program. Trying to restore the original environmental situation in those deltas is the very challenging task of this program, which calls for research and development of options to create artificially watered landscape ecosystems and to undertake the necessary melioration to those deltas and the exposed seabed.

Fifth, a program to prepare and implement intergovernmental programs on clean water and health was approved. The scope of this program is to supply the population affected by Aral Sea developments with good-quality drinking water and to improve the sanitary and epidemiological situation.

The sixth program basically calls for the basic research and actions required to effective watershed management for the Aral Sea region.

The seventh program is to provide the Amu and Syr River basin authorities with necessary technological equipment and to create information and forecasting centers there.

An eighth program approved by the heads of state concerned diversion of waters from arctic rivers and other sources to the Aral Sea region. This was not addressed by the World Bank mission in February and March. However, the issue of capacity-building for regional institutions was addressed. This involves providing assistance to those institutions for planning, preparing, and implementing the overall programs approved by the heads of state.

I am pleased to be able to report that the Executive Committee working with the

mission was able to identify eighteen specific projects plus the capacity-building program that accord with the approved programs. Now even more challenging work is before the international community; agreeing upon, coordinating, and of course very importantly funding or making contributions to the projects. Before I go on to the prospects of the program, I would like to mention that the World Bank mission had a meeting in Tashkent the representatives of 12 non-government organizations. Each representative presented his opinion on the major causes of the Aral Sea crisis and suggested measures to address them. Although there were considerable differences in their views, the main emphasis was on the urgent need to improve water supply, sanitation, and public health conditions and on reducing the effects of salinization and agro-chemicals. Restoration of the Aral Sea is not considered possible by most NGOs, but stabilization of its level was suggested by some.

Program Strengths

As it stands now, the Aral Sea program with attendant projects has major inherent strengths that are not usually found in international programs of this kind. The strengths provide favorable opportunities and good prospects for achieving the program objectives and ensuring its success. Let me review these :

- The program is consistent with and supportive of the objectives of agreements, resolutions, and protocols that have been concluded or issued by the governments of the basin states and related agencies. Indeed, these documents laid the foundation for the program.

- The projects included in the program have been prepared by teams of the Executive Council and approved by the Council. The "ownership" of this program by the basin states and their created institutions is a key feature that should help to ensure further effective action.

- The assistance rendered to the Executive Council teams in selecting projects, preparing project briefs, terms of reference, cost estimates, implementation schedules and other details was useful in enhancing the quality of the teams' product. The assistance helped to provide an acceptable basis for carrying out feasibility studies.

- The priority of selected projects is assured by the fact that they are consistent with the priorities and program framework endorsed by the Republics, the donors, the international agencies and the Bank at the international seminar organized jointly by the Bank, the United Nations Environment Program, and the United Nations Development Program in April 1993 to address the Aral Sea crisis.

- The Aral Sea crisis has attracted world attention. The urgency of rehabilitating the environment and ameliorating the hardships of the people living in the disaster zone is recognized by the basin states as well as by external agencies. International agencies and donor countries have expressed keen interest in supporting the cooperative efforts of the countries concerned to address the crisis.

- Despite their differences on other matters, the basin countries have demonstrated their commitments to cooperate on the Aral Sea Program. While their decision-making process has perhaps been slow, their decisions on policies, programs, and institutions has been sound. The prospects for continuing cooperation are good and the sustainability of cooperative efforts is reinforced by the fact that economic development of the individual stated is inexorably depended on addressing the Aral Sea crisis.

- The basin countries have responded positively so far to international recommendations and advice. The prospect of maintaining productive relationships between the countries and international institutions for addressing the challenges of the Aral Sea crisis are good.

Program Issues

Despite these considerable strengths, the Aral Sea program is large, complex, multi-sectoral, multi-country, and long-term. It involves redressing decades of *mismanagement of water resources and destruction of the environment.* While the program's policies, concepts, priority projects and institutional structures are good in theory, their implementation in practice will be difficult. Aside from any matters related to the projects or to technical questions, the main problems now are the program size, institutional issues, local expertise, and issues of technical assistance and capacity-building.

A year ago the cost of the Aral Sea program in terms of grant financing was estimated at $ 50 million in order to meet urgent needs and prepare projects for a second of the program that is envisaged. Today, the scope of the programs defined by the heads of state is larger and includes 18 projects plus a capacity-building program identified by the Executive Council.

I assure you that these projects are in no way a "wish list" but are needed to implement the program. The total requirement for completion of feasibility studies is estimated to be about US$41 million. The probable investment requirements will be about $200 million. Finally, the capacity-building program would require about US$9 million of foreign exchange, for a total program size currently estimated at about US$250 million. Financing these needs is going to be a tremendous challenge. I hasten to point out, however, that not financing them will have enormous implications for the economic development of these

countries and of the region, to say nothing of he conditions of people who are living with the consequences of a dying resource. competing feasibility studies is the most urgent current requirement.

There are a number of institutional issues, and I must defer to other speakers on many of these. Supplying funds to the International Fund for the Aral Sea is one of these, and institutional arrangements concerning the Executive Council provide another set of issues. It is clear that there needs to be a formal definition of the role of the International Fund for the Aral Sea in terms of project formulation, implementation, and procurement. Other issues will, I hope, be resolved to the satisfaction of the states and the international organizations involved.

The water resources professionals in the region developed and managed huge sophisticated irrigation and drainage schemes that have been responsible for much productive agriculture. The multi-sectoral nature of the task before the Aral Sea states, however, would raise difficulties and questions of expertise in many other regions. The Aral Sea Program requires skills such as strategic planning, economic analysis, water quality management, engineering, project analysis, environmental assessment — the list goes on. Moreover, these skills must be developed and imparted in order for the countries and regional institutions to both "own" the program and to be able to manage developments long into the future. The issue of local expertise is intimately tied to that of capacity-building, one of the most important issues in water resources development - as well as in economic development in general.

Capacity-building assistance does not merely involve provision of experts, hardware, and training. It requires developing the institutions, enhancing their values and commitment for quality, improving their practices and increasing their accountability for the results. Above all I would emphasize that it is crucial that the basin states and their Aral Sea regional institutions — including the river basin organizations — continue to develop programs and manage the necessary projects themselves. Assistance from other countries, international organizations and professional societies may be offered in the short- to medium-term, butt in the long run no measures will be effective without adequate local skills, capabilities, and institutions.

It is in the last of these two areas — expertise and capacity-building — that professional associations such as the ICID have a large role to play.

The Role of Professional Associations and Challenges to Irrigation and Drainage Professionals

In preparing this meeting, Secretary 65General Chitale expressed his hope that the interaction between irrigation and drainage experts and the representatives

of the Aral Sea Basin countries may help in the search for a proper course of action in the basin. There is of course a great deal that the ICID can do to assist in the challenges that lie ahead, and I suggest that the wealth of expertise in this organization is the key to this assistance.

The countries of the Aral Sea basin and the new regional organizations will face many technical challenges that are unprecedented in their size and scope, but not, perhaps unprecedented in their nature. By this I mean that among the ICID's membership are professionals who have encountered the problems of salinity, waterlogging, pollution, in short most the problems associated with the Aral Sea crisis. Providing technical support to local professionals in that area could be an important role for the organization. In particular, there are several projects in the approved program where ICID could be of enormous help in preparing the feasibility studies. I will leave detailed discussion of this to the future.

The cross-sectoral nature of the problems faced in the Aral Sea region emphasizes once again the need for irrigation and drainage professionals to reach beyond their current areas of expertise to other areas, especially those related to environment and to environmental sustainability. Environmental issues are certainly not unique to this region — they exist in every country, in all environments that involve water, which is to say every environment. The world has, out of necessity, for some time been undergoing a major shift in the water resources paradigm, away from regarding uses of water as unique too seeing them as integrated. Part of this is viewing the environment as a use of water. I urge professionals to take advantage of the opportunities and challenges we face to expand their understanding and expertise.

The enormous challenges of the Aral Sea will only be met with inspired and energetic leadership from individuals in the basin states and with the continuing cooperation of the states themselves. The international community must also continue to unite and cooperate to preserve and improve this great resource. We must continue to commend and support the states of the region in their efforts to take action to restore the resource and enhance the lives of those who in some way depend on the Aral Sea.

Thank you.

The Further Improvement of Water Resources Control in Connection With the Problem of Aral Sea and the Role of International Organizations

*Jalolov A.A.,**

'Water is life' says the proverb, which all people of Central Asia know. Really, where there is water there is life; there where water is finished life is finished. Water for the inhabitants of the Central Asia is not only a natural resource but a means of inhabitation. In thousand sharjate was written : 'If the owner of water will want to prohibit somebody from water use and the needy of water is afraid of himself or of his cattle, then he has the right to struggle with the owner of water with arm as the refusing of water dooms him to death' (see Fatkh-al-Kadr, v. IX, page 13, Ibn Abidin. v., page 313).

Under presence of the vast free spaces people of the Central Asia live on the territory with a limited irrigated area - these are the artificially created oases, and river valleys form not more than 10 per cent of the total territory.

The system of water resources control was created and improved over a thousand years, but its main feature remained invariable, that is the strict administrative system of accountability. The century-old experience proves the correctness of such a system.

At present, in all republics of the Central Asia water resources control is the prerogative of the State, which, through the specially created organs, conducts the given function. It is needs to be noted that water resources control in Central Asia is realized on the basis of territory, administrative and basin (systematic) principles. In all republics there are for a long time the Ministries of Water Economy (in Kazakhstan State committee) for which the functions of the State organ of water resources control are legislatively consolidated. In particular, in the Republic of Uzbekistan in 1993 the new law "About water and water use" was adopted with due regard to all factors ensuring from the independence of the republic and interconnection and indissolubility of water resources of Central Asia.

Further, almost each republic is depending on the natural hydrological conditions of operation of interregional canals control. In the Republic of Uzbekistan there are five such systems.

Also, the control function is transferred to regional subdivisions where interregional canals and regional offices of water economy are situated. Besides, the regime

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of the existing more than 50 reservoirs is controlled, depending on capacity and importance, by the republican or regional organ.

All interrelations with water consumers are realized at the level of the regional subdivisions. In particular, in the Republic of Uzbekistan in 1993 by the governmental resolution all interrelations between water consumers and organs of water economy, limitation of water use, working out of agreements, grant of permissions on the special water use and recycling, transfer of water with the corresponding calculation and registration were defined.

The acquisition of sovereignty by the Central Asian states demanded a considerable change of the earlier approaches to the interstate water resources control which was carried out by a department of the Union.

It was necessary to take into account that the people living in Central Asia had the historical community and equal rights and responsibility for the guaranteed rational use and protection of water resources. Besides, the basin of the Aral Sea has the exceptional feature of an exclusive water basin, and only the acceptance of coordinated measures may check and prevent the negative consequences arising out of its drying. Some water economic objects (canals, reservoirs, constructions) were also built and operated with regard to the interests of all Republics of Central Asia.

In 1992, at the initiative of the Ministry of Water Economy of the Central Asian republics, the Interstate Coordination Water Economic Commission with two executive organs BWA "Syrdarya" and BWA "Amudarya" was created to which the water economic objects relating to interstate water resources control and water division were transferred for temporary use.

At the same time, an agreement was achieved between the republics of Kazakhstan, Kirgiztan, Tajikistan, Turkmenistan and Uzbekistan on collaboration in joint control for the use and protection of water resources of the interstate springs. This agreement was put into practice in every republic through a special governmental document.

According to the agreement, the interstate water resources control is realized on the base of structures already constructed, and principles of distribution based on the present normative documents on the distribution of water resources.

As it is known, the main normative document defining the principles of water distribution is the basin "Master plan of the complex use and protection of water resources".

Besides all earlier accepted protocol decisions and mutual commitments of the republics on the given question are acted upon. Yearly MKVK with regard to the

availability of water resources, prognosis of hydrometeorological service and, on the whole, water economy situation, determines the limits of water intakes to the republics from the interstate water springs - rivers Amudarya and Syrdarya in the limits of "schematic volumes". According to these limits, with regard to the peculiarities of water economy situation each republic fixes the limits on canals, regions and ten-day period.

BWA was given the right with regard to the formed water economy and hydrological situations and weather conditions to regulate the discharge of water intakes in consent with the regions and water economy organs in the range of +10 per cent.

Two years' experience of ICWC and BWA work on interstate water resources control showed on the whole the correctness of the selected way. During two years of activity one or another problem arose, but did not lead to any conflict even in the existing conditions of water resources deficit.

The problems met with are necessarily solved at the meetings of specialists and the leaders of the Ministry of Water Economy of the concerned republics.

In my opinion, the following are the shortcomings in interstate water resources control in Central Asia :

1. Absence of a common constant work organ in ICWC, to coordinat the water economic activity of the republics, influence water resources control, and realize the calculation and analysis of water use.

   The executive committee of the interstate council "Aral" and the already established secretariat of ICWC do not presently have a place in the decision relating to the above-mentioned question.

2. Several reservoirs of interstate importance are operated taking into account the energy requirements of the republics. The BWA cannot actually influence on the regime of these reservoirs with regard to the regime of regulation of the rivers Syrdarya and Amudarya on the whole. As a result, the common, earlier worked out regime on the stem of the rivers is broken and corrected depending on the operational regime of reservoirs. These all have created additional difficulties in regulation and use of water resources of the two rivers in their middle and lower reaches.

3. The administrative method of water resources control on a territorial basis (region, district) reduces the efficiency of control, increases wastages of water discharge, and makes the calculation and analysis of water use difficult.

4. The existing low technical level of the irrigation systems on more than a half of the territory does not permit improvement of exactness and operative control and restrains the introduction of an automatized system.

5. Lack of the automatized systems of control predetermines the real low exactness and subjectivness of approach in water resources control.

6. Unpreparedness of water consumers, in the first place of the agricultural farms, to the introduction of automatized control systems is explained first of all by the lack of the elementary irrigation techniques which, as a matter of fact, are the main element of automatization.

In the republics there are local nets of automatization which represent separate constructions, pump stations and small canals. On the whole, there is no integral automatized system of water resources control in the basin or even in small rivers, canals or region.

In Uzbekistan the first turn of AWCS - Syrdarya was worked out by SPA SANIIRI but has not yet been finally introduced.

In connection with the drying of the Aral Sea and the need to feed it by large volumes of waters arises the necessity of working out and introducing the second turn AWCS - Syrdarya and the first turn AWCS - Amudarya. These suggestions led to the formulation of "The program of concrete actions on improvement of the ecological situations in the basin of the Aral Sea in the nearest 3-5 years with regard to the socio-economic development of the region", which was accepted in January 1994 in Nukus by the leaders of the states of the Central Asia. Taking into account the difficult economic situation of Uzbekistan, the World Bank began the work of realization of this task "Program...". The experts of the World Bank together with the specialists of Minvodkhozes of countries - members of the World Bank - defined the volume of work and worked out the terms of reference setting the date of completion of the feasibility study; the preparation of the final first turn, the supply and contract, introduction of the first turn in the years beginning from 1994.

The preparation of the feasibility study will be realized by the local specialists in collaboration with foreign consultants. The completion of the feasibility study and the preparation and choice of the first turn of the project is suggested during seven months. The preparation of the final version of the selected project will be during nine months. The realization of the total project is suggested in about four years.

The cost of works based on the feasibility study is expected in the range of 0.75 million dollars. The preparation of the final project will require about 157.0 million dollars.

The above costs together with the attendance conditionalities and term of reference relating to the "Program" will be considered by the Council of donors of the World Bank in June 1994 in Paris to define the sources, aspects and volume of funding. After this, the realization of the project of the second turn of AWCS - Syrdarya and the first turn AWCS - Amudarya will begin. This will finally effect a saving of about 3 km^3 of water resources in the basin of the Aral Sea, which is the expected contribution of improvement of water resources control to the resolution of the problem of the Aral Sea.

In my opinion, for the further improvement of water resources control and the introduction of the automatized control system, it is necessary in the first place to prepare the water consumer, i.e., the peasant farms, having in view the gradual supplying to them the irrigation techniques.

The state of unpreparedness of the farms to these problems comes under constant changes of the coordinated regimes, and in consequence leads to unproductive water losses.

The conducting of the complex reconstruction of the irrigated lands with regard to the executed land reforms is necessary. It is also necessary in each republic with the cooperation of the experienced specialists and sponsors to create some exclusive automatized control systems in separate basins and canals with regard to the suspended load for its further circulation.

In this plan, an agreement was concluded with the firm BRL, and the first stage of the automatization of a separately taken canal has been completed and 600 ha of land are now provided with full water supply with the necessary equipment.

At the same time with this, I consider expedient to introduce the immediate training of personnel in automatized control systems and their functioning.

The Concept for the Solution of Aral Sea Problem and Measures of the five States for Improvement of Ecological Situation in the Basin

*Viktor Dukhovny**

The aspects of the concept have gone through two years of elaboration by a group of experts, specialists and government representatives from the five Central Asia states. The final version of this work was confirmed on 11 January 1994 at the Nukus conference by the Heads of Central Asian states of Kazakhstan, Kyrgystan, Tajikistan, Turkmenistan and Uzbekistan, with the participation of the Deputy Chairman of the Government of the Russian Federation.

The following goals were crucial in the framework of the concept for solution of the Aral Sea problem :

- The necessity to organize the implementation of the measures for improvement of ecological situation, that could stop complication and environment of the Aral Sea coast and drying bed of the sea;

- Besides, this main ecological aspiration is to enforce the technical and water actions for the reduction of the negative consequences of water usage, the quality of water in rivers Syrdarya and Amudarya and ground waters;

- The joint approach to the improvement of Aral Sea situation developed by the five states of Central Asia is taking into account the necessity to satisfy requirements of water, food, employment of population in the region, which is characterized by high birth rate. In order words, the improvement of the Aral Sea environment has to be accompanied by the creation of opportunity for socio-economic progress of all the five now independent states of Central Asia.

Due to the limited quantity of water in the basin and the need to assess both the ecological and socio-economic requirements of the region it is necessary to take into consideration the contemporary interests of each country. The concept has accepted (as a framework) the impossibility of rehabilitating the Aral Sea to its initial state and the necessity to form new ecologically stable profile of the changed system of water-land protected landscape in the drying bed of Aral Sea.

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On the basis of this framework the more detailed description is presented in the text of concept, which is distributed to the participants of the session.

The decision of the Heads of the five states confirmed the "Plan of Actions", which includes seven main programs :

Program 1

"Preparation a general strategy of water usage and protection of water resources in the Aral Sea Basin" - is the main program, which stimulates the elaboration of a single regional water, land and environment strategy for the future development of the region, and which will guarantee the creation of good conditions for economy, population, society and nature.

The speciality of this program is the right interrelations between interstate and state strategies of each country : the coordination of international and national interests for common prosperity : the prevention of the danger of conflicts between them, between the economy and the nature, between upper and lower parts of the basin, indeed between different branches of economic development of water users.

All this must be taken into account in the preparation of guidelines and optimal model of future measures, which will be planned in all programs of the Aral Sea Plan of Actions in their interconnections and progress.

The program includes :

- the assessment of the present situation in the basin of economic, ecological, social, legislative and other sides;
- the assessment of ability to satisfy the national demands in water and land from the point of view of national interests and their coordination in the basin and the requirements of the environment;
- the definition and alternative selection of contents; measures for the successful development of Aral Sea Basin; the planning of these actions taking into account their priorities;
- the elaboration of institutional, legal, informative, technical, ecological measures for carrying out and providing this strategy.

The project will produce an approved regional strategy containing a set of water management action subprograms, recommendations in basin-wide legal and normative acts, capacity of development through training, institutional strengthening, and technical and equipment assistance.

The total cost of project is expected to be about 5 million US dollars, including preparatory phase of 6 months - US $ 375,000.

Program 2

"The preparation and introduction of a unified aquified system of water availability and consumption measurement; regional system of monitoring the environmental situation" - has the task to create a single high quality interactive regional information infrastructure which will serve the need of all the five states, international organizations and will have the ability to supply them by real data and forecasts. It includes the delivery and installation of the most modern hydrometeorological data gathering, transmission, receiving, processing and dissemination equipment; the electronic access to the global hydrometeorological and climatological networks.

The system includes the process of building electronic databases on some levels of hierarchy : "Basin - state - irrigation system (or water users association) - water user (or field)". The principal objective of system is to facilitate the exchange of data and information about water, land use, environment, socio-economic consequences between regional and national decision-makers and managers.

The common cost of the program is 30 million US dollars, including a sum of 2.5 million US dollars for the preparatory period.

Program 3

The working out of principles of improving water quality and limiting pollution has the next objectives;

- conduct an assessment of all significant sources of water pollution in the basin;
- conduct pilot programs and develop action plan of priority investments for reducing pollution from irrigation;
- prepare the water quality management programs on the basis of comparison of alternative options : different scheme collection and removal of drainage and waste waters; reuse of mineralized and used water; reducing quantity and salt content in return flow, etc.

The cost of the project is estimated at 15 million US dollars and includes the cost of project preparation of 415,000 US dollars.

Program 4

"The preparation of projects and creation of artificially watered landscape ecosystems in the deltas of the Amudarya and Syrdarya rivers and on the exposed Aral Sea bed" - beginning from the undertaking of research works and the carrying out of the experimental projects directed by the decisions of this program, the comparison of efforts from different versions of these measures will permit the selection of the common plan of protection actions for the delta and the sea.

There are some subjects of the program which differentiate :

- the North part of Aral Sea (so called "Little Sea") can be saved as a dividing part of the former sea and supported at level 38 with appropriate engineering work. If low part of river bed of Syrdarya will be rehabilitated for the flow of needed discharge of water, these measures will permit to create joint landscape in the combination of Little Sea and Syrdarya delta;

- the creation of new ecological profile of south part of Aral Sea as a complex of some zones of watering delta of Amudarya, chain of polders; afforestation of drying sea's bed and others';

- the ecological studies and assessment of the ability to save and protect the proper part of 'Big Sea' taking into account the future usage of water in the Aral Sea Basin;

- the forecast and planned protection of environment of the Aral Sea include the quality of water, control of salt and dust storms, biodiversity, cimnology and climate change.

The common cost of the program is about 100 million US dollars including a sum of 1.7 million US dollars for the preparation period.

Program 5

"Preparation and implementation of intergovernmental plan to clean water and health" - is directed to the clean water guarantee for the population of low lands of both rivers and Aral Sea coast. In its content, the development of existing and ground water well field, new transmission tubes for conducting fresh water, the building of sewerage and sanitation systems for cities in the region. All measures are dividing on short term (one year), middle term (3-5 years), and long term (more than 10 years). If the first two parts of the program begin immediately, the last part would review the possibility and design of planned works for the improvement of the quality of drinking water (Tyuamuyn Reservoir,

treatment plants, booster pumps) and alternative sources such as desalinization plants or pipelines from distant but high quality mountain sources.

The cost of the project is more than 100 million US dollars, but first stage will cost 8.25 million US dollars.

Program 6

"Integrated land and water management in upper watershed" - must reflect the specialities of water and agriculture activity in Kyrgystan, Tajikistan and part of Uzbekistan where begins the antropohenic influence on the changes of quality and quantity of natural water resources and which defines the ability of reducing that influence finally. The objectives of the project are to :

- assess existing conditions and impacts of water and land management activities on surface waters, groundwaters, soils and so on;
- investigate, assess and implement on pilot plots more appropriate methods of this management for the decrease of impact on the whole basin;
- predict and plan possible improvement in environmental quality as a result of implementation of remedial actions.

The total project costs are estimated to be 2 million US dollars, and project preparation - 200,000 US dollars.

Program 7

"The creation of automatic control system for water management of Syrdarya and Amudarya rivers" - is planned to provide real time automated regulation, covering all main structure on both rivers, capacity building for two basin water organizations and on the base of this to save nearly two to three million m^3 of annual water. As a base of this work, the first stage of ASM Syrdarya, which has been executed during the last 10 years, would be used with improvement of modern computerized technology, including the monitoring and management of quality of water, connections with Aral Sea and so on.

The common cost of these two projects is 158 million US dollars for BWO Amudarya and 25 million US dollars for BWO Syrdarya, the first stage for both the projects costing approximately 4 million US dollars.

GIF Japan : Our Actions Toward the Rehabilitation of the Aral Sea

*Yoshihiro Takano**

1. Introduction

Good afternoon, ladies and gentlemen. On behalf of GIF Japan, I would like to take a few minutes for our presentation.

The "Global Infrastructure Fund, Research Foundation Japan" was established in September 1990 at the initiative of Japanese private companies, to improve of the welfare of mankind and to prepare ourselves, the crew of "spaceship earth", for the forthcoming "global community" through international cooperation.

The GIF concept aims to promote the sustainable development through the establishment of global-scale or borderless infrastructure. We think such infrastructure can be a basis for an efficient and well-balanced management of the globe, a basis that will create a better living sphere and environment for all mankind in the global community age.

Since the attention for sustainable development is increasing all over the world, we feel that now is the time to contribute further to the development of global infrastructure. The present world increasingly requires realistic solutions for well-balanced management of the global community through multilateral coordination. The case of the Aral Sea region is no exception. Such realistic solutions are required for the all the Republics concerned.

The main cause of environmental destruction in the region was the program to transform barren desert land into large-scale irrigation farm land (covering 7.2 million hectares) by withdrawing water from the Amu Dar'ya and Syr Dar'ya Rivers that both drain into the Aral Sea. In the 1970's, the Aral Sea started shrinking, salinity of the Aral Sea rose, and several phenomena of environmental degradation such as the destruction of ecosystems around the lake, extinction of fishers' species and pollution of groundwater were discovered. The occurrence of illnesses among the local residents rose because of the rising of salt and dust particles. Such disastrous environmental destruction originated from the large-scale development plan that had been designed and implemented by the Central Committee of the former Soviet Union on the basis of totalitarianism without giving much thought into its negative effects.

* International Coordinator, Global Infrastructure Fund, Research Foundation, Japan

2. Progress

The substantial solutions of the environmental disaster of the Aral Sea region shall be, therefore :

- First, from the technical point of view, to find sustainable utilization measures of water and land resources of the basin.
- Secondly, to seek the ways of the autarky of inhabitants.
- Thirdly, to change the socioeconomic structure so that the same kind of catastrophe would never repeat.

GIF Japan believes that the restoration plan or the 'Environmental Management Plan (EMP) of the Aral Sea region' must take those points into account.

We consider that the role of GIF Japan is unique. In its founding and operations, private companies are largely involved, and therefore, the major advantage of GIF Japan is that we can take rather flexible approaches. GIF has been undertaking basic studies for the formulation of the environmental management plan through the cooperation of researchers of Japan, the U.S. and the Commonwealth of Independent States since 1992.

For the purpose of clear identification of the Aral problems and reviewing the project policy, GIF Japan has carried out several field surveys, attended the International UNEP/former USSR conferences and had numerous discussions with ministers, government officials and specialists of the relevant Aral Republics. The brief history of GIF's activities and other epoch dates is shown in Table 1.

Table I . Chronology of Aral Problems and GIF

Date	Subject
Aug., 1990	. Dr. Zonn (Ministry of Irrigation and Water Resources, former USSR) contacted Dr. Takano about the cooperation for solving the Aral problems. . Voluntary study of the problem started by Dr. Takano and colleagues
Jan., 1991	. The Aral Problems introduced to Dr. Yamamoto, Managing Director of GIF-Japan, through Dr. Takano
29 Mar.,1991	. Aral Problems presented at the GIF Tokyo Conference
5 Apr., 1991	. Several GIF member companies started the preparation for organizing the Aral Environment Sub-Committee (AESC)
End of Apr., 1991	. GIF Japan asked President Hayashi of "TACHIBANA TSUSHO (a firm specializing in Japan-USSR trade)" for collaboration . Explanation of the problem to Japanese government officials

11-22 May, 1991	. GIF staffs visited Moscow, Alma-ata and Nukus for field survey of the local situation
11 June 1991	. GIF received request for cooperation from the Ministry of Irrigation and Water Resources of the former USSR.
14-30 June 1991	. GIF staffs participated in the USSR/UNEP meeting on the preparation of Diagnosis Report
7-20 Aug., 1991	. GIF staffs visited the World Bank to discuss about the ways to tackle the Aral Sea Crisis
11 Sept., 1991	. Organized Domestic 'Aral Seminar' in Tokyo to promote understanding of the problem
17-20 Oct., 1991	. GIF Atlanta Conference . Dr. Takano was appointed as International Coordinator . Resolved that the Technical Working Group should be organized
Nov.-Dec., 1991	. Visited Alma-ata to discuss about the organization of the Technical Working Group
4-13 Jan., 1992	. Business Trip for Moscow, Alma-ata
4-5 Jan., 1992	. The Aral Consortium was reorganized in Alma-ata
6-13 Jan., 1992	. The First GIF Technical Working Group Meeting on the Aral Sea Problem held in Moscow
5-6 Mar., 1992	. The Second GIF Technical Working Group Meeting on the Aral Sea Problem held in Alma-ata
29 Sept., 1992	. Symposium on Environmental Management of the Aral Sea Region is held in Tokyo . Symposium organized by GIF-Japan and the United Nations University. Participation of Ministers from the five Central Asian Republics.
26 Mar., 1992	. With the initiative of Kazakhstan's President Nursultan Nazarbaev, the five relevant Republics agreed in basic as follows (meeting attended by Dr. Takano) : . Establishment of the International Aral Salvation Fund . Permanent Intergovernmental committees to be built. . Each country supposed to donate 1% of their GNP to the above fund
Apr., 1993	. Dr. Takano and Dr. Yamamoto participated in the Seminar on the Aral Sea Problem organized by the World Bank
June, 1993	. Mission from the World Bank, UNDP and UNEP visited the Region
10 Dec., 1993	. Second GIF-UNU Meeting held to report on the output status of basic research for the Aral Sea Problem
13 Jan., 1994	. Dr. Takano attended the International Conference on the urgent support for Uzbekistan

In the meantime, GIF Japan has been working hard to create global partnerships and has been carrying out several research projects in cooperation with GIF North America, a brother organization of GIF Japan. At the first GIF International Conference in Atlanta, USA in October 1991, it was concluded that the Aral problems would be taken up as the project that GIF would give the highest priority. On the basis of the resolutions, I was appointed as International Coordinator and the 'Aral Problems Advisory Group' was formed by the representatives of USA, Japan and the former Soviet Republics. Subsequently, the International Technical Working Group was organized in order to make further concrete programs. Since then, Technical Working Group meetings took place three times: the first meeting in Moscow; the second in Alma-ata; and the third in Alma-ata, Nukus and Tashkent. At the meetings, the following articles were agreed:

Given that the basic studies' aims are for designing the EMP, two studies should be carried out under tripartite cooperation of Japan, USA and CIS:

1. A study on the present condition of land use by using satellite imagery technology; and

2. A study on water resources with the water resources analyzing model supplied by the US Corps of Engineers.

3. Research Activities

GIF International, whose leading role is being taken by GIF Japan, has been making efforts to reform and revitalize the Aral Consortium that broke up with the dissolution of the former USSR. In March 1993, with the initiative of the Kazakhstan's President Nurusultan Nazarbaev, the five relevant Republics agreed in basics to establish the International Aral Salvation Fund that confirmed the mutual collaboration of the participants. Permanent committees are to be built within and each country is supposed to donate a portion of their GNP to this fund. The World Bank sent large missions to the Republic twice. And we highly commend the meeting of the relevant Republics' Heads of States last January to approve the Interstate Council's recommendation and agreed on the contents of the Phase I (short term) program for the rehabilitation of Aral Sea.

In the course of rehabilitation of the Region's environment, in addition to the collaboration with various organizations, we are proceeding with the following research activities. These research activities started as the result of the Technical Working Group as mentioned earlier.

(1) Environmental Management Plan (EMP)

An Environmental Management Plan (EMP) must essentially be designed as a

master plan for environmental rehabilitation. The most important considerations with respect to its objective are;

(a) implementations of a land resource study, and
(b) an examination of water balance.

GIF International has initiated these essential studies led by Professor Philip P. Micklin of Western Michigan University, Associate Professor Mikiyasu Nakayama of the Utsunomiya University, Dr. Zhongping Zhu then of the Stockholm Environmental Institute-Boston, and Professor Hikaru Tsutsui of Kinki University. The results of the studies shall be incorporated in the EMP and environmental rehabilitation programs prepared accordingly. Please see the attached flow chart for the proposed scheme (Ref: Figure 1).

It will take at least several years from the time of the designing of the EMP to full implementation of the environmental rehabilitation programs. However, during this period, GIF will keep working in cooperation with the relevant bodies such as the relevant Republics, the World Bank and other researchers.

(2) Research on Land Resources

The Aral Sea Basin is vastly expanded, and obviously takes too much time and requires too many hands to study the land usage by field research alone. Therefore, we plan to judge the land usage of the region by analyzing satellite's imagery in combination with ground truth studies.

Research in this field is undertaken by Professor Micklin and Dr. Nakayama. Several other researchers such as Mr. Mori of Shimizu Corporation and North Atlantic Treaty Organization (NATO) are also starting their research.

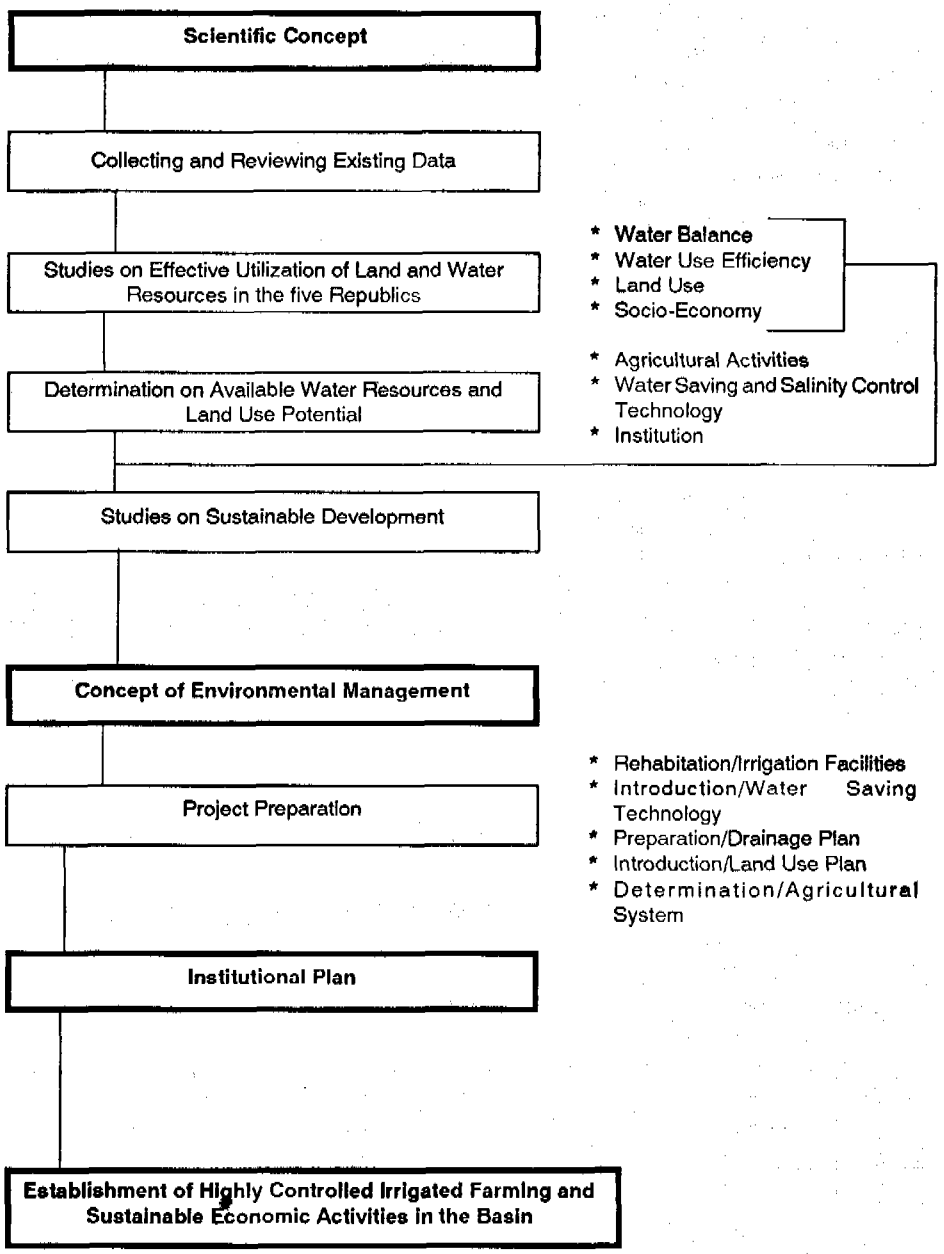
(3) Research on Water Resources

Currently, studies of water exploitation as the collection of basic data in order to make a water usage plan in both the Syr Dar'ya and Amy Dar'ya basins which flow into Aral Sea are carried out. For instance, Dr. Zhu's research in using the water balance model developed by him and utilized by the US Corps of Engineers now. Professor Tsutsui is surveying the status of water control institutions and the usage of water in the water management facilities. The next step is to study how to evaluate the detailed irrigation status. For researching the irrigation status, Japan Agricultural Land Development Agency (JALDA) had sent investigation groups to Syr Dar'ya and Amu Dar'ya twice.

4. Prospects of Global Partnership

Research program is now proceeding in Japan and the USA. We wish to

Figure 1. The Study Scheme Flow Chart for the Rehabilitation of the Aral Basin.



continue our research studies after evaluating this year's output and including new items necessary to study. Globally, NATO is also to be involved in the Land Resources studies. Domestically, Professor Tsutsui's Team is expected to receive the aid of funding from Ministry of Education and the Ministry of Agriculture, Forestry and Fisheries for their studies on the usage of Water Resources.

5. The Destination to Resolution of the Aral Problems

The Aral Environment Sub-Committee (AESC) organized in GIF Japan will continue its effort to rehabilitate the environment of the Aral Region. Its activities will not be confined to the basic studies already mentioned. We must especially take into account the fact that one element making the rehabilitation difficult is the disintegration of the former Soviet Union. We assume that under such circumstances, the introduction of technique alone will not work. If we are to introduce new techniques, we must start from the training of personnel who utilize the techniques. Hence, we wish to continue our communication with relevant authorities about the need of personnel training.

6. Conclusion

The cause of the Aral Sea crisis is the same one that destructed the Mesopotamia and Mohenjo-Daro civilizations. The same catastrophic phenomena that mankind experienced those days are reoccurring today due to inadequate countermeasures against salinization and other failures of arid region irrigation. If we fail today to solve the environmental crisis because of our ignorance and arrogance, the next generation will lose their place to live and suffer. The cause of the Aral Sea crisis is apparent and its countermeasures technically attainable. We must solve the crisis since it is a crisis universal to us, the human beings. The concept of GIF is relatively new and its footing still quite powerless. Nevertheless, we believe we have the ideas to find a new direction without prejudice. We are determined to dedicate our efforts to contribute furthermore to the environmental rehabilitation of the Aral Region in cooperation with global community, and with researchers and organizations both in Japan and abroad.

APPENDIX 1

Protocol

On ICID President Mr. John Hennessy's mission to Uzbekistan, Tashkent September 16, 1993

The Representatives:

of Uzbekistan	of ICID
Minister R. Giniatullin First Deputy Minister A. Jalalov Director General of SPA SANIIRI Prof. V. Dukhovny	President Mr. J. Hennessy

The President of ICID Mr. J. Hennessy has visited Uzbekistan in September 14-18, 1993 & acquainted himself with the activities of the Ministry of Land Reclamation & Water Management of Uzbekistan, ICWC, SPA SANIIRI, BWO "Syrdarya".

Mr. Hennessy has visited as well the objects of exploration & development of Golodnaya Steppe, of Samarkand region, Charvak reservoir & the industrial base of the Ministry of Land Reclamation in Bektemir.

President J. Hennessy notes with great pleasure a very huge work, implementing by the Ministry on water saving, improvement of meliorative systems operation, introduction of new economic & organizational principles of management, experimental using of perfect kinds of drip irrigation & other kinds of perfect irrigation.

The Ministry of Land Reclamation & Water Management of Republic has a big powerful design, construction & industrial potential, which leads to increase the level & perfection of irrigation system & drainage with speedy temps. However, unfortunately it is necessary to note that this potential is not in use in its bigger part because of sharp lack of funding & capital investments for all required needs of ecologically important measures & land reclamation.

President Hennessy expressed a great pleasure with the unique organizational work, implemented by five Central Asia States on joint working activity organization upon Syrdarya & Amudarya river basins water resources management & its

automation, elaboration of joint concepts of Aral Sea problem, planning of prospect scenario of development, etc.

At the same time it has been noted, that International Community & International organizations, showing interest in general for study the experience of Aral crisis arise, up to the present don't bring required assistance to solve this region problems, although the World Bank Mission report states the general statements on the region, concurring with the Joint Conception of five Central Asia States. In the opinion of Mr. Hennessy the community of approaches must attract the attention of International organizations to Aral Sea problem & bring required assistance to the region.

ICID in this issue must shoulder in following directions :

- forming of common opinion around the problem, issue & publication of principal reviews & reports;
- consideration & approaches to Aral basin as a pilot world object of working out of measures on the water deficit prevention & optimal solvation of mutually interfering socio-economic & ecology problems of development in the conditions of demographic pressure;
- forming in the region on the base of SPA SANIIRI as a scientific centre of ICWC basic organization of IPTRID & IIMI;
- forming of Donor Committee for Aral basin assistance & organization of meeting of countries in Tashkent up to December of 1993.

Sd/-
R.Giniatullin

Sd/-
John Hennessy

APPENDIX 2

General Remarks and Conclusions of Special Session on Aral Sea Basin 19 May 1994, Varna, Bulgaria

The United Nations Environment Programme, the World Bank, and other governmental and non-governmental national and international organizations—as ICID-as well as many state governments are taking action to tackle the problems of the Aral Sea region. The participants of the Session considered that the role of ICID is unique.

There is a great deal that the ICID can do to assist in the challenges that are associated with the Aral Sea Program. ICID's professionals have encountered the same problems before, such as problems of salinity, waterlogging, erosion, sedimentation, pollution, etc. Providing assistance for the Aral Sea region in the future could be an important role for ICID members too. The ICID must continue and support the states of the Aral Sea region in attempts to take action to restore the resource and enhance the lives of those who in some way depend on the Aral Sea.

On 23 June 1994 a meeting will be held for the NGOs in Paris on the Aral Sea problems. ICID would be invited to present the conclusions and recommendations of the Varna meeting as follows :

- Aral Sea is a profound ecological problem with a complex socio-economic consequence for the five involved states.
- Restoration of the Aral Sea requires comprehensive water resources development of the two river basins and the surrounding territories.
- Water use tradeoffs between agricultural, industrial, and municipal and environmental conservation have to be found.
- There is a need for quicker action in the resolution of current problems. Establishing an immediate funding mechanism is needed at the disposal of Interstate Coordination Water Commission (ICWC) to permit the financing of the studies, planning and preparation of projects responding to short-term plans.
- International organizations intending to assist with the resolution of the problems are invited to coordinate their efforts with the ICWC to ensure concerted efforts and beneficial actions.

- There is a need to strengthen the decision support systems for the Aral Sea states in the water resources areas.

- ICID is to help by appointing a Special Work Team on Aral Sea which will undertake the following :

  (a) Assist in organizing and establishing National Committees of ICID in the basin countries and assist in liaison with international bodies to obtain and disseminate information on relevant irrigation and drainage problems of the area and those experienced by other ICID members.

  (b) Identify issues for ICID's consideration within its technical activities structure.

  (c) Organize discussions for scientific and technical issues related to irrigation and drainage systems in the Aral Sea Basin.

  (d) Propose amelioration, rehabilitation, modernization of irrigation systems in the basin.

DOCUMENT CIRCULATED

ARAL SEA PROBLEM : REVIEW AND DECISION

Aral Sea Problems : Review and Decisions*

The problem of Aral Sea became known as a famous example of antihuman and antinature activities of state and society which initiated the disappearance and desertification of one of the biggest fresh lakes in the world.

Beginning from 1974, the problem of water resources of the Aral Sea basin had been intensively discussed in the former Soviet Union, when the special commission created on the decision of the Chairman of the Council of Ministers of the USSR had carefully studied this question and the water resources safe together with the improvement of its management from one part and donor feeding of rivers from the different sources (the Ob, the Irtish, the Volga) in the volume 25 cub km per year had been pushed as the main decision of the water deficit in the interest of ecological and social-economic prosperity. Under this the orientation of planned and directive organs was aimed at the further development of the irrigated agriculture as one of the main trends of the region process under the necessary reduction dimensions of the Aral Sea and the protectionist measures on the Aral Sea coast.

The planning from the achieved under the high past rates of irrigation rise, the powerful created construction — development potential in the region and the scantiness of the allotted capital investments moved aside the ecological -- demands and possibilities of the water safe on the second plan and favoured to the intensive removal of runoff in the process of irrigation development with the corresponding increase of the damage to the surroundings. All this was paid by hope in the change of situation under the river runoff transference in the region, in the first place from the Siberia.

The beginning of the "perestroyka" processes and the growth of "green" movement coincided with the wishes of the federal government to reduce the capital investments in the region led gradually to the growth of attention to the problems of the basin, to the pressing here negative trends and ecological complications, in the first place, to the degradation of the Aral Sea and Aral Sea coast.

The formerly published prognoses of the inevitability of losses of the gross national income under the preservation of the available tendencies in the water economy have been noticed and was marked by the change into side of reconstruction, improvement of the available water consumption and water limitation in all branches of the national economy, in the first place, in the

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* Copy of booklet circulated by Interstate Coordination Water Commission at The Special Session on Aral Sea Basin, Varna, Bulgaria on 19 May 1994.

Figures 2-5 have been omitted.

irrigated agriculture. This line on the limitation was crowned with the definite success for the past decade permitting to reduce the specific water-intakes on irrigation in the basin from 18.3 thous.cub.m./ha of water in 1980 to 13.7 thous.cub.m./ha in 1992.

The big victory was the acceptance in 1986 of the special government decision on improvement of water consumption and ecological situation in the basin as the result of it some principal measures in this trend were carried out:

- the creation of two basin inter-republican organization "Syrdarya" and "Amudarya" with subordination to Ministry of Water Resources of the USSR in the aims of realization of single water management in the basins of the both rivers;

- the Aral Sea and Aral coast were recognized direct water-consumers and the progressive increase of water supply to them was projected from 9.0 cub km/year to 15 cub km/year in 2000 abreast with 2010 year;

- tasks on reduction of water consumption and gradually reduced limits of water consumption with regard for increased demands of the sea were established to all republics as aggregated water consumer.

At the same time, it was projected and begun the realization of the engineer decisions on drainage of collector-drainage water from the industrial and communal domestic runoff into rivers, works on the centralized municipal-drinking water supply of the Lower Syrdarya and Amudarya were began by the way of construction of specialized drinking structures and material water pipes within the Tashayz, Khoresm, Kzil-Orda regions and the Karakalpak ASSR.

The creation of the special department of the Aral Sea in the part of the Committee on the extraordinary situations of the former USSR and also special inter-republic Consortium "Aral" favoured to the growth of works in these trends and considerable degree of attention at all local and republic institutions to the given suggestions.

The collapse of the USSR and its disintegration in 1991 was considerably reflected on the creation of the definite difficulties in the began work remained without sources of financing and single leadership. In such position it is very important to give the real assessment to the modern situation and its connections and on base of this to define the real way of solving socio-economic and ecological tasks which now are very tight connecting in limiting nature and financing resources of five independent states.

1. The Aral Sea and Aral Sea basin

The Aral Sea basin represented the big scale area of 690 thous.km. on the territory of watershed of two main rivers: Syrdarya and Amudarya. The common average water resources of these two basins is 120 cub km per year including the surface and connected with it ground water permitted for usage. The Aral is a big lake by which this closed basin is finished. For the last 300-400 years the surface of lake was supported on the level 50,5-53,0 with the common volume near 1000 cub km and water surface 66000 sq. km. The average evaporation from this lake was 60 cub km per year, which balanced with the inflow of two rivers 47-51 cub km per year, underground inflow 5-6 cub km. and precipitation 5.5-6.5 cub km. per year.

The growth of water requirement and water consumption in region as a result of democratic pressure couldn't remain untouching this lake and the whole basin and naturally began the changes in its environment. The total volume of water income was decreased for 30 years on 700 cub km. of water and desertification of former delta of two rivers and drying bottom of sea took place on area of 2 mln ha. This disaster accompanied by worsening of quality of water in river as a result of collector drain water in river bed.

Naturally, that in 20th century the jump of population and its water demands reflected in many points of world: Ganga, Indus, Colorado, San Hoakin, Sacramento, Nile and many other examples are the consequences of such inmanage development of limiting water resources. But difference between those and Aral Sea is that they fall in open sea or ocean and reducing of fresh water supply decreases only fishery production but not other nature conditions — in Aral Sea as a closed river basin the consequences of such hyper water consumption became more big and tragical. One similar example in American continent — is the lake Mono. The size and rate of its level falling is equal to Aral Sea disaster.

All long history of Central Asia — more than 6 thous. years connected with irrigation and using of water. "Water is the life" — this old eastern law is in all nations of Central Asia and other neighboring countries. The very big rate of population and demographics pressure (table 1 and picture 1) in the second half of ongoing centuries after 1960 (year of beginning of natural disaster) received the "good decision" with point of view of the federal government. In this framework for the Central Asia region was presented the role of raw appendate for industry centre of Soviet Union. Only 6-8% of all raw transform all raw products were processing up to the final stage, others were transfer to metropolia instead of food (meet, milk, wheat) and industry products. But such distribution of obligations transform the Central Asia Republics to "consuming" part of the country with the big expenses natural resources on the unit of GNP and full dependence from federal government in receiving investments, direction

and strategy of development. Thanks to good understanding of such situation by former strong leaders of region such Rashidov, Kunaev, Rasulev and other the industry development of % republics step by step went upstairs that permitted for the 30 years to increase the industry products in some times (7.01), but this industry was not oriented on self supply of region, but most part on the industry for agriculture and agromachine productions, cotton first processing, water maintenance and water construction industry. The big growth of agriculture production on the base of irrigation for 30 year in 2,5 time when irrigated area increases only for 45% allowed to support the rate improvement of welfare population on the average level of USSR, but absolute value of national income per capita was twice less than in Soviet Union. Moreover, on Aral Sea coast (Karakalpakistan, Kzyl Orda and other) it was twice less than average level of the region. The old Russian principle was reflected here: "the far from eyes, the far from hearts". It is related to Central Asia bodies so as for Federal Government. Poor sanitary and epidemiological and social service, absence of modern hospitals, medicine staffs, drugs are the result of such attention, of low living standards of local populations, but not the Aral Sea drying. But disaster of Aral Sea coast and deterioration of water quality in low reaches of rivers call to increase the negative situation here so the bad social situation met here with worsening of nature conditions of living.

If till 1960s the water resources of basin were distributed between the creation of national income (63 cub km. of water per 14.2 mln people) and unproductive waste and losses of runoff 57 cub km. including 47 for Aral, socio-economic situation in 1990 changed the water distribution to 98 cub km. for creation of national income per 35.6 mln peoples and remaining part 21.5 including only 9 cub km. for Aral Sea.

Although the consumption of water per capita and per unit of national income constantly decreased so as gross irrigation rate the saving of existed trend is not enough for solving the problem of region in future.

Under agriculture direction of economy in 1960-1985 the mentioned distribution of water resources promoted the growth of agricultural production and proper branches of agroeconomic complex, which passed ahead of population growth. Subsequent braking of water management and land reclamation works with former tendencies — inadequate industrial development of the region — led to the decrease of national income of Central Asian Republics, to the drop in well-being of the population.

At the same time, Republics of the Central Asia did their best to decrease specific water expenditure (to 5000 cub m./ha for ten years) and to intensify the rise of land productivity. However for last 5 years the population growth were exceeding the results of these works, what led to the drop in agricultural production, tilt area and water resources capacity per head.

The total volume of water income to Aral was decreased for 30 years on 700 cub km under natural drop in runoff, 165 cub km for 30 years and another withdrawal of 550 cub. km. for the same period. If strict water limitation, accepted in 1982, has been in force since 1960, and all irrigation systems were constructed as ones in Hungary Steppe and Surhansherabad with high capacity (0,789-0,80) then that would allow to economize 160 cub.km. of water for the sea. It wouldn't save the sea, but sea table would 42-43 m., what is better than present one 36-37,0 m. In consequence of level decrease the zone of former sea bed presents now new desert of 2 mln.ha. area and the source of salt and dust-weathering. In coastal zone the climatic and hydrogeological conditions changed for the worse, and what is more — deltas and ecosystems were destroyed.

In itself the drop of Aral Sea level couldn't change for the worse the ecology and medic and epidemiological situation in the whole Aral region, including Karakalpakistan, Khorezm, Tashauz, Kizil-Orda district of Kazakhstan. The sea level drop and further deserted emerged on the narrow strip 250-400 km. from the former water front and on the area of former deltas. Reasons of deterioration in ecological situation of above-mentioned area are bound up with the quantitative and qualitative change of Amudarya and Syrdarya river runoff - from one hand, and the reconstruction of land-reclamation systems in these zones was behind the requirements to change land-reclamation regime with the purpose to adopt the irrigation systems to conditions of low river level and poor water quality. As a result, the mineral regime of soil changed for accumulative one, increasing the accumulation of pesticides and herbicides against useful substances (potassium, calcium and etc.).

In view of the present and demands to decrease the loss of environment, some suggested decisions sea reserving on the present level are useless and inactive measures. This, the present reservoir of 37 m water table and 28-30 gr/1 of mineralization cannot keep the stable ecosystem.

Under such water mineralization the sea fish-breeding won't be productive and algae and plankton have to change their composition what is more, it is necessary to increase the annual income of surface water not less than 30-35 cub.km./year to keep the stability of this reservoir. These steps will be unrealizable ones, without bringing of water from outside.

Levels 38-40, close to present ones, cannot recover deltas of both rivers with all natural structures; cannot decrease salt and dust-weathering from the dried sea bed. The present situation is 2,0 mln. ha. of former sea bed is dried and becomes the source of salt and dust-weathering.

2. Perspectives of social and economic development of the region

The forecast of population growth in region is defines the population in 2000 on the level of 48 mln. peoples and in 2010, 68-72 mln. peoples. The needs of the population is employment, the providing with foodstuffs and comfortable living conditions is the task of top priority for solving of social and economic problems of independent states for saving of peace and silence in region.

In this time the need of ecological requirement of Aral Sea also must be satisfactory. These two tasks - socio-economics and ecological must be solved only on the base of one water - 120 cub km. per year.

There is not acceptable the amount of concept and proposals aimed at the Aral saving at any price, also at the expense of well being and future of people, up to the discrimination of the local population. The need of the population to employment, the providing with foodstuffs and comfortable living conditions is the task of the top priority for the solving of social and economic problems of the republic at the expense of its own forces.

According to the calculation, the problems of providing the population with foodstuffs (besides flour and meat) may be solved by fundamental improvement of irrigated lands using and the increase of farmers incentives, buying and development of advanced technologies of the crop-growing, seed-farming and irrigation.

In the best case, in year 2000 these measures will give the opportunity to increase the productivity of the agriculture up to 34 mird roubles in the Central Asia: 15% at the expense of irrigated area rise and 33% at the expense of the modern technology and the increase of farmers incentives.

Undoubtedly, there may be got great result in states of the Central Asia by the introduction of advanced technologies on the base of local irrigation methods (drip and underground irrigation), which allow to supply water to each plant and in proper quantity, and also to provide the optimal are regime with dosage injection of fertilizers and nutrients.

The average expenditure of polyethylene to develop 1 ha land on drip irrigation of vineyards and orchards is 700 kg. clean tilled crops about 1 t.

In views of this, it is possible to double orchards and vineyard yield capacity, and to reach 50% cotton growth with 50% of waterflow decrease.

With the purpose to use this technology for plant-growing (about 5 mln. ha.) in 2010, decides significant investment — 42,5 mlrd. rouble, it is necessary to

establish the industry of polymer materials with the output capacity 800,000 t. per year from the available gas stock.

This direction must get the top priority. the intensive polymer production also will permit the agriculture to get film lining crop-growing in greenhouses and mulching. What will increase the food production with their amount of farm.

Effective using of the agricultural potential requires the local processing of raw materials and getting of the final products: "cotton-yarn-fabric-clothes", "vegetables-tinned food". "peanut-sweets-oil", "cattle-skin-shoes and consumer goods" and etc.

Such reorientation of the agriculture would increase the production capacity of agroindustrial complex, including the processing and growing of low-water-using and highly-effective and highly effective crops, up to 45-55 mlrd roub. in 2000, and 85-120 mlrd in 2010 in the region (in price of 1984 years).

In Aral region the great attention must be paid to the reconstruction not of the sea, but of the deltas, especially Amudarya one. Filling of the delta with water, the creation of the number of controlled reservoirs, the irrigation basin method and regular one, the using of irrigated pastures to increase the cattle-breeding, musquash-breeding and fishery will allow to rise population employment, food production and living standards.

The organization of fishery on watering area (220-250,000 ha. of water surface) will exceed the present capacity 150-200,000 t. of fish. What will give products on 0,5 mlrd roub. annually.

The rest unemployed population have to work in the industry and service. In view of this, the rise of industry will in 1,9 - in year 2000, 4 - in 2010, as compared with year 1990.

To concentrate home and foreign investments industrial production, it is necessary to make favourable and protectionist conditions by the reduction in tax of investment and producers and material provision according to the state supply and hard prices and etc.

In conditions of republic independence, sovereign rights, the rise of the interest of each state in getting of final products such as cotton-fibre, silk, gas and minerals, vegetables, fruits what will become the most payback products with high quality processing and the increase of specific cost of agricultural products up to world prices. On the base of the compensation and barter, the concentration of foreign investments, the creation of joint venture we will develop the production and advanced technology, and probably come to the agreement with Russia on the transfer of some Siberian river runoff to the Central Asia under equivalent change "water-agricultural products".

On carrying out all construction works by Central Asian Republics and water economy organization, such decisions will promote the distribution of labour of the region and the allay further toughening of the demographic situation. This transfer will place in job 2 mln. people and then will rise it up to 5-6 mln people by the developing of low-water-using agroproduction.

Only the intensive solution of the population employment problems will be effective in improving of life and medic service. In view of this, until year 1998 there have to provide all Aral region with drinking water, hospitals and dispensaries, special food supply for children. It is necessary urgently to buy 2-3 foreign plants on bottling of mountain water and to build such plants to provide all children of Aral region with drinking water free of charge. To improve the epidemiologic conditions it has to be topped the drainage water waste to Amudarya and Syrdarya and to diverse these waters while we construct evaporation-lakes.

The versions of social-economic development was suggested in result of socio-economic and ecological approach and described analyzing in region (table 1).

a. conservation of existing situation inertia in water supply to Aral Sea according to previously agreed Government decision by the volume of 125 cub. km. in 2000:22 cub per year in 2010;

b. cutting the irrigated lands area in interest of water supply to Aral;

c. the same, but with making up the employment deficiency by additional working stuff in industry;

d. realization to 2010 of the procedures in radical improving of agriculture on the basis of advanced techniques; local methods of irrigation and intensive processing of agricultural crops;

e. redistribution of river flow in the northern part of Central Asia region;

f. Siberia water delivery plus the action of item "DS".

The comparison of various variants of 2000 and 2010 year shows unsatisfactory regional social-economic and ecological situation in any variants. No variant a,b,c oriented the Aral supporting and keeping the tendencies of inertia development cannot prevent the growth of negative environmental tendencies both in the sea and in the whole region, especially near the Aral Sea. All these procedures are estimated at more than 100 mlrd. roub. but do not exclude great damages, which anew kept at existing level for economics and environment. At the same time these variants do not provide the agricultural production in volume, keeping the provision with food stuffs at the level of 1990. No variants will not let to achieve the population employment conservancy without high

capital investments. Most of all, all these variants decrease socio-economic indices in comparison with 1960 or for 20-25% against the existing level with huge wastes for realization of the first two ones.

The variant "c" gives the possibility to increase the national income due to the high capital investments by the reorientation of the whole republican economy for industrial development. But here Central Asia becomes less provided in agricultural products per unit in comparison with 1960.

In conditions of independence and difficulties in interstate supply such orientation may lead the former republics to the famine.

The variant "d" - the improvement of irrigated agriculture together with the development of drip irrigation by the volume of 5 mln. ha and through processing and "e' - Siberian rivers transference will significantly improve the indices of socio-economic development for population provision with food stuffs and employment and let high water supply to Aral and Aral region, keeping the attachment of agricultural population to its places.

At the same time, at the level of 2000 these both variants are unreal in time and at the level of 2010 in will able lead to realization.

That is why the states considers necessary to use the variant "D" for further work. It requires great efforts for realization and lead not only to satisfaction of the regions requirements but to the decision of foodstuffs problem using the natural and demographic potential of Central Asia.

In future with worsening of water delivery in Siberia, Ural and northern Kazakhstan and growth of unit tendencies for joint development. Central Asia states basing on water buying and its barter for agricultural products, may use the variants "f" - the improvement and partial delivery of Siberian rivers flow to Aral Sea basin.

3. The environmental protection in Aral Region and the control of negative consequences

Great breaches of natural conditions and geographic position, also the drop in Aral Sea level may be summarized as follows:

Aral Region

delta deserted, the vegetation degradation, the loss of fishery capacity and musquash-breading, the worsening of pastures, and dust-weathering from dried sea bed, the rise of climate aridity along the coast strip of 60-100 km. the drop of underground waters and the transition of gydromorphic

sautomorphic ones the water mineralization increase in the sea basin and underground waters on the area approximately 2 mln ha.

Lower reaches of river

the loss of natural watering; the exceeding of total mineralization in ions, pesticide and herbicide water pollution; the drop of river sediments, therefore,the increase of canal losses and infiltration; the loss of natural fertility of lands.

Special two versions of calculations on the sea recovery to 53 level (Tables 3 and 4) up to years 2000 and 2010, demonstrate that annual water requirements are 111 and 73 cub.km./year, not taking into account delta demands. Indeed, that it is impossible to get such resources neither in the sea basin, nor anywhere (Siberia, Kaspiy) without any damage to the region and population.

Keeping of sea on 38 level, including delta demand, require 28-30 cub.km. However, the sea reserving won't save us from worsening of environment, what is more, it will be increased under 39 sea level also.

Since 1976, there were researching processes of salt and dust-weathering, deserting of the area, salt accumulation and water dynamics in Aral region, the process of biological clearance of water from salts, pesticides, herbicides etc. (picture N. 3,4). On the base of above researches it was suggested to reserve the rest sea basing on level of cultural zone, not on the lower hypsometric sea table, the pose to recover deltas, to prevent deserting, to stop the climate aridity and salt and dust-weathering from the dried sea bed. Hence, there appeared the suggestion to create entire avant delta along the southern sea coast by Amudarya delta to make land reclamation, irrigation basin method and the number of storages.

In 1989-90 there was began the fulfillment of the fixed program with the participation of Aral region population. It demonstrated, that on the base of irrigation and drainage water usage and their separate supply, it is possible to develop shallow lakes (55-60,000 ha area) of 3 m. depth where may be formed natural ecologic processes, promoted the increase of fishery, musquash-breading, growing of rush, reed and reed mace of 5-7 t/ha yield capacity.

Under the defined stream velocity, water vegetation is very active on the base of absorption of salt, pesticide and herbicide absorption.

On coming across of salt dust-weathering with water surface, the sediments of hard aerosol increase in 10-20 times and reaches 70-90% of initial intensity on 15-20 km distance. On the base of our experimental works and modelling we prepared the suggestion about the creation of new environment profile of Aral

Sea coast and part of sea which permits us to use the real water resources to formulate new ecological active area with the stable regime of nature processes and productivity of this area more much than initial productivity of the natural biosystem.

In Aral region the great attention must be paid to the reconstruction not of the sea, but of the deltas, especially Amudarya one.

The first stage of the filling delta with water includes following steps; the construction of Mejdurechensk reservoir of 500 mln cub m. volume with syphon spillways, Muinaksky and Ribachy artificial basins, the stabilization of Sudochic lake on 53 level, the construction of 3 influent channels from Mejdurechensk reservoir to 3 ones of water intake to the polder system, the creation of irrigation basin systems on the distance between reservoir with the purpose to recover gydromorphic regime of delta and initial level of underground waters on 160,000 ha area of Amudarya region.

The second stage is gradual progress of avant deltas. Now it is suggested to make avant delta by the construction of mounting polder system, against the first version of entire avant delta along the southern sea coast because it is difficult to ensure the uniformity of water distribution and necessary regime of mineralization. In the shallow part of the polder there is made the bioplateau from reed, rush and reed mace for the absorption of pesticide, herbicide and salt. The water supply to the polder will be made in 3 points with 20-25 km. interval between each other. The central part of the polder (near Muinak) may be used as mother ponds; due to their great dissalinization and stable depth regime, what is important for the wintering of fish, the most remote parts for the fresh water supply — as fattening ponds. The presence of these phenomenon permits to meet all demands in fish production — the running of water the absence of slack zones necessary depth in summer —1.5 m., the temperature - 15°-20°C, the nitrate content - 40 mg/l and less, the mineralization - 3-7 g/l - in the central polder; and 10 g/l - in the remote one.

The sea bed along the tail-water of polder dams have to be strengthened by phyto-land -reclamation method - some raws of the planting - 100-200 m width; also using contour ditch irrigation. The filtration along the tail-water of dikes will promote the moistening of the raws and their good growth.

In view of these steps, it is suggested to make watering zone along the southern and some part of western coasts of 35-40 km. width including zone of irrigation basin method. What will help to recover deltas and to abolish deserted zone along the former sea coast.

According to the calculation, the evaporation from water surface near Muinak of 600,000 ha area (e.g. half of the whole deserted zone) will allow to decrease the climate aridity at the expense of evaporation 4-8 cub km/year.

The rightness of such idea was confirmed by the experience of 1989-92 years where we fulfill 3 shallow lakes (55-60 th.ha. area) of 2-5 m in depth with the help of some temporary structures where natural ecological processes were formed promoted by increase of fishery, musquash-breeding, growing of rush, reed and reed mace. The falling down the sediments of hard aerosol on coming across of salt-dust-weathering with and under water surface increase in 10-20 times and reaches 70-80% of initial intensity in 15-20 km. distance. Taking into account the direction of north-eastern winds (61%) and north-western 10-12 km. (pic. 5). For the north part of Aral Sea ability to save the little sea is and all measure here must be directed for this goal.

4. Ways of water saving and increase of productivity of water

1. Water saving must free necessary volume of water for increasing industry production. Aral Sea and possibility of increase water demand from some water users:

- Improvement of activity of interstate (former inter-republic) water basin organizations, improving of management of water resources by this BWO decreased losses of runoff in the rivers now on 1,5 cub km./year and we are planning that introduction of II stage of automatization operation system of Syrdarya river and I stage of such of Amudarya will permit us to save any 1,5-2 cub.km/year; these two projects now proposed for the financing of World Bank and other sponsor bodies.

- The complex measures by the control of providing of losses water in irrigation on the base of :

		Year 2000	Year 2010
a.	implementation of advanced methods of irrigation techniques (drip, surge, underground, basin irrigation) in the combinationwith land levelling	mln. ha. 2,0	5,0
b.	introduction of advanced methods of drainage for the reducing of leaching requirement	mln. ha. 1,0	2,8
c.	rehabilitation of irrigation systems	mln. ha. 1,8	4,2
d.	lining of irrigation nets on the interfarming level	thousand km 28	84

- We hope to receive the biggest effort from the advanced methods of irrigation. Our experience in the big scale research-productive plot

projects indicated that drip and surge multifrequence irrigation are allowing to save to 50% water in the field -- irrigation rate netto become 3500-4100 cub. m/ha. instead of 6500-8800 cub. m/ha. The task of distribution of these methods can be solved on the base of creation the polyethylene production in region and own production of drip irrigation system which now is beginning by SPA SANIIRI;

- Conjunctive water market and limiting system of water distribution between of water consumpters. The past 10 years when on the base of constant administrative pressure and installation of each year the strict limit of water we reduced gross irrigation rate in basin shows us the necessity to develop the combination of straight administrative measures in the basin, state, district, system level with economical mechanism. The active experience of self-financing and water payment in 14 districts of Uzbekistan demonstrated effective reduction of above planned water use in farms. We hope that implementation of agreement's relation between water organization and waterusers which will pay the proper part of their common productivity and penalty in big size for the extra outtake and worsening of water quality in sources would create the efficient instrument in water management;

- Introduction of rotate water using including the increase of usage of drainage water in the place of their forming, the development of purification and demineralization of salt water.

2. Increase of GNP - the most important task of development — must be founded on the change of scenario of society development in the industry direction with the final products production with use of own raw and agrarian materials.

- Effective using of the agricultural complex in rural areas by wide local processing and upgrading by chain lines;

- Creation and introduction the science full of water saving high labour technologies (device, equipment production; electronics; TV; automotive and other industry);

- Development of chemical production of polymer material on the base of using the natural products (oil, petroleum, gas and others);

- Upgrading of mineral resources (gold, cuprum, rare materials, etc.);

- The improvement of irrigated agriculture on the base of advanced world experience, introduction of new varieties of crops; expenditure the program "Land fertility and new Agriculture Technologies", aimed at the

connection practical and scientific experience in the crop-growing, involving the main reserves of irrigated fields so; entire land reclamation; optimal crop selection the differentiation of agrotechnical methods and the injection of fertilizers; amendments and chemicals to inhomogeneous soil dependence from their passport clarification; the improvement of plant selection to get high yield capacity.

All these aspirations and expensive works must guarantee on the level of 2000 year - 16-18 cub km per year, 2010 - 22-25 cub km per year of water for Aral Sea and its coast and also to guarantee satisfactory of increasing water consumption in interests of non irrigated water user (industry, municipal and fish farmers) (Table 5).

5. The institutional changes in management of Aral Sea basin improvement

After collapse of USSR the understanding the unity of the situated water resources in the basin and its common responsibility for the management and use of water in the region led to that five Ministries of water economy and irrigation of Central Asia states considered the necessary not only to preserve the common management by water on the inter-state level as in creation of two BWOs, but to develop and strengthen it on more high conciliatory level on a par with five countries of the basin. With this aim in the beginning of 1992 it was proclaimed the thesis about common principles of water resources use and management and then was organized the unity organ of this management — Inter-state Coordination Water Commission. Both BWOs were turned into constantly acted functional organs of this Commission.

It is ought to note that depending upon the earlier existing in the epoch of the USSR proposition when BVO were practically only operative functions of control and distribution of water resources in its way "Key about water gate" that already in the first agreement were proclaimed the clear understanding of unity in planning as annual so and perspective of water resources use and development, in control not only for the quantity but for the quality of waters, in realization resources safing and nature protected activity on the improvement of the ecological situation in the basin, especially in the area of the Aral Sea.

Proceeding from this ICWC from its first steps and conferences gave the great meaning to such questions as the working out confirmation of the annual plans of water consumption and water distribution on the inter-state level, establishment of the hard limits as on the vegetative and so on unvegetative season, search of the common technical decisions on all questions of the mutual interests as on rivers so and on its main tributaries and on interstate main ways of collection and with a raw of collector-drainage waters, the further improvement of water resources use.

In contrast to the old practices when water was distributed according to the master plans completely between the republics of the basin, at present there is already the third year water is practically divided between six aggregation water consumers among which the sixth is the Aral and Aral Sea coast for which ICWC and BWO is strictly watched for the fulfillment of water delivery into deltas and sea not less than the definite volumes on the annual plan. Such method did not slow down to reflect on the volumes of the ecological delivery and observance of the limits of water delivery to all states -- during 1992 and 1993 under the deviation in water delivery to them in the range plus and munes 5% runoff in Aral and sea coast with regard for the waterness of years was 33,5 cub km in 1992 and 23,6 cub km in 1993 per year.

Though the cascades of the reservoirs on the rivers are in different hands the status of BWO as the distributor of all main structures on the water intakes from the river and tributaries permitted them simultaneously with the putting in order in water assessment to achieve the considerable safe of water resources, earlier hided as "the channel losses and base removal". BWO "Syrdarya" achieved the special success in this where thanks to the capable use of ASM system of the Ist part of the basin worked out and introduced in 1987-1988 with the whole complex of structures, mathematical and program ensuring, the perfect work of the operation staff succeeded to include in the account and use of more than 1.5 cub km of water resource of the surface waters.

This volume of safe justified at once all expenses on the creation of ASUB the I stage.

Simultaneously with the direct activity on the operation, planning and management by water in the basin. ICWC gave considerable attention to the questions of the perspective.

Exactly in this trend it is need to consider the efforts of ICWC on working out of the single strategy of management, on creation "Concepts" and "Plan of the necessary measures" on decision of the problem of the Aral Sea Basin with regard for its ecological and social-economic demands.

As it is know, these documents prepared for 2 years by the experts of all 5 states on the initiative and active participation of ICWC were on the base of the documents of two conferences of the Heads of states in Kzil-Orda and in Nukus in 1993 and 1994 approved these basis state positions and what is more -- raised the common activity in the basin to the level of inter-state Council of the Aral Sea Basin and its Executive Committee.

Unquestionable achievement of ICWC is the understanding of the necessity of the joint scientific activity on the investigation and improvement of the ways of the optimum management by water in the basin, which was crowned with the

'creation of Scientific-information centre ICWC as SPA SANIIRI as the main organization and 15 design and scientific-research institutes coexecutors and also by the approval and work beginning from 1994 on a single program of works on water economy in ICWC system. The financing of all activity (BWO SIC ICWC and newly created its secretariat) is by all states on the base of share participation defined by the special decision, mainly, proportionally to the volume of waterintake.

The program of SIC ICWC with the common volume more than 3 mlrd roubles in the prices of the end of 1993 consists of 7 main tasks: the working out of a single regional water strategy in coordination with national water policies; creation of a single information system of improvement of water-land resources use in coordination with the system of natural monitoring; the improvement of water quality in the rivers; creation of lawful base of management by the water resources; creation of natural protected complex in Aral Sea coast, deltas of both rivers and on former dried bottom of sea; working out and introduction of ASUB of the 2nd turn of BWO "Syrdarya" and ASUB of the Ist turn of BVO "Amudarya"; the river straightening and river regulation works on the rivers and so on.

It is natural that sufficient complicated financing situation of the independent states the definite complications on the scope of all questions necessary to the execution in the sphere of inter-state management by water resources. In particular extremely insufficient means are given on the direct realization of measures on improvement of calculation system, capital investments on the reconstruction of facilities, channel regulation works, means on discharge of collector-drainage water channel, clearing and perfection of channel river below the Chardarya, direct works on Aral Sea coast.

Exactly in this it is demanded considerable help and addition from the side of the internal organization, in particular, UNDP, World Bank and other sponsor and creditors. Unfortunately inspite of the great member of different commissions and delegations visited and studied on our material the problem of the Aral and its basin, mainly, these efforts have the character of accumulation of experience of our successes and mistakes more than real assistance.

It is truth that for the last time Mission of MBRR during 1,5 months together with SIC ICWC on the instruction of Executive Committee of the Inter-state Council prepared TOR on 7 main projects and 12 subproject of the transmission of financing to the international sponsors, the conference of which is fixed on May-June 1994. Nevertheless, there are only hopes, but insufficient confidence in reality and scales of this assistance.

Such attitude of the International association is slightly incomprehensible. The complication and crisisness of the situation in the Aral Sea basin was proclaimed

and recognized by all; it was written hundreds of articles, publications and statements. If compare the Aral basin and Mekong basin it is clear that the situation in our region is more complicated. Nevertheless, if the international organization under the pretence of grants and gratuitous assistance and credits gives the Mekong basin hundreds of millions of dollars per year, the real assistance to our region amounts 1 mln dollars in 1993.

Nevertheless, the deep understanding of this tasks, unity of efforts and means of the states of the Central Asia and in the first place, workers involved in the sphere ICWC, their support by the government raise hopes that the decision of the problem of management by water resources of the Aral basin on all levels of its hierarchy will receive the further development in the interest of ecology and social progress of the region.

Prof. Victor Dukhovny
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Figure 1. The dynamics of the distribution of the runoff expenditures between the Aral Sea, ecology and regional development (1960-2010)

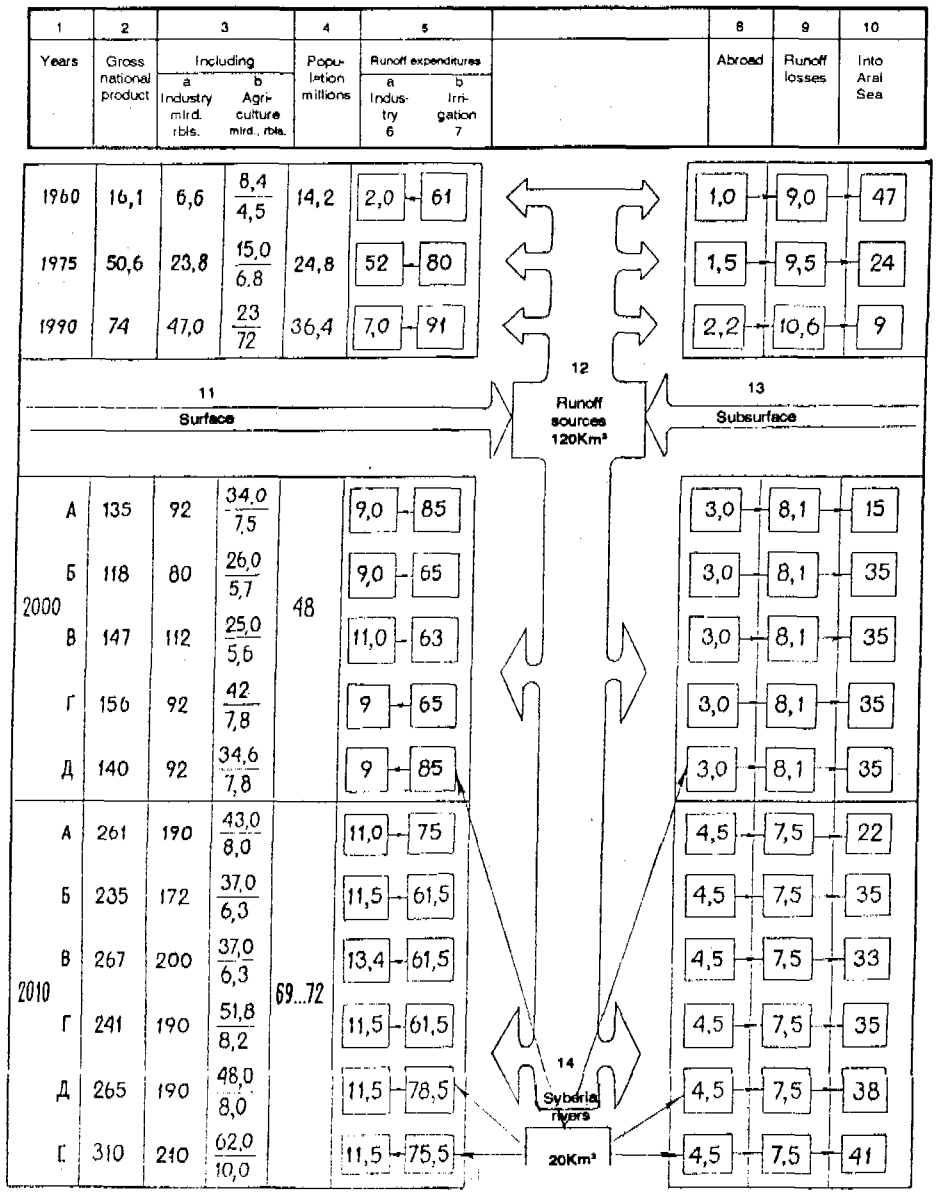


Table 1. Dynamics of consumptive use dealing with social-economic developing of Central Asia

Year	Variant	GNP mlrd rbls	National income mlrd rbls	Agricultural production per head (per capita) rbls	National income per capita	Irragable area per 1 person ha	Consumptive use per 1 person cub m/year	Necessary investments mlrd rbls*	Draw off and run off per 1 person cub m/year	NOTE
1950		16,1	7,4	590	521	0,317	2460		4470	
1975		50,6	23,3	638	936	0,236	1920		3420	
1990		74	43	630	1105	0,2	1580		2550	
2000	A	135	73,5	708	1531	0,16	1370	132	1968	
	B	118	64,2	541	1338	0,119	1100	126	1542	Aral support
	C	147	80,1	520	1668	0,117	1100	178	1542	Aral support
	D	156	85,0	875	1770	0,16	1100	168	1542	& keeping of employment Drip irrigation 5 mln ha
	E	140	75,2	720	1580	0,16	1370	152	1968	Using the Syberia
2010	A	261	142	614	2030	0,114	965	349	1286	rivers
	B	235	128	528	1828	0,09	782	331	1042	Aral support
	C	267	145	528	2062	0,09	805	422	1286	Using the Syberia
	D	241	131	729	1872	0,117	782	404	1042	rivers
	E	265	144	686	2057	0,114	965	379	1286	
	F	320	174	885	2483	0,153	965	458	1286	Drip irrigation 5 mln ha

* For agriculture and industry only with regard for the Aral problem

In prices of 1984.

Table 2. The change of main features of Aral Sea

Years	Level, m	Area sq.km.	Volume cub.km.	Salt content g/l
1960	53,0	66,08	1061,6	10,0
1965	51,90	61,76	991,87	11,5
1970	50,94	58,01	993,2	13,0
1975	48,59	56,15	797,3	15,0
1980	47,18	54,08	719,5	16,6
1985	41,94	44,60	466,0	23,6
1990	38,29	36,40	323,0	34,0
1991	37,56	34,8	299,0	36,0
1993	36,94	33,31	277,5	39,6

Table 3. The balance of water for rehabilitation of Aral on the level 53 to 2000 year (in cub km)

Years	Volume cub.km.	Level m	Precipi-tation	Under-ground inflow	Evapo-ration	Flow from the river
1990	290,5	38,0				
1991	374,6	39,0	6,3	2,6	35,9	111,0
1992	155,9	41,5	7,1	2,3	39,0	111,0
1993	556,3	44,0	7,4	2,0	40,0	111,0
1994	615,5	45,5	7,5	1,7	41,0	111,0
1995	694,45	47,0	7,5	1,5	41,05	111,0
1996	771,65	48,5	7,9	1,4	43,1	111,0
1997	546,20	50,0	8,4	1,2	46,0	111,0
1998	920,35	51,0	8,7	1,2	46,8	111,0
1999	993,9	52,0	9,5	1,05	48,0	111,0
2000	1061,6	53,0	9,9	1,0	54,2	111,0

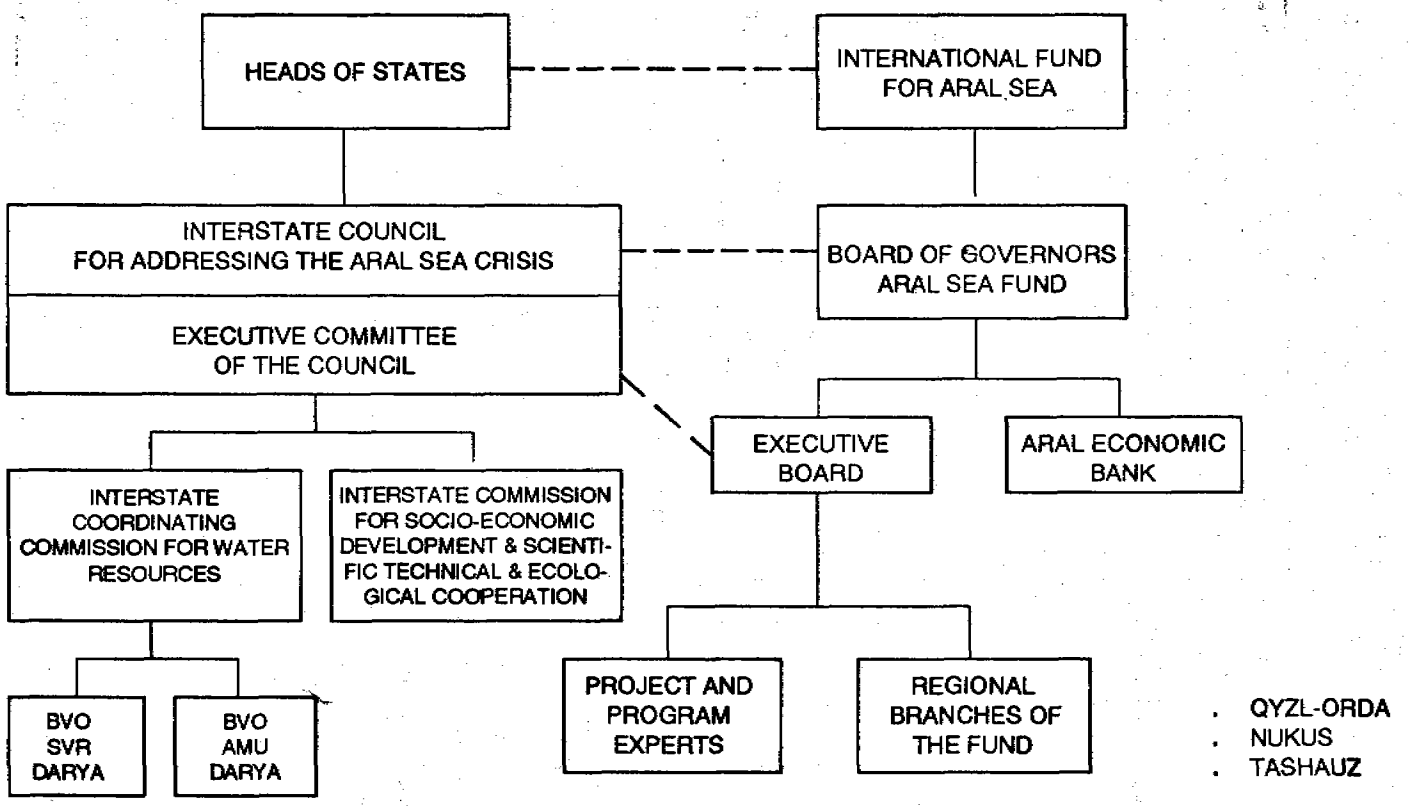
Table 4. The balance of water for rehabilitation of Aral on the level 53 to 2010 year (in cub km)

Years	Volume cub.km.	Level m	Precipi-tation	Under-ground inflow	Evapo-ration	Flow from the river
1990	302,6	38,0				
1991	349,6	38,0	6,3	2,7	35,0	73,0
1992	396,1	39,5	6,4	2,4	35,3	73,0
1993	440,2	34,0	6,7	2,25	37,9	73,0
1994	481,7	42,0	6,9	2,2	38,6	73,0
1995	525,0	43,0	7,0	2,1	38,8	73,0
1996	553,3	44,0	7,25	2,0	41,0	73,0
1997	594,4	44,5	7,35	2,0	41,2	73,0
1998	647,1	44,5	7,5	1,8	42,0	73,0
1999	687,1	46,0	7,7	1,6	42,9	73,0
2000	725,7	47,0	7,8	1,50	43,7	73,0
2001	764,6	48,5	8,0	1,40	44,5	73,0
2002	791,1	49,0	8,2	1,3	47,0	73,0
2003	838,3	49,5	8,4	1,2	47,4	73,0
2004	869,2	50,0	8,5	1,2	47,8	73,0
2005	904,2	50,5	8,5	1,2	47,8	73,0
2006	938,8	51,0	8,6	1,2	48,2	73,0
2007	972,0	51,5	9,0	1,2	50,0	73,0
2008	1000,5	52,0	9,3	1,1	51,9	73,0
2009	1031,9	52,5	9,75	1,05	53,4	73,0
2010	1061,6	53,0	9,9	1,0	54,2	73,0

Table 5. The growth of water consumption for industry municipal and fish farms, cub. km.

NN	Region, river basin	Level routing (year)						
		1985	1990	1995	2000	2005	2010	2015
1	**Amudarya**							
	back consumptive use	1,95	2,5	2,8	3,1	3,5	4,23	5,25
2	**Sewage rivers**							
	back consumptive use	0,5	0,5	0,5	0,6	0,6	0,6	0,6
3	**Syrdarya**							
	back consumptive use	1,8	1,8	2,2	2,8	3,3	3,88	4,6
4	**Total on region**							
	income and usage of fresh water	15,5	17,0	18,2	19,9	23,6	28	32,3
	including :							
	industry	10,0	10,2	10,2	10,2	12,5	15,2	17,6
	municipal farm	4,1	5,2	6,3	7,8	9,3	11,0	12,9
	fish farm	1,4	1,6	1,7	1,8	1,8	1,8	1,8
	back consumptive use	4,23	4,83	5,47	6,47	7,42	8,71	10,45
	including:							
	industry	1,6	1,9	2,4	3,3	4,4	5,8	7,5
	municipal farm	1,23	1,23	1,37	1,37	1,22	1,01	1,15
	fish farm	1,4	1,6	1,7	1,8	1,8	1,8	1,8

Figure 6. The Structure of Interstate Organization for Addressing the Aral Sea Crisis



Principal Provisions
Concept

Concerning Kazakhstan, Kyrgizstan, Tajikistan, Turkmenistan, and Uzbekistan on the Resolution of the problem of the Aral Sea Basin with allowance for Socio-economic Development

To the main text of the principle provisions of the subject Concept were laid the proposals of the representatives of Kazakhstan (1992), which has been largely worked out by the working team at the Cabinet of Ministers of Uzbekistan (1991-92). It also includes all other data of the project and research organizations of the Republic, the materials of the Ministry of Melioration and Water Management, of the State Committee on Environmental Protection, of the Academy of Sciences of Kazakhstan, Kyrgizstan, Tajikistan, and Uzbekistan as well as materials of the World bank Mission's presentation on the problem of Aral Sea and a number of other documents.

The problem of the Aral Basin, of the Aral Sea itself and the air balance around it are being associated in tense relationship with the peculiarities of the Central Asian Region, with its geographical and natural characteristics in consequence with the past, present and future socioeconomic development.

The established for the last decades agro-raw trend in the economy of the basin has brought this region into a very hard conditions in solving the most important tasks of the economy. Though the national income was growing per capita but it was always less than in other developed regions of the FSU. Cotton growing, first in the interest of cotton-independent country and then for the needs of export has occupied more than 50% of all irrigated lands and taken more than 50% of all water resources.

The strategy of the all-union labour distribution has made the Republic to import meat, milk, potato and other products and commodity goods.

In the arid climate conditions and of the isolated basin's nature, at the increasing growth of water demand there appeared the problem of Aral Sea, as the result of long, careless and reckless exploration of basin's resources when there were used about 60% of all water resources of the region that is around 55-60 billion of cubic meters annually, that's the volume of water taken from the sea over its stable level before.

Before 1960 the general resources of surface and underground waters were feeding the Aral Sea equally distributing between the creating of the national income - 65 cubic kilometers and of a inflow expenses - 57 cubic kilometers annually for filling in the sea. Together with it when on the basis of water and

farming management there were created 55-60% of GNP and only 10-12% of end product and that might inevitably bring to socioeconomic crisis. Large scale irrigation and the low culture of the land development and as well slow industrial progress and the high growth of population brought to the reduction of the national income and of the life standard, slowing up to the public production and to more dependence on import. To slow on these negative processes the Central Asian Republics were increasing the efforts on decreasing the efficient consumption of water (for a decade they have decreased by 5 thousand cubic meters per hectare) and on the growth of the soil productivity. But for a lack of industrial development they couldn't stop the total fall of the efficient indications of the agricultural production of the rate of water supply per capita.

In the condition when all incomes from the main branch of agriculture were concentrated in other regions but the producers of agro production were financed through the "subsidies" these circumstances determined the low level of social and sanitary-epidemiological service and health care in the region.

That was reflected first of all in the poor supply of drinking water to the 50% of the population, in the shortage of hospitals and other medical clinics.

This situation was much worse in the Aral Sea Basin for the changing of hydrological regime and the destruction of habitation medium, worsening of the quality of water in all the region in all sources with the invasion of the deserts as a result of the level of Aral Sea.

The unfavourable socioeconomic and sanitary conditions and the uncontrolled usage of pesticides up to 20-25 kg per hectare have told negatively on public health in the Aral Sea Basin. During the medical control of the adult population in the Aral Sea Basin there were registered medical disorders at 63.5% of population in Karakalpakistan; 72.6% in Khorezm region of Uzbekistan, in Dashkhovuz and Lebakh viloyat (regions) of Turkmenistan. Children's disorders accounted consequently for 66% and 70%. The rate of medical failures in intestine infectious diseases in the region is three times more than that of other areas in FSU. The situation is alike in Bukharam Dashkhovuz and Kzyl Orda regions.

In this connection this concept may not be examined separately of the problems in the region and of priorities of socioeconomic demands of the population living in this region on creating the satisfactory ecological situation.

The concept is coming out of the general decision of the socioeconomic problems of the region with a view of the growth of population by the 2000 at 1.5 times and by the year 2010 at 2 times.

The modern conditions as political as well as economic bring certain constraints to the solution of the critical issues of Aral Sea Basin. The breaking up of

economic ties with the FSU republics, the inflation growth and the monopoly obstacles have turned this Central Asian zone into the extremely economically and ecologically poor area.

It's quite natural, that the Concept should be based as on general ideas, measures and tasks aimed to come out of the vexing situation of all interested states, as well as on peculiarities and definite goals of each of them.

Taking into consideration the specific aspects in economic, social and economic conditions of every country, the Concept nevertheless puts out an objective of working out the joint measures and outlooks on the formation of the specific and scientific ways of improving the socioeconomic, medico-biological and ecological situation in the Aral Sea Basin.

Considering this, the aims of the Concept are :

- definition of the main trends in region development, in order to provide the necessary level of the social-economic existence with limited water resources, primarily in Aral area and in economically backward regions of the basin considering new economic conditions;
- creation of the right solutions on preservation of ecological balance of the decreased basin of Aral Sea, and of the means for elimination of negative influence of ecological crisis in Aral area;
- improvement of the hygienic and health-care and biological conditions in Aral area;
- definition of the reasonable means on water supply and water resources improvement considering possibilities of watering of Aral area and the economical reasons.

I. The definition of trends of social and economical development under circumstances of limited water resources

The Concept had taken into consideration several variants of development for the region including existing water resources and external water resources.

As a result of study of possible results by 2000 and 2010, the variant, recommended by the Concept, includes radical changes in trends of social and economical development (Improvement of water supplied agriculture together with development of local water-supply systems upto 5 mln. ha. and with more complete utilization of agricultural resources).

The basis of the new way of development in current background is water saves, that is, the reduction of average water spending for one unit of product in all of the fields of national economy.

Under conditions of arid region, the total; economy of water becomes the primary responsibility of the society, because it influences the development and ecological improvement of the region.

These circumstances, considering demographical situation, define the primary trends of reasonable utilization of existing water resources :

- In irrigated agriculture - to ensure strict management of hydromelioration systems and to provide the keeping of water spending of end water-users within reasonable amounts, with further implementation of economic systems of irrigation and watering technologies, that requires investments;

- in consumer systems - to upgrade water supply systems and pipe works, implementation of proper equipment, definition of reasonable spending amounts in city areas and rural areas;

- in industry - to decrease average water spending by implementing the recycling systems, and further by development of non watery technologies.

The limitations of the water resources impact negatively whole social development and require :

- Solution for the food supply problem and improvement of other fields of agricultural industry, basing on water-saving methods, by more complete implementation of existing resources;

- Solution of the employment problem and in common - concerning the whole economy of the region - to make shift from water-demanding technologies rather to labour-demanding ones, try to decrease the amount of water spent in the industry by increasing the amount labour spent, which will also improve the employment situation, especially this should be done in textile, light, food, mining, metallurgy, machinery-building and oil-gas industries;

- Solution for the problem of ecological improvement of region, and primarily the Aral area, by providing the quality control for rivers, and by creating the artificial complexes that will simulate natural purifying of waters;

- The approval of contracts, laws and decrees on water usage, considering old agreements as well as changes in society and economy.

The utilization of water-saving methods and technologies in irrigated agriculture, melioration, other fields of economy will change rapidly the hydrological and economical parameters of watering systems and will decrease the maintenance expenses and increase the reliability of the investments.

Further development of agriculture and industry in Amudarya and Syrdarya rivers basins should be in accordance with requirements mentioned above, and should be conducted by each state within the limits and defined amounts to be able to fulfill the internal needs.

II. The investments

The states of the region have limited abilities for investments. To attract foreign and local investors for creation and improvement of labour-demanding but not water-demanding industry, it is recommended to ensure the creation of favourable conditions such as low taxes for investors and producers, the licence-free and tex-free export of goods, received as compensation for investments and so on.

In order to attract local and foreign private, cooperative and other free funds, it is supposed to be reasonable to promote in any ways the organization of the shared capital enterprises that will be dealing not only with development of watering system, but investing in common economical development of regions. The promotion will include the favourable conditions of credits and refund.

The implementation of resources of international organizations, banks, funds, for fulfillment of different programs concerning the improvement of watering system. This will be achieved successfully by cooperation of states of Central Asia.

III. The means of improvement of living conditions and health care

Considering the high rate of rural population and climate conditions, it is considered most reasonable to solve the problems of employment and increasing of national product by creating in rural zones the factories of end processing of the product, and other labour-demanding small industries. The experience of certain areas on creation of small industries in rural zones is to be supported and developed by the means of enterprises with shared capital of the appropriate level and size. At the same time, pay the most attention to Aral area and other backward zones of the region and for this :

- to require the approval by Central Asian states of legal documents on social status and social aid for people suffered in ecological disasters;

- to provide the special attention and primary consideration for industry and agriculture on expenses of state investment funds;

By 1997, the supply of all the dwellings in Aral area with water should be completed, the hospitals and other health care institutions should be created as well as children institutions, and the special program "Ration" should be conducted. It could be reasonable to buy several lines on water bottling, in order to provide the population of Aral area for minimal price with the clean water, in zones where central watering system will not be introduced soon.

Aral area recovery is not possible without taking practical steps on stopping of pollution of rivers with mineralized post-irrigative drain flows. This is the reason to speed up the building of Left-Bank and Right-Bank tracks. To start working on stopping in nearest years the drain flows drop-in's to Amudarya and Syrdarya and other water arteria of the region, including drop-in's on a territory of bordering states. To locate and define the pollution sources in the basin and create a plan on their elimination, by building of the purifying systems an artificial plates. At the same time, at all levels, from state to single-farm, to create the program of decreasing the water spending per one product unit, thus decreasing the rivers pollutions. To improve and install the biological methods of plants protection, decreasing the usage of pesticides and herbicides, mineral fertilizers, and improve the usage of nitrofication inhibitors in order to increase the strength of fertilizers.

Through the demineralization of post-irrigative drain waters is very expensive and energy spending, consider this to be the subject of primary interest, and develop this field.

Total medical registration and control over the population of the Aral area and location of most usual diseases in order to provide solution on this, assigning people suffered most to certain health care institutions for treatment and control.

Starting in 1994, begin the creation of special health care centers in Aral area.

Until dedicated staff will be trained, keep sending the personnel from other health institutions of state.

The creation of good living environment includes recovery of nature, water, air, improvement of food ration, communications and transport. The recovery of nature is the most important and others depend on it somehow. So the most attention now should be paid to this problem, suing experience of Kazakhstan and Karakalpakistan, help of other countries, Russia and foreign sources.

IV. The solution of Aral problem and creation of system of area watering

The recovery of the sea up to the 53rd mark requires yearly input of 65 square kilometers of water until 2010, without requirements of delta. It is too difficult by now. Keeping of the level at 38th mark is more possible and requires about 30-35 square kilometers a year. But simple to keep it still is not enough because of the natural processes of desertisation.

The researches and the actions conducted since 1989, have let to improve the climate and the condition of the dry bottom parts of sea, allowing even some breeding around.

The aim is to create stable ecological system, that will be improving total situation.

As expert researchers showed, the creation of watered zones in deltas of both rivers will let to decrease the aridity of the climate. The work on creation of artificial ecosystems in deltas and dry sea bottom are to be considered primary (on total Aral level) and should include the following actions :

- Creation of the regulated system of basins for Amudarya and management of the part of Small Sea for Syrdarya;
- Artificially irrigated landscape ecological systems on dry sea bottom and at deltas;
- Phytomelioration on moving sands fixation;
- Including drain flow waters into aguatoria through the sand areas.

At the same time the zones of salt balance should be defined and information obtained should be taken into account while planning.

V. Water resources change forecast used for further definition of resource usage

The forecast is created on information about total refilling resources of two basins, Amudarya and Syrdarya, including underground waters - 120 sq.km. yearly.

The population growth, water supply improvement in consumer field, will help in further development of new water system described above.

Under this conditions, spare water supply for Aral Sea, delta and irrigation are by 2000, 100 thousand sq.km. and by 2010 - 97 thousand sq.km. per year. Among these, the resource for Aral area should be averagely not less than 22,000 sq.km. per year. The amount of water supply exclusively for Aral area is defined yearly by Interstate Commission, considering dryness of the year.

The cooperation is necessary with other states on utilization of external water sources in order to increase the amount up to 30 and more sq.km. a year.

The first step should be the improvement of state level water management institutions. Certain structures created by the governments has already played positive role in situation improvement.

Further implementation of this interstate management system is necessary :

- Creation of legal documents on joint activity of the countries of basin, agreements and rules of participants;
- Development of "Syrdarya II" project, implementation of "Amudarya I" project and introduction of the new methods of water purification;
- Creation inside of management institutions the division of control for underground water systems, quality control and management of appropriate delta areas, monitoring of region natural conditions.
- The improvement of water resources prediction including aerophoto control and glaciers control;
- The monitoring of natural events influencing or connecting with water resources, including the problem of Sarez lake;
- The creation of united policy of joint actions on water saving and constant reduction of average water spending that will free up water resources in region.

The actions on reduction of water spending, drain systems repair and reconstruction and drain flow clearing at Aral area, should be conducted in all the states simultaneously.

The priority should be given to the development of new irrigation technologies such as capillary, in soil, and high-precision irrigation, that should decrease average water spending by 50% and increase product quality.

During reconstruction of drain systems, inside of Aral basin, the priority should be given to low-tech technologies.

Together with this, the average water spending will be decreased by :

- Changes in seed planning for the area;
- While seeding the preference of less water-demanding species;
- Recycling systems implementation.

The important role could be played by improvement of conditions of mountain areas, their forestry, and natural flow system.

The coordinated utilization of these methods by all of the states of region will make economy of 10-11 mln sq.m. of water considering the decrease of secondary waters.

VI. The Concept implementation system

After approval of this document, the schedule is defined, that will include projects, described in Concept. The schedule is to consist of three main steps; urgent (3-5 years), primary (5-10 years), and secondary or long-term (10 years and more).

The definition of projects by these and also regional categories is to be conducted by Interstate Council, with its management institutions and through the governments of the countries.

All the construction works should be financed by and on expenses of states-participants, from funds dedicated to Aral problem by them and by other investors and from grants and credits of World Bank, and other investors.

Confirmed by the Nukus Conference of Heads of 5 States of Central Asia with participation of Vice-Chairman, Russian Federation on 11 January 1994.