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# Environmental Policy and Technology Project

Contract No. CCN-0003-Q-00-3165

## **NEW INDEPENDENT STATES FIELD REPORT**

**Regional Water Pricing Committee Meeting  
Regional Water Pricing Technical  
Working Group/Applied Demonstration  
Project Retreat  
Water Pricing Partnership Activity  
June 23-July 3, 1996  
Medeo, Kazakstan**

**Delivery Order Eight  
Task C and D**

Prepared for:  
Central Asia Mission  
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## Executive Summary

USAID/EPT sponsored three water pricing events from June 23 through July 3. The first meeting of the Regional Water Pricing Policy Committee Meeting was held June 23-25; the Regional Water Pricing Technical Working Group was held June 26-29; and EPT consultants worked with local economists to support applied demonstration projects July 1-3.

High level policy makers and technical experts from throughout Central Asia gathered for two separate meetings on water pricing in Central Asia followed by three days of technical assistance. Participants identified critical factors related to water pricing which include the need to establish water rights and the need to shift production decisions to water users, particularly in the agricultural sector. The participants elicited strong sentiment for reaching inter-republic agreements that address water quality.

In resolution participants of the policy meeting agreed to consider both water quality and water quantity in interstate agreements, consider water pricing as a prerogative of each republic and to consider separate interstate water agreements for the Syr Darya and Amu Darya, provided that the interests of the Aral Sea are taken into account. In this connection, the countries will develop agreements on cost-sharing for water structures (reservoirs, basin, dams and canals) shared by more than one republic, examine trade-offs among various water uses, starting with irrigation and hydropower, and pursue environmental damage assessment as a basis for establishing water prices to compensate downstream users for degradation in water quality.

During the water pricing technical working group meeting dialogue on appropriate approaches to water pricing and compensation, charges for water pollution and resource damage assessment, assessment of trade-offs between water uses, and building decision support systems for water charges and prices for a large river system was substantive and intense. Prior to the meeting, guidelines for project presentations were distributed. EPT asked for focused presentations on work conducted to date and the policy implications of that work. The presenters policed each other to ensure the presentation program was adhered to. The peer interaction was surprisingly open and the technical dialogue on issues which had not before been part of the predominant thinking on resource management was encouraging. Clearly, the researchers take professional pride in their efforts. There was indication that national laws on water pricing and pollution charges are being affected by the work that is taking place in the context of these projects.

Three significant impacts evolved from the USAID-sponsored meetings on water pricing:

- The decision to consider separate agreements for the two primary river systems of the Aral Sea uncouples issues of the two basins and the number of countries involved in each problem. This increases the likelihood of success in reaching water sharing agreements on either one or both river systems in the short term, which will aid in the full implementation of water pricing within the territories of the involved republics.
- The openness of the dialogue and exchange of ideas was unique for Central Asia. This new openness is encouraging and may greatly speed the process of

reaching agreements for water sharing and management in the Aral sea region.

- Recognition of the need for water rights, end user control of production forces and the need for economic damage assessment of environmental impacts of the Aral sea problem clearly framed the direction for local efforts and future support of the international donor community.

## **Recommendations**

1. Support bilateral negotiations on annual and multi-year operating regime of the Toktogul reservoir of the Syr Darya basin.
2. Conduct a preliminary environmental damage assessment to associate the economic costs of failure to act on the Aral Sea basin. This assessment could be used as the basis for water prices attributable to degradation in water quality to downstream users.
3. Continue to emphasize the fact that water pricing cannot be implemented effectively on the republic level without international agreements that establish water rights. To the extent possible, assist the CARs in developing agreements that promote the establishment of water rights.
4. In support of applying water pricing as a demand management tool in Central Asia, recommend that follow up work of the international donor community address agriculture sector reforms to shift production decisions to the local level.



## Section 1 Introduction

### 1.1 Background

The purpose of the Regional cooperation in Water Management Program of the EPT Project in Central Asia is to share US expertise on water management with Central Asian counterparts. The program's objective is to help develop legal, policy and institutional arrangements for the management of a complex international water system with serious environmental problems. It accomplishes this through:

- Identifying areas of broad consensus among key groups in the CARs on the need for policy reform and regional collaboration in water management
- Strengthening multi-disciplinary regional cooperation and non-infrastructure approaches to water management through US-CAR partnerships, workshops, and cross-cutting applied research

### 1.2 Issue

In Central Asia there is only limited experience with the application of water charges of any kind. There is, however, a strong interest within the region as water management authorities seek measures to improve the efficiency of water use, improve water quality and cover the costs of providing water services. In addition, water pricing and effective management of water resources in the context of international trade and energy development has proved crucial to the republics of Central Asia over the last year.

### 1.3 Approach

EPT's approach to promoting adoption of water pricing policies throughout Central Asia is to bring together representatives of water management entities and environmental policy agencies from throughout the region. In these gatherings, the participants work cooperatively to identify issues considered to be the most crucial to solving republic level and regional water management problems. U.S. experts provide technical and analytical support.

The first water pricing activity was the regional water pricing seminar held in Bishkek, Kyrgyzstan in November of 1995. During this three day gathering, participants actively discussed this topic and agreed on an agenda for follow up actions. A consensus was sought and achieved on the basic concepts, on the appropriate roles of country-specific versus regional work, and on a plan of action to be supported by the EPT Project.

Five high priority issues requiring further cooperative study and analysis were identified at the Bishkek meeting, including two regional comparative analyses and three specific subjects:

- Comparative analysis of each republic's experience with water pricing schemes

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- Comparative analysis of each republic's experience with the measurement of water use as it relates to the implementation of water pricing schemes
- Economic evaluation of the operational regimes of existing irrigation and power generating reservoirs considering their basin-wide impacts
- Approaches for using water prices to compensate for changes in water quality

A second activity, a Water Quality Management Working Meeting took place in Bukhara, Uzbekistan in April, 1996. Here concepts relating to water pricing, water pollution charges, and economic damage assessment of poor water management practices were introduced.

#### 1.4 Follow Up on Water Pricing Activities

In response to the opportunities presented by the Bishkek mandates to develop policy, legal and institutional arrangements for implementing water pricing and water pollution charges in the region, EPT has developed a work program with the objective of introducing new concepts and policies. The schedule for this set of activities begins with the Bishkek Water Pricing Seminar and ends with a fall executive retreat of high level regional officials. The key steps in providing assistance in the development and implementation of water pricing and pollution charges for application in Central Asia include:

- **Applied Demonstration Projects (Task B).** Local researchers are undertaking applied demonstration projects related to water pricing. The research will provide analyses related to the high priority issues of cost based water pricing, assessment of trade offs in dam and reservoir operating regimes, and water prices which take into account degradation in water quality. The projects include:
  - **Water Pricing During Economic Transition.** This multi-country project includes investigators from Uzbekistan, Tajikistan, Kazakstan, and Turkmenistan. Its purpose is to investigate cost-based water prices for various water uses, including tariffs for water used in agricultural irrigation.
  - **Scientifically-based Methods of Water Pricing.** This multi-country project includes participation from Kyrgyzstan, Tajikistan, Uzbekistan, Kazakstan, and Turkmenistan. It takes a methodological approach to water pricing and examines tariffs for different aspects of water consumption. It also examines application of water charges attributable to water quality degradation. It will also assess the trade offs in dam and reservoir operating regimes in supplying water for irrigation and hydroelectric power generation.
  - **Economic Damage Evaluation in Water Use.** This is a single country

project which examines the economic damages associated with water pollution originating upstream from Uzbekistan. The work will contribute to the effort considering water prices for changes in water quality.

- **Pricing Policy and Technical Committees (Task D).** In place of a regional conference included in the original scope of work for Delivery Order Eight, EPT is sponsoring smaller meetings to bring together applied researchers to discuss policy recommendations evolving from their efforts. In addition, it sponsors meetings for working bodies such as the Regional Cooperation Working Committee, the Water Pricing Policy Committee, and the Water Pricing Technical Working Group.
- **US-CAR Partnerships (Task C).** With requests to its Consortium members, the EPT project selected environmental economists to support the work of applied researchers above and to provide technical support to the water pricing committee and working group. They were tasked with assisting the committees and researchers in investigating the five issues that evolved from the Bishkek seminar.

## Section 2

# Summary of Water Pricing Activities

USAID/EPT sponsored three water pricing events from June 23 through July 3. The first meeting of the Regional Water Pricing Policy Committee was held June 23-25; the Regional Water Pricing Technical Working Group was held June 26-29; and EPT consultants worked with local economists to support applied demonstration projects July 1-3.

The regional cooperation working committee, including members of the international donor community and related USAID-funded projects were invited to attend both meetings and the follow up sessions. Four professionals from the U.S., in the area of water pricing and compensation, broad-based natural resources economics, water pollution charges and environmental damage assessment, and energy and water trade-offs, served as valuable resource experts for all three activities. Economic expertise was also drawn from locally based resident advisors. In addition to resource economists, a team member from the EPT-sponsored partnership to build an automated decision support system for the Syr Darya, attended both sessions to continue the process of data collection to adapt the system to address water pricing and water pollution charges.

### 2.1 Meeting Preparations

A team of US experts was assembled under EPT Project auspices to support the water pricing activities in Medeo, Kazakstan. The visiting team members, selected from the EPT Consortium under the EPT/CAR partnership program (Task C) included: David McCauley (IRG; water policy, and co-task manager for water pricing efforts); John Keith (Utah State University/CID; cost-based water pricing); Robert Anderson (IRG; water quality and water pricing); and Richard Browning (IRG; power versus irrigation in water policy). In addition, it was arranged for KeongAe Choe (RTI; water economics) to take part in an effort to better link the Research Triangle Institute's RIMDESS partnership effort with other elements of the EPT Regional Cooperation in Water Resources Management component. Considerable preparations were made in the US and CAR by the consultant team and EPT/Almaty staff to ensure that their inputs to the subject meeting and subsequent working sessions would be fruitful.

### 2.2 Regional Water Pricing Policy Meeting

In 1996, a crisis over water sharing arose along the Syr Darya. Faced with diminished supplies of heating fuel the Kyrgyz republic accelerated production of hydropower during the winter period, reducing stores of water available for Kazakstan and Uzbekistan for agricultural production in the spring and summer months. In April, 1996, the governments of Kazakstan, Kyrgyzstan, and Uzbekistan agreed to develop and execute a program of fuel and energy development in Central Asia, making most efficient use of the Syr Darya. In May 1996, the three countries signed a declaration to develop coordinated strategies of water allocation and management for transboundary flow, to develop legislation and economic tools for water resources allocation, and to use the Toktogul hydropower dam in conjunction with a program

of exchange of hydropower, gas coal and oil products. The Water Pricing Policy Committee meeting was designed to build upon these agreements and to build upon results of the 1995 US-AID/EPT Water Pricing Seminar follow up activities.

The purpose of the meeting was to:

- follow up on five issues related to water pricing from the November water pricing seminar in Bishkek
- share world experience on the management of large international river systems to facilitate current and future agreements in the region
- identify constraints to developing water pricing policies and determine necessary actions to remove constraints
- provide technical assistance to all five republics to allow them to develop national policies for water charges which promote increased water availability and improved water quality
- identify areas of consensus among the five republics where possible agreements can be reached in the short term.

This first meeting of the Water Pricing Policy Committee was jointly sponsored by USAID and the Interstate Council for Kazakstan, the Kyrgyz Republic, and the Republic of Uzbekistan. These 3 republics mediated the April/May 1995 agreements of water use along the Syr Darya that resulted in exchanges of energy for agreements on timing of water releases. The Executive Director of the Interstate Council, Mr. Mambetov, served as the meeting's convener. Fifteen local participants who attended were nominated by their respective governments, from the ministries and committees of nature protection, water management, and economy/finance of all five Central Asian Republics. A complete agenda and list of participants can be found attached.

The program included presentations on international experience in the management of large river basins, setting water quantity and water quality priorities, assessing trade-offs in water quantity management, policy instruments to address water quality problems, cost based water pricing and demand management, and implementing water pricing schemes in Central Asia. Republics presented five highest-priority issues. Break out sessions by type of ministry/committee supported inter-republic dialogue on specific topics. Session reports were presented and a resolution was drafted and agreed to based on the two-day activities.

Based on presentations and discussion of world experience the meeting participants identified critical issues relating to the a management of large international river systems. The identified critical issues helped to frame the resolution drafted (attached) and approved by the meeting participants.

- **Compensation for Water.** International treaties are based on mutually

beneficial trade offs in water uses. They generally involve exchanges between countries such as barter exchanges or lump sum payment for water releases. World experience demonstrates that on the international level, application of water compensation rather than water prices is the norm.

- **Water Rights are Essential.** Water rights are essential to application of water pricing. Without a treaty agreement on the allocation of water rights and service rights among countries, it is unlikely that agreements can be reached on operation and maintenance of existing facilities, development of new facilities in the region, or effective application of water pricing on the republic level.
- **End Users Must Pay the Water Price.** For water pricing to be effective in demand management, the price must be paid by the consumer or end user. Therefore, for water pricing to be applied as a demand management tool, production decisions must be shifted to the local level.
- **Water Quality is an Important Component of International Agreements.** International agreements on water pollution are less difficult to negotiate than agreements on water rights and water allocation; and,
- **Environmental Damage Assessment for the Aral Sea Problem is Needed.** Environmental damage assessments can serve as a basis for establishing water charges to compensate for degradation in water quality of transboundary waters.

In resolution, the countries agreed to the following principals:

- The major problem of water management in the region is meeting the basic water needs of the population and the countries' economic sectors under the conditions of water scarcity.
- Both water quantity and water quality are important aspects of human survival and the sustainable development of the republics, and they are appropriate subjects of interstate agreements.
- The pricing of water for various uses, such as municipal and industrial water supply or irrigation, is the prerogative of each republic.
- Separate interstate water management agreements may be negotiated for the two rivers of the Aral Sea Basin, the Syr Darya and Amu Darya, provided that the interests of the Aral Sea are taken into account.

Based on these principals, the republics agreed to:

- develop agreements on cost sharing for water structure (reservoirs, basin, dams and canals) shared by more than one republic

- further examine trade-offs among various water uses, starting with irrigation and hydropower

### **2.3 Water Pricing Technical Working Group**

Subsequent to the Water Pricing Policy Committee meeting, a more technical meeting was held with the EPT Applied Demonstration Project (ADP) subcontractors and other invited researchers. The purpose was to discuss in more detail the subjects of water pricing and water quality management in the context of developing improved regional water policies. The meeting was organized around presentations by the three ADP research teams and by the visiting water policy and economics experts.

This was the second meeting of the regional Water Pricing Technical Working Group. This group is primarily comprised of researchers of the three applied demonstration projects mentioned above. It was held to continue activities which evolved from the Bishkek seminar on water pricing. The objective of the gathering was to provide an opportunity for U.S. experts to provide technical assistance to local CAR investigators and guide pricing and damage assessment work. In addition, the meeting provided an opportunity for peer interaction on the work being done on those ADPs.

The program included presentation and discussion of the following topics: policy instruments for managing water quality and water use, building a river basin decision support system to consider water pricing and pollution charges, results of a comparative analysis of water pricing and water measurement schemes in Central Asia, recent water sharing agreements in Central Asia, and trade-offs in developing dam and reservoir operating regimes.

The dialogue on appropriate approaches to water pricing and compensation, charges for water pollution and resource damage assessment, assessment of trade-offs between water uses, and building decision support systems for water charges and prices for a large river system, was substantive and intense. Prior to the meeting, guidelines for ADP presentations were distributed. EPT asked for focused presentations on work conducted to date and the policy implications of that work. The presenters policed each other to ensure the presentation program was adhered to. The peer interaction was surprisingly open and the technical dialogue on issues which had not before been part of the predominant thinking on resource management was surprising. Clearly, the researchers take professional pride in their efforts. There was indication that national laws on water pricing and pollution charges are being affected by the work that is taking place in the context of these projects.

### **2.4 Technical Assistance Meetings**

The technical assistance meetings following the technical group meeting, consisting of individual small group meetings held over a three day period, were convened to provide U.S. expertise on the application of economic instruments. U.S. consultants were available to work directly with project leaders and to guide their project work.

The follow-up discussions offered an opportunity to go into considerably more detail on the

subjects of water pricing and economic instruments for water quality management. It is anticipated that these discussions and interactions among the participants will have a very positive impact on the quality of the ADP studies. It also provided consensus on some further analyses to be undertaken during the final phase of the Regional Cooperation in Water Resources Management component of the EPT Project.

## **Section 3 Analysis**

### **3.1 Water Pricing Efforts**

The Bishkek meeting on water pricing produced an agenda of five follow-up topics to guide the EPT efforts in this area. As the two workshops reported on here complete this next stage, it is useful to take stock of where things stand with regard to these study areas.

#### ***3.1.1 Water Pricing Policies and Measurement Approaches in Each of the Five Republics***

The EPT project has served as an important vehicle for encouraging the exchange of information among the five Central Asian republics on alternative approaches to water pricing within the region. During April and May, Dr. David Smith conducted a comparative analysis of water pricing schemes and methods of measurement currently in use in Central Asia. This analysis was presented during the meetings and the participants commented on it, made corrections and additions.

The comparative analysis has shown that all five republics now have some form of water charges in place for irrigation and industrial water supply. All but Turkmenistan charge flat rates for urban water supplies. All Central Asian republics also are either already applying or are strongly considering the introduction of water pollution charges, though none are high enough to do anything but raise revenues for possible use in reducing pollution damages. This dialogue will continue through interactions among those institutions cooperating in various aspects of the project, though no further comparative analysis is anticipated.

#### ***3.1.2 Cost-based Water Pricing Methods***

During the Medeo meetings, participants expressed tremendous interest in water pricing methods applied outside of the region. The ADP studies are continuing to develop and apply these approaches in Central Asia.

#### ***3.1.3 Water Pricing and Water Quality Management***

Probably the single most significant insight to emerge from the Medeo deliberations was the chance to further develop links between water pricing policies and the application of economic instruments to addressing water quality management problems in the Aral Sea Basin. There are significant opportunities for well-targeted follow-up analyses under EPT sponsorship, including the possible approximation of pollution-based damages within the two sub-basins as the basis for deciding upon water policies.

### ***3.1.4 Trade-Offs between Irrigation and Hydropower in the Operation of Multi-Purpose Dams***

One of the most important recent economic agreements between Central Asian states relates to the balancing of irrigation and hydropower interests on the Syr Darya River among the Kyrgyz Republic, who are seeking hydropower generation in the winter, and Uzbekistan and Kazakstan, who both want water released in the summer to support their agriculture sectors. Only limited analysis has been conducted to date of the real trade-offs between these two high-valued water uses. As part of the Water Pricing Policy Working Group meeting, it was agreed that further work should be conducted on this subject. There appears to be interest in linking this effort with ongoing energy sector analyses. Contact with this work should be maintained.

### **3.2 Applied Demonstration Projects and Partnerships**

The meeting of the Water Pricing Technical Working Group was designed to allow the three relevant ADP research teams to discuss their work in progress amongst themselves and with the assembled U.S. experts. All three teams showed good progress with their work, and there were intensive interactions with the U.S. experts, funded as partners under Task C, on both methodological and practical issues. Continuation of such support for all pricing activities can be considered in connection with other elements of the EPT/CAR policy component.

With the presence of the RTI partnership team's economist, there was also an opportunity to explore better links between the water pricing activities and the decision support model that RTI is currently adapting for the Syr Darya. It would seem advisable to take a hard look at the stated objectives of the effort and its accomplishments to date to see if adjustments are warranted in light of the recent flurry of discussions on this subject.

### **3.3 Support for Regional Water Management Agreements**

These meetings definitely helped to lay the basis for further progress on regional water management agreements. Several key points of principle were reached, and some specific follow-up actions identified. The EPT Project would be advised to consider possible support for the development of bilateral agreements on minor irrigation works as well as to revise and expand the annual water-power three-state agreement on the Syr Darya River. These two opportunities may well constitute the best prospects for the planned Executive Retreat to be sponsored by the EPT project before the end of 1996.

## **Section 4**

### **Findings**

The following three observations constitute the most important conclusions concerning the future of the Central Asian EPT Project water policy efforts.

#### **4.1 Water Pricing**

- There currently appear to be only limited prospects for interstate use of water pricing mechanisms, though considerable progress continues to be made on country-level applications--at least in part influenced by EPT Project efforts.
- For water pricing to be applied on a large scale within the republics, water rights must be established through interstate agreements.
- For water pricing to be effective as a demand management tool, end users must be responsible for paying the price. Currently, centrally planned governments are in control of the factors of production in the agriculture sector, the largest water user in the region. Therefore, production decisions in the agricultural sector must be shifted to the farm level for pricing to work within the respective republics.

#### **4.2 Economic Instruments for Water Quality Management**

There clearly are intriguing opportunities for the application of effluent charges and other economic instruments for the management of water quality in the Aral Sea Basin. This should constitute the single most important area for further project-sponsored analysis--particularly if tied to the ADP research on water quality management.

#### **4.3 Development of Interstate Water Agreements**

If handled carefully, there should be good opportunities to support the development of bilateral agreements on minor irrigation works as well as the revision and expansion of the annual water-power three-state agreement on the Syr Darya River.

## Section 5 Conclusions

Three significant impacts evolved from the USAID-sponsored meetings on water pricing:

- The decision to consider separate agreements for the two primary river systems of the Aral Sea uncouples issues of the two basins and the number of countries involved in each problem. This increases the likelihood of success in reaching water sharing agreements on either one or both river systems in the short term, which will aid in the full implementation of water pricing within the territories of the involved republics.
  
- The openness of the dialogue and exchange of ideas was unique for Central Asia. This new openness is itself encouraging and may greatly speed the process of reaching agreements for water sharing and management in the Aral Sea region.
  
- Recognition of the need for water rights, end user control of production forces and the need for economic damage assessment of environmental impacts of the Aral Sea problem clearly framed the direction for local efforts and future support of the international donor community.

## Section 6 Recommendations

- Support bilateral negotiations on annual and multi-year operating regime of the Toktogul reservoir of the Syr Darya basin.
- Conduct a preliminary environmental damage assessment to associate the economic costs of failure to act on the Aral Sea basin. This assessment could be used as the basis for water prices attributable to degradation in water quality to downstream users.
- Continue to emphasize the fact that water pricing cannot be implemented effectively on the republic level without international agreements that establish water rights. To the extent possible, assist the CARs in developing agreements that promote the establishment of water rights.
- In support of applying water pricing as a demand management tool in Central Asia, recommend that follow up work of the international donor community address agriculture sector reforms to shift production decisions to the local level.

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**Appendix A**  
**RESOLUTION**  
**Meeting of the Environmental Policy and Technology Project**  
**Regional Water Pricing Policy Committee**  
**24-25 June 1996, Medeo, Kazakstan**

**Preamble**

Government representatives from the Republic of Kazakstan, the Kyrgyz Republic, the Republic of Tajikistan, the Republic of Turkmenistan and the Republic of Uzbekistan met in Medeo, Kazakstan to discuss issues of mutual interest relating to the waters of the Syr Darya and Amu Darya River Basins which are common to these republics. The meeting was held in a congenial atmosphere with the purpose of identifying fundamental principles of water and energy resources management based on international experience with such issues which may inform decision making concerning the disposition of common waters within future interstate agreements. In particular, the participants discussed the use of economic instruments, including the pricing of water and mechanisms for investments financing, both the operation and maintenance of existing structures as well as the costs of future projects.

The meeting participants took full account of the interstate agreements already in place which establish a preliminary basis for the exchange of fuel-energy and water resources of the three parties to such agreements, namely, the Republic of Kazakstan, the Kyrgyz Republic, and the Republic of Uzbekistan. The participants also acknowledged the various statements of and institutional steps taken by the Heads of States of the five Central Asian states on the problems of the Aral Sea Basin's sustainable development, most recently reaffirmed in the Declaration adopted by the Nukus International Conference on Sustainable Development of the Countries of the Aral Sea Basin in September 1995.

**Principles**

As a result of their discussions and review of international experience with the management of large river basins, the participants recommend the adoption of the following four principles in future efforts to achieve regional consensus on water and energy resources management in Central Asia:

1. ***Basic Needs.*** The major problem of water management in the region is meeting the basic water needs of the population and the countries' economic sectors under the conditions of water scarcity. The priority direction is to provide the population with good quality drinking water.
2. ***Water Quantity and Quality Management.*** Both water quantity and water quality are important aspects of human survival and the sustainable development of the republics, and they are appropriate subjects of interstate agreements and integration.

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3. ***Water Pricing.*** The pricing of water for various uses, such as municipal and industrial water supply or irrigation, is the prerogative of each of the states.
4. ***Interstate and Institutional Agreements.*** In the process of developing regional water management agreements, the specific roles and responsibilities of the Interstate Council of the Aral Sea and its associated bodies will be established, including potential functions relating to river basin planning, monitoring and data management, and involvement in the operation of agreed water management schemes. Separate interstate agreements may be sought for the Syr Darya and Amu Darya Basins by the republics concerned, to take into account the interests of the Aral Sea.

### **Specific Recommendations**

Participants of the meeting split up by three sections groups for the development of the below stated concrete proposals on short-term and longer-term proposals on follow-up measures under the following topics:

#### ***I. "Transboundary Water Quality Management"***

##### **Short-term measures**

1. On the basis of bilateral and multilateral agreements, the interested countries will take equal part in elimination of existing transboundary water pollution sources.
2. Undertake to prevent the development of industries, which may have negative impact on the environment, including water resources.
3. Undertake to accelerate solution of the water pricing problem.
4. Recognize the necessity of increased international assistance in addressing water quality problems in the Aral Sea basin.
5. Undertake to develop interstate standards for clean water.
6. Establish joint water quality monitoring stations on the borders.

##### **Longer-term measures**

Implement all country and regional activities following the idea of sustainable development.

#### ***II. "Different Water Uses and Water Pricing"***

##### **Short-term measures**

1. Establish water pricing on the basis of water delivery and distribution costs.

2. Develop and improve water pricing mechanisms.
3. Allocate targeted credits for water users by the government.

#### Longer-term Measures

1. Conduct water pricing studies.
2. Improve the legal and regulatory documents of the states to bring the sides together for the sake of reaching common ground.
3. Implement project cost recovery through water pricing.
4. Introduce non-governmental forms of water management.

### *III. "Issues for Interstate Agreements on Water Management"*

#### Short-term Measures:

1. Water structures (reservoirs, basins, dams and canals) shared by more than one republic should be identified and agreements on cost sharing should be signed.
2. A proposal should be prepared to develop a simulation exercise which will examine--in a forward-looking manner--the trade-offs among various water uses, starting with irrigation and hydropower.

#### Longer-term Measures

The agreed long-term goal is to establish comprehensive agreements on water resources management in the Syr Darya and Amu Darya Basins, which would incorporate all previous agreements relating to each basin and also take into account the interests of the Aral Sea.

#### Conclusions

The participants concluded that the meeting represented a very positive step towards achieving consensus on a range of important issues which will guide future water resources management agreements in Central Asia. They further recommend to their governments that:

- the principles outlined in this document be adopted as the basis for future agreements; and
- immediate steps be taken to resolve the specific issues identified in the previous section of this document, including further analyses to support their implementation.

**Appendix B**  
**RESULTS OF BREAK-OUT SESSIONS**

**Break-Out Group Summary Report I**

**Theme:** Different Water Uses and Water Pricing

**Objective:** To reach consensus related to introduction of water charges for water delivery, to development and improvement of water resources.

**Areas of Agreement:**

1. Charges for services to improve water resources.
2. Charges for services to deliver and allocate water.
3. Rapprochement of legislation to develop mechanisms for implementation of agreements.

**Short-term Measures:**

1. Establish water pricing on the basis of water delivery and distribution costs.
2. Develop and improve water pricing mechanisms.
3. Allocate targeted credits for water users by the government.

**Constraints:**

1. Water user inability to pay.
2. Countries' unequal attitudes and understanding of water pricing issues.
3. Different transition tempos of countries to market economy.

**Longer-term Measures**

1. Conduct water pricing researches.
2. Improve and unify legal and regulatory documents for bringing the Central Asian countries together.
3. Implement project cost recovery through water pricing.
4. Introduce non-governmental forms of water management.

## **Break-Out Group Summary Report II**

### **Theme: Transboundary Water Quality Management**

**Objective:** Transboundary waters should be clean, chemically harmful and toxic elements in them should not exceed maximum permissible concentration (MPC.)

### **Areas of Agreement:**

1. For the first step all Central Asian countries will have equal cost shares to decrease water pollution resulting from former Soviet economic activities.
2. Will observe the principle "Polluter pays" if pollution exceeds MPC. If a user wishes to have cleaner water, then the "User pays" principle will be observed.

### **Short-term Measures:**

1. On the basis of bilateral and multilateral agreements the interested countries will take equal part in elimination of existing transboundary water pollution sources.
2. Undertake to prevent the development of industries which have negative impact on the environment, including water resources.
3. Undertake to accelerate solution of the water pricing problem.
4. Recognize the necessity of increased international assistance in addressing water quality problems in the Aral Sea Basin.
5. Undertake to develop interstate standards for clean water.
6. Establish joint water quality monitoring stations on the borders.

### **Constraints:**

Social and economic reasons.

### **Longer-term Measures**

Undertake to implement activities following the idea of sustainable development.

## **Break-out Group Summary Report III**

### **Theme: Issues for Interstate Agreements on Water Management**

**Objective:** To establish the appropriate subjects for future interstate agreements on water management and to identify steps that can be taken to promote the development of such agreements.

#### **Areas of Agreement:**

1. Separate agreements on the Syr Darya and Amu Darya Basins can be negotiated, provided they take into account the interests of the Aral Sea (including the possible specification of minimum flows).
2. The costs of operating and maintaining water and energy structures (dams and canals) which serve more than one republic should be shared on a proportional basis tied to the water allocation.
3. Meeting basic needs for water supply within Central Asia should be a high priority in any future interstate agreements on water management.
4. Water pricing within the boundaries of each Central Asian country is the responsibility of each country.
5. Future interstate agreements on water management should acknowledge the decisions taken by the Heads of State in establishing the Interstate Council on the Aral Sea and its associated agencies, with specific and limited functions to be included in the agreements.

#### **Short-term Measures:**

1. Water structures (reservoirs, basins, dams and canals) shared by more than one republic should be identified and agreements on cost sharing should be signed.
2. A proposal should be prepared to develop a simulation exercise which will examine -- in a forward-looking manner -- the trade-offs among various water uses, starting with irrigation and hydropower.

#### **Constraints:**

1. The working definition of "transboundary waters" needs further clarification to serve as the basis for interstate agreements.
2. It was agreed that water is an important natural resource for management in the region, but no consensus was reached on the definition of "water as a natural resource" as it relates directly to water pricing.
3. No consensus was reached on how to assign initial rights to water within the Aral Sea Basin.
4. No consensus was reached on the issue of inter-state compensation for water transfers.

#### **Longer-term Measures:**

The agreed long-term goal is to establish comprehensive agreements on water resources management in the Syr Darya and Amu Darya Basins, which would incorporate all previous agreements relating to each basin and also take into account the interests of the Aral Sea.

**Appendix C**  
**Comparative Analysis of Water Pricing in the Central Asian Republics**

<b>WATER USE/ COUNTRY</b>	<b>IRRIGATION</b>	<b>INDUSTRIAL</b>	<b>URBAN</b>	<b>HYDRO- POWER</b>	<b>IN-STREAM FLOWS</b>	<b>POLLUTION CHARGES</b>
KAZAKSTAN	“Symbolic” water prices (14 tyn/m <sup>3</sup> ); in new water law, price based on water as a “natural resource.”	Some water charges, but industries currently not paying.	Cold and hot water charges per capita flat rates.	Part of agreement with Kyrgyz, barter arrangement.	No pricing for any services provided by in-stream flows.	Effluent charges two rates below and above norms, but not fully implemented.
KYRGYZ REPUBLIC	Water charges: valleys (1.5 tyn/m <sup>3</sup> ); hills (0.5 tyn/m <sup>3</sup> )	Some water charges, but industries currently not paying.	Cold and hot water charges per capita flat rates.	Use of water in irrigation incurs some opportunity cost.	No pricing for any services provided by in-stream flows.	Considering an effluent charges scheme.
TAJKISTAN	Water charges for some irrigation schemes.	Some water charges, but industries currently not paying.	Cold and hot water charges per capita flat rates	None, though electricity priced for various uses.	No pricing for any services provided by in-stream flows.	Considering various effluent charges schemes.
TURKME- NISTAN	Fixed water allocation and charge; 3x charge if over allocation.	Some water charges, but industries currently not paying.	Water is free of charge.	None, though electricity priced for various uses.	No pricing for any services provided by in-stream flows.	Modified effluent charges for “rent” of water.

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## Comparative Analysis of Water Pricing in the Central Asian Republics

<b>WATER USE/ COUNTRY</b>	<b>IRRIGATION</b>	<b>INDUSTRIAL</b>	<b>URBAN</b>	<b>HYDRO-POWER</b>	<b>IN-STREAM FLOWS</b>	<b>POLLUTION CHARGES</b>
UZBEKISTAN	Water provided free; collectives pay O & M, rest by the State.	Some water charges, but industries currently not paying.	Cold and hot water charges per capita flat rates.	Part of agreement with Kyrgyz, barter arrangement.	No pricing for any services provided by in-stream flows	Effluent charges two rates below and above norms, but not fully implemented.
INTER-STATE ASPECTS	Water-energy agreement in principle an equal trade; sharing O & M costs for joint facilities.	No interstate pricing for surface or ground water used by industry.	No interstate pricing for surface or ground water used by municipalities; may share O & M costs for joint facilities.	Water-energy agreement implies price for hydro-power; also opportunity cost.	No interstate pricing for maintaining in-stream flows.	No inter-state water pollution charges yet, though concept under consideration along with damage payments.

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## **Appendix D**

### **Consultant Issue Papers**

#### **ISSUE PAPER: VALUE OF WATER AS A NATURAL RESOURCE**

Dr. Robert Anderson

**Issue:**

Historically, authorities in Moscow were responsible for developing and allocating water resources in the five Central Asian Republics. Municipal, industrial and agricultural users had priority in these allocations, with little or no concern for the environment. Recently, water managers in some of the republics are advancing the concept of water as a natural resource. Better information about this value could help enormously in the allocation of scarce water resources in the region.

**Background:**

A recurring theme in the Medeo meetings on water pricing held between June 23 and June 30, 1996, was that water had a value as a natural resource. This value might be attributed to the productivity of water for generating electricity, as an input to agriculture, as an input to industrial production, for use to meet basic human requirements, or for ecological and environmental reasons.

A base value of water as a natural resource may be established conceptually in terms of the environmental services water provides. These services include such things as fisheries, support of wildlife, natural vegetation, and the like. Indirectly, human health and agricultural productivity can be affected by a lack of water in the environment if vegetation dies, lakes recede, soils become unstable and airborne, climate changes and other related effects. Municipal, agricultural, industrial users of water should pay at least this base value to compensate the losses to nature.

In most parts of the world, water can be diverted from nature for human uses without causing measurable impacts on the environment. In water scarce regions such as Central Asia, however, the environment can be severely damaged by diversions of water.

**Implications for Central Asia:**

Adverse environmental effects in the Aral Sea basin over the past three decades provide a basis for estimating the value of water as a natural resource to the area. Take as the baseline the environmental situation preceding human interventions that diverted to agricultural uses most of the waters formerly flowing to the Aral Sea. The ensuing decline of the Aral Sea from a volume of 1,090 cubic meters in 1960 to a present volume of less than 60 cubic meters has caused widespread environmental damage with serious consequences for human health and agricultural productivity in the region adjacent to the Sea.

Scientific studies conducted over the past several years have documented in detail the decline in environmental conditions, in human health, and in agricultural productivity in the region of

the Aral Sea. While methods exist for placing economic values on all of these effects, none of the scientific studies takes the analysis that far.

An economic assessment of the adverse effects resulting from the decline of the Aral Sea would provide a minimum value as a natural resource for the waters that were diverted from the Sea. For example, if the damage amounted to \$10 billion, the value on each cubic meter of water in the Aral Sea would be approximately one cent. (Computed as \$10 billion divided by 1000 cubic km or 1000 billion cubic meters).

This base value for water as a natural resource could be compared to the prices currently charged to municipal, industrial, and agricultural users. In a sense, one might say that the Aral Sea region is also a user willing to pay one cent (or whatever was calculated) for each cubic meter. To the extent that water was being diverted away from use by the Aral Sea and to lower valued uses, water resources are being misallocated.

In the long run, the economic welfare of the region would be enhanced if water were allocated to the uses in which it is most valuable. Such an allocation can be done on the basis of price: a base price for water as a natural resource plus the cost of delivery service.

A water pricing system would generate large revenues. These funds could be allocated for maintenance of the water management system (dam repair, lining canals, municipal and rural water treatment facilities, cleanup of leaking mining sites, and the like) and for compensation of those whose livelihood is adversely affected (training costs for agricultural workers who lose their jobs, moving costs, and the like).

#### **Area of Consensus:**

1. Participants of the water pricing policy and water pricing methods workshops in Medeo agreed that further study of the value of water as a natural resource would be desirable. Methods for pricing both water quantity and water quality need to be worked out.
2. During the second workshop, Mr. Aganov presented a comprehensive system for cataloging the damage caused by decreases in water quality and quantity that was well received by the participants.
3. Dr. Rafikov indicated that environmental and water resource administrators in all five republics would be very interested in the results and that he would not anticipate any opposition to such a study.

#### **Potential Constraints:**

The principal factors that might limit such an analysis are financial and analytic resources. At least one person skilled in resource valuation and damage assessment would be required. As far as can be ascertained people trained in the methods of economic damage assessment are rare or nonexistent at present in the five republics. However, such expertise is available from consultants.

Other obstacles might arise from the different perspectives of the five republics. Republics located in the upstream parts of the Aral Sea watershed have few resources other than water

and would like to have a rationale for charging for delivering water. Republics located in the downstream reaches would like to impose charges on upstream republics for water that is of substandard quality. With these narrow self-interest perspectives, problems in the immediate Aral Sea area tend to be neglected. Documenting the extent of loss in the Aral Sea region might be viewed as a threat by some water resource managers in the five republics (though this was not observed at either workshop).

**Recommendations:**

EPT could initiate a damage assessment of the environmental effects in the Aral Sea region to serve as a basis for calculating the value of water as a natural resource. According to Dr. Rafikov, many of the scientific studies that would provide the foundation for an economic assessment of the environmental impacts near the Aral Sea are located at The World Bank headquarters in Washington, D.C. Other potentially useful materials reside in various ministries and other organizations in the five republics and in Moscow, but access to some of these resources might be difficult as some are classified and for others there could be an access charge. Dr. Rafikov, Mr. Aganov and Mr. Nesterenko agreed to help locate necessary materials if such a study were conducted by EPT.

The intention would be to present preliminary results of these calculations to high level officials during the executive retreat planned for late in 1996. Further refinement of the methods and analysis might be supported by HIID or other US-AID contractors in 1997.

## **ISSUE PAPER: DESIGNING POLICIES TO IMPROVE WATER QUALITY**

Robert Anderson

### **Issue:**

Water quality in the Amu Darya and Syr Darya watersheds has deteriorated over the past two or three decades due to heavy metal contamination from mines and industrial discharge, biological oxygen demand from municipal sewage, and runoff from nonpoint sources such as agriculture and logging activities. Poor water quality is a concern for human health as well as agricultural productivity. The June 26, 1996 Medeo resolution proposes to impose charges at national boundaries for substandard water quality, but provides no basis for setting the charges.

### **Background:**

With support from the U.S. Agency for International Development, the EPT Project held a three day meeting on water quality management in Bukhara, Uzbekistan from April 16-18, 1996. The purpose of the meeting was to identify the major water quality problems of the region and to focus attention on the policy mechanisms and actions, including both regulatory measures and incentive mechanisms such as effluent fees and water pricing, that are needed to improve water quality management in the Aral Sea Basin.

At the Bukhara meeting representatives from all five republics working under the World Bank/ICAS program 3 presented interim findings on major water quality management issues in the Aral Sea Basin. Major pollution sources include industrial, urban and agricultural activities. Agricultural runoff increases mineralization (principally salinity) and also carries pesticides, herbicides, fertilizer residues and animal wastes. Industrial sources discharge petroleum fractions, heavy metals, and other toxic substances. Old mining sites release heavy metals, particularly in the upstream republics. Although most cities have sewerage systems, there is little treatment of wastes.

A principal finding of the Bukhara meeting was that monitoring data are very limited. Of 26 monitoring stations on the Syr Darya River, only 8 were functioning by 1996, with only one station providing a full range of water quality parameters. The limited monitoring data show that nitrates and phenols are typically 2 to 4 times designated maximum acceptable concentrations (MAC), pesticide residues 4 to 8 times MAC, and salinity levels up to 2 grams per liter.

### **Implications for Central Asia:**

Poor water quality has adverse implications for human health, agricultural productivity and the environment. At the June, 1996 Medeo meetings several representatives from the five republics described some of these impacts: a life expectancy in the lower basin as much as 20 years less than in upstream areas; decreasing agricultural productivity, and sharp declines in wildlife and fish populations.

**Areas of Consensus:**

1. Transboundary waters must not contain harmful elements above maximum acceptable concentration (MAC) limits.
2. All five Central Asian republics should share equally in the reduction in pollution caused by former Soviet activity (such as old mining sites).
3. The polluter pays principle should be observed for waters at national boundaries. Water sending republics would pay receiving republics for waters exceeding MAC limits, with the respective republics charging polluters in the sending area and (possibly) compensating users in receiving areas. If the receiving republic desires to have cleaner water (concentrations of pollutants below MAC), the receiving republic should pay.
4. A need exists to establish consensus on MAC, particularly at national boundaries, and these MACs probably should reflect international norms.
5. International financial and technical assistance should be sought in dealing with water quality issues in the five republics.

**Potential Constraints:**

The Medeo resolution seems to provide the basis for addressing water quality problems in the region, especially at national boundaries. However, it may prove difficult to address water quality problems separately from water quantity problems. Further, the agreement does not specify what quality water should be received by the Aral Sea and how compensation to the Sea for substandard water would be paid. Finally, and perhaps most importantly, the resolution provides no guidance on setting the charges for substandard water.

**Recommendations:**

Damage assessment techniques are directly relevant to water quality issues. The charges that should be imposed for failing to meet agreed-upon MAC levels ideally would be determined through region-wide damage assessments. To conduct the appropriate damage assessments, water administrators in the five republics will have to learn these methods and agree upon protocols. While damage assessments cannot reasonably be expected to be done for every pollutant at every national boundary, it appears that the most important pollutants could be identified and their effects quantified in economic terms.

The logical next step would require some training of regional economists and resource managers in the techniques of damage assessment and (perhaps) a case study assessment of a prominent CAR water quality/quantity problem by international experts.

## ISSUE PAPER: COST ALLOCATION, PRICING, AND THE EFFECTS OF PRICING IN A COMMAND SYSTEM

Dr. John Keith

### Background Presented:

Demand can be managed through pricing. The higher the price, the lower the quantity of use, as world experience in elasticities suggests. However, this requires that the end-user pays for water on a volumetric basis and adjusts his or her consumption to changing prices. For irrigation, this means that production changes are made (both in terms of cropping patterns and technical production activities) as price changes. For cost allocation and pricing among countries, unless each country adjusts its consumption based on price, demand for water will not change. Demand management is effective only in a relatively free market system with reasonably certain property rights.

Cost allocation is reasonably well understood, and the methods being developed in the ADP's appear reasonably consistent with international practice, although costs of some national agencies which may not be directly related to project management are included (Ministry of Ecology, Ministry of Forestry, etc.) are included in the calculations for some republics. Normally, these agencies would be financed from general funds. An agreement about the use (rights) to water among countries, however, is contentious at best, although the cost allocation processes being developed are based on proportional use. Two problems arise: First, without an agreement to property rights, cost allocation is more applicable to national, rather than international, frameworks and the over utilization of the flows is likely to continue. Second, the limit of the ability of users to pay (to benefits derived from water use) is not explicitly considered in the allocation process (as it is in the SCRB methods). Thus, it is likely that end users will be assigned costs in excess of their ability to pay.

### Implications for Central Asia:

Until property rights and markets for commodities are established for irrigation in these republics, pricing will be relatively ineffective in controlling demand. Cost allocations among and within countries is proceeding reasonable well, on a theoretical level, and water payments seem to be somewhat consistent with water delivery in those countries in which costs are allocated to users. However, in some countries, the prices paid to irrigators for their products are controlled, as are production "orders" and those prices are substantially below world market prices net of transport costs. This suggests that national governments are gaining the rents to irrigation and that few irrigators are able to pay significant water charges. Thus adjustments of consumption based on price are questionable. Water allocations among countries is a necessary condition for full cost allocation, but is an area of dispute.

### Areas of Consensus:

- There is general agreement that monetary and in-kind exchanges among countries are feasible and desirable in the short run.
- The representatives agree in general that cost-based pricing is the choice of pricing

mechanisms to users.

- There is a general interest in exploring a range of cost-based pricing mechanisms.
- Pricing of water to end-users is a national concern, rather than an international one.

#### Constraints to progress or resolution:

- There is not an agreement with regard to pricing of water as a "natural resource," both internationally and nationally, which is a basic concern of all countries. This problem involves both the trade-off between energy and irrigation and environmental issues.
- The transition to market economies in irrigation is very different among the republics; it is essentially non-existent in at least two. The irrigated agricultural sector is clearly perceived as of primary importance to the republics' economies and will likely continue to be highly subsidized.
- Irrigators are not capable of paying even the separable costs of O&M in most countries, particularly in the controlled-production republics.
- The concept of demand management through pricing is not well established among economists in the republics.
- There is not a clear definition of water rights at the international or the national level; riparian rights systems appear dominant internationally. Even in the U.S., riparian rights are generally established on a case-by-case basis in the courts. Water rights are absolutely essential for water markets. At this time, the concept of water markets is not well established in any republic. There is a clear unwillingness to attack the issue of international allocation of water rights. However, an equitable allocation of rights is a difficult problem.

#### Conclusions:

- At this time, a full demand management scheme using water pricing appears to be beyond the realm of possibility.
- Until property rights and free markets are developed, particularly for irrigators, there is little opportunity for pricing as demand management tool, or for the development of local water markets. The development of international water markets is possible, but likely even further in the future. It should be noted that the current agreements on exchange of energy for irrigation water is a step toward monetizing water exchanges among countries. However, such exchanges (compensation) will not affect water consumption unless the compensation is applied to end-users.
- Cost allocation methodologies could be improved in some countries. However, without an implicit or explicit agreement about water allocations among countries, cost allocation will likely be on a year-to-year basis.

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### Recommendations:

- EPT could encourage development agreements about property rights to markets on a short and long term basis at the ministry level or above. A consistent, equitable, and acceptable method(s) of allocating those rights in each river basin should be developed. However, it should be clearly understood that any such agreement must come from negotiations among the republics themselves. It is necessary that the republics and administrators understand that property rights are a necessary condition for cost allocation, pricing, and water markets.
- EPT could encourage open discussion of the results of the EDP's among both the technical committee and at the high official level. This discussion was particularly helpful to all. It seems clear that there is a general agreement with regard to methodology of cost allocation. The next step will be to apply the methodology internationally, which will mean that water allocations among countries will become an important issue which has to be resolved.
- EPT could emphasize that so long as markets remain command-based, pricing will have little effect on consumption. The development of water user associations should be encouraged, but these associations will have little impact on overall water use unless production decisions can be made at the local level (and prices and costs are free to reflect market conditions).

# ISSUE PAPER: INCLUSION OF ENVIRONMENTAL COSTS IN COST ALLOCATION AND PRICING

Dr. John Keith

## Background:

The issue of environmental costs is clearly of importance to cost allocation and pricing. Clearly, the costs of environmental degradation are extensive, both in terms of human health and productivity. The principal issue in cost allocation is, it seems to me, the salinity issue arising from irrigation (which includes the lack of water for dilution of return flows). While methods of calculating the costs of reduced water flows and increased salinity may have significant methodological problems, it is essential that some estimate of those costs be included in the allocation process. There was considerable discussion in the break-out sessions relative to this issue.

## Implications for Central Asia:

The impacts of water diversion, consumption, and pollution on the Aral Sea must be considered by the republics in their calculation of costs. This means that some estimate of the costs must be attempted, and that an agreement about these costs must be reached. Clearly, this is more than a one-basin problem, so that the allocation of costs between the two river basins will be necessary. All five republics must participate in this determination (as opposed to cost allocation for existing structures and operation within each river basin).

## Areas of consensus:

- The environmental costs of current water use are important, and environmental costs should be considered in water management.
- The trade-offs between production and water use and environmental damage must be assessed in each country and in the region as a whole.
- There appears to be general agreement about regulating point sources, and about using prices for that regulation, as well as a shared responsibility for existing but non-functioning point sources, such as mines.

## Constraints to progress or resolution of problem:

- The low and dropping agricultural production creates a problem with the implementation of environmental cost allocation, at least as it impacts water use. Clearly, the republics dependent on irrigated agriculture are not willing to trade that production for decreasing salinity and water use. Thus, regulation of non-point sources does appear to be contentious among the republics.
- The use of prices to regulate non-point sources has proven ineffective in developed nations. At best, use of input taxes have been relatively ineffective.
- The concept of the price of water as a "natural resource" seems to have an environmental aspect, but that concept is not firmly understood or agreed upon by the republics. A

categorization of the value of water quantity and quality is not consistent.

- The concept of water rights (quantity and quality) across boundaries is also clearly contentious. There is some dispute about the polluter pays principal, and upstream republics refer often to a consumer pays principal.

#### Conclusions:

- It is possible to achieve some agreement about control of point sources and of the distribution of costs of clean-up for those sources among countries.
- Application of charges to point sources may be feasible in the short run, but estimating the damages for inclusion in cost allocation is problematic.
- Regulation of non-point sources is probably not feasible in the short or longer run. Clearly, pricing mechanisms are not applicable in any easy way to non-point sources in the republics.
- The opportunity costs of salinity control and increasing flows to the Aral Sea are perceived as very high in the irrigating republics.

#### Recommendations:

- EPT should encourage further discussion of the application of pollution taxes and or tradable permit systems for non-point sources should be pursued by the technical and policy committees. This seems to me to be the most fruitful area of focus at the moment.
- Pricing of non-point pollution should be dropped from consideration probably for both the short and medium term.
- Specific inflow requirements to the Aral Sea (quantity and quality) appear to be the only real avenue to improving or maintaining the condition of the Aral Sea. EPT should sponsor discussion and negotiation on these specifications should be of primary concern. International community involvement is probably going to be required (most likely in the form of either rehabilitation subsidies or "purchases" of water).
- Freeing up agricultural markets may allow some further pricing mechanisms to be used for pollution control and demand management, but without functioning markets at the farm level, those mechanisms will be fruitless.

## ISSUE PAPER 3 - PRICING OF INTERNATIONAL WATER

Dr. John Keith

### Issue:

The pricing of water at national boundaries is a significant issue. This price was termed by some as the "natural resource price" of water. It is not completely clear what this term means in different republics. However, the pricing of water volumes at national boundaries is not found in the international experience, and neither are water markets. Further, given the system of market control, it is doubtful that volumetric pricing at boundaries would change consumption patterns.

### Background:

The presentations relative to this issue were primarily concerned with the international experience in water pricing and cost allocation. As indicated above, pricing is not generally used for allocations among countries; treaties dealing with quantities of water and services among countries, cost allocation, and compensation are the rule. The difference between pricing (volumetric) and cost allocation and compensation (fixed sums) was emphasized. Also, the Western definition of the "natural resource value" of water - that is the value of the marginal product and the opportunity cost of water in other uses - was presented. Thus, the trade-off between irrigation and hydropower is a critical issue in the Central Asian Republics.

### Implications for Central Asia:

The allocation of water and services among the countries is critical to the efficient use of water in the two river systems. These will have to be decided (and implicitly have been recognized) by treaty. Cost allocation among countries for construction, operation, maintenance and rehabilitation of facilities should be accomplished. As it is, there is a general neglect of infrastructure and a free-rider aspect to operation and maintenance. An agreement about the value of water in alternative uses and in the different republics will be necessary for overall basin management.

### Areas of consensus:

- The interstate flows are critical to the well-being of the republics in the river basins, and to the Aral Sea.
- There is a value associated with the release of stocks from the reservoirs which serve more than one country. However, the determination of that value is problematic.
- The costs of maintenance of joint facilities should be shared based on some equitable solution.

### Constraints to progress or resolution of the problem:

- There is a lack of agreement about the valuation of water at the border; that is, the definition of the "natural resource" value of water is significantly different among countries.

- The trade-offs between countries is of significant importance to water allocation, and the recent agreements are an indication of that trade off. However, long term solutions will require an agreement about the allocation of water rights between countries, which appears to be a significant barrier.
- It is highly doubtful that decentralized markets for water internationally will emerge as allocating mechanisms. They are essentially absent in most international settings.

#### Conclusions:

- Without a treaty agreement on the allocation of water rights and service rights among countries, it is unlikely that agreements can be reached on cost allocation for operation and maintenance, rehabilitation, or new construction of facilities in either river basin.
- Consumer-level water markets should probably not be expected as allocation mechanisms among countries.
- Focus on the "natural resource" price of water is problematic unless an agreement can be reached about the definition of the terms (that is, about the value of water between nations).
- Water markets and water pricing is probably only applicable in the short and medium run at the national level.

#### Recommendations:

- EPT continue efforts to encourage a clear definition of methods to value water at international borders. Continued support of international agreements in cases of shortages will give a focus on the opportunity cost of water in alternative uses.
- EPT recognize that water pricing is likely not to be a feasible method for international allocation purposes, but water pricing can play an important quantity and quality role in intra-national water use. As such, support for national pricing programs should be forthcoming.
- The development of water and land property rights is essential to properly function markets and to economic incentives for efficient use of water. As such, institution-building in property rights should be encouraged.

## **ISSUE PAPER: ASSESSING TRADEOFFS BETWEEN IRRIGATION AND HYDRO-POWER IN WATER QUANTITY MANAGEMENT**

**Dr. Richard Browning**

### **Issue:**

The selection of the best method of operating dams and reservoirs and developing resources to speed economic growth and social progress is of great importance to Central Asian Republics. Competition between hydropower, irrigation and other water uses generally centers on the timing and quality of water released from reservoir storage for producing electricity. Agricultural water use is seasonal and can be in conflict with planned hydropower releases at certain times of the year. Currently, 92% of total water use in the Aral Sea Basin serves an irrigated area of about 7.9 million hectares, making it one of the world's largest irrigation systems.

### **Background:**

The Aral Sea Basin is made up of the Syr Darya Basin and the Amu Darya Basin. In the water resource system of the Central Asian Republics full complementarity between agricultural use and power generation is not attainable because the seasonal water demand patterns for the two uses are different. Maximum demand for power generation in the upstream countries occurs during the winter months while maximum demand for irrigation occurs during the summer months. In addition to the difference in the demand patterns for irrigation and for hydropower, the distributions of inflows into reservoirs can be markedly different from year to year.

Although all large storage reservoirs were designed to serve dual objectives of irrigation and hydropower generation, the principal importance of irrigation was unquestioned in the former Soviet Union. Reservoirs were operated to store as much water as possible in the winter and spring and to release water during the summer to irrigate crops. Since independence, the upstream republics where the large reservoirs are located are more interested in maximizing production of electricity, especially during the cold winters. The potential conflict between the upstream republics, which are best served by winter releases of water, and the down stream republics, which are best served by summer releases, have recently been addressed in an ad hoc manner, through bilaterally negotiated agreements. These agreements involve the supply and purchase of electricity and compensation of the upstream republics in the form of coal and natural gas by the downstream republics.

However, release patterns that represent various degrees of compromise between the two optimal single-purpose modes of operation can be identified that yield higher levels of economic efficiency of the system. It is evident that a wide range of blends of agriculture and power targets are practicable and the problem arises as to the proper method of ranking the many alternative operating schemes. Techniques of operations research and computer mathematics make it possible to examine systematically many alternative operating schemes and to identify the optimal scheme to maximize social benefits.

A large sustained multi disciplinary effort combining economic analysis, engineering design, and governmental planning will be required. Mathematical models for computer studies will need to be developed to elucidate and quantify the relations between the variables, beginning with agricultural and power uses.

## **Implications for Central Asia:**

Water is critical to the economic development of each of the Central Asian Republics. The primary importance of water to each republic is largely a function of whether the republic is upstream, as are the Kyrgyz Republic and Tajikistan, or downstream, as are Kazakhstan, Turkmenistan, and Uzbekistan. Tajikistan and the Kyrgyz Republic together are the source of about 75% of the total surface resources in the Basin, while together they use only about 10% of these resources. Agriculture is important to the future economic growth in each republic while the Kyrgyz Republic and Tajikistan are placing special emphasis on hydropower developments as a major contributor to economic growth. Agriculture contributes between 23% to 34% of Gross Domestic Product and employs between 24% to 45% of the labor force in the Central Asian Republics. At present, hydropower provides about 27% of the energy consumed in the Basin with substantial undeveloped potential existing in the upstream republics.

The multi-objective analysis of the multi-year tradeoffs between agricultural water supply and hydropower production can indicate there is a possibility of increases in hydropower in exchange for small sacrifices in supply of firm agricultural water. Whether this is a sacrifice worth making depends upon the relative value of water in these uses over time.

Historical analysis in other countries suggests that irrigation will overtime become a lower priority water user as the demands for water resources increase from new land reclamation projects, urban growth, and industrial expansion. Since municipalities and industries are usually high value water users, the low priority, marginal water users in the future will be in the agricultural sector.

Another implication for Central Asia which is likely to result from this analysis is the value of additional storage downstream of Kyrgyz Republic. The idea is to release more water during the winter in order to increase firm hydropower production, and then to store the water in excess of winter agricultural requirements somewhere downstream for use the following summer.

**Areas of Consensus:** Based on the feedback obtained during the conference, including the breakout sessions, the following appeared to be areas of consensus:

- Prepare a proposal to develop a simulation model which will examine in a forward looking manner the tradeoffs among various water uses, starting with irrigation and hydropower.
- Separate models should be developed for assessing the tradeoffs between irrigation and hydropower in the Syr Darya and Amu Darya Basins. The initial modeling efforts should be directed to the Syr Darya Basin.
- Currently analysts in Central Asia should focus their attention on using the farm crop budget analysis technique to calculate the value of water for irrigation and the value imputed to the water used for hydropower as the difference between the alternate cost of electricity and the cost of hydropower.
- "Stakeholders" from each republic must be identified and selected in order to have the

commitment and ownership that is necessary to ensure that the models' results are used in reaching negotiated decisions associated with the allocation of water among the republics as well as within a specific republic.

### **Constraints:**

Based on the currently available information, constraints which are likely to be encountered in reaching a resolution to this issue include:

- Simulation models will require a Basin-wide common information database which includes all important variables and is accessible to the modelers.
- Many national and interstate institutions will want to be active participants in this modeling effort. Efforts to manage water resources are currently fragmented among various ministries, divisions, and organizations, all of which have suffered from dramatic budget cut-backs.
- The frequency of measurement and the number of working monitoring stations have been reduced such that the quality of any assessment has been reduced significantly. For example, Tajikistan reports that about 15 % of its hydro-meteorological stations are operational.

### **Conclusions:**

Based on the information reviewed for and the information obtained from the discussions held during the June 23rd- 28th workshops, the major conclusions associated with this issue are summarized below:

- Better assessment of resources, uses and the tradeoffs between uses is required for any negotiated water sharing agreement among the Central Asian Republics.
- Enhanced management of the water resources in the Basins, including the allocation of water, will require developing a simulation model for assessing trade offs between irrigation, hydropower, and other uses.
- Analytical tools and mathematical models for integrated analysis affecting water management decisions in the Basins all will need reliable inputs/data.
- The success of a comprehensive modeling effort will depend to a large extent on a proper organizational structure.
- There are probably existing simulation models that can be adapted to the Syr Darya Basin.

### **Recommendations:**

Listed below are the specific action items that EPT could do over the next several months to facilitate progress on this issue:

- Prepare a proposal to develop a simulation model for the Syr Darya Basin which will examine in a forward looking manner the tradeoffs among various water uses, starting with irri-

gation and hydropower. This will include the identification of the national and interstate institutions which will participate and the role of each institution as well as identifying donors to fund the proposal.

- Construct a list of the minimal information required to develop a model that will assess tradeoffs between irrigation and hydropower.
- Continue to focus analysts/specialists on estimating the value of water for irrigation and for hydropower.
- Support the installation of water flow and water quality automatic monitoring stations at strategic locations, at least at the interstate boundaries on the Syr Darya.

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## Appendix E Meeting Agendas

**USAID Environmental Policy and Technology Project  
Executive Committee of the Interstate Council of the Republic of Kazakstan,  
Kyrgyz Republic, and the Republic of Uzbekistan**

**Regional Water Pricing Policy Committee Meeting  
June 23-25, 1996 / Medeo, Kazakstan**

### Agenda

#### Sunday, June 23, 1996

- 18:00 Registration
- 20:00 Dinner Reception

#### Monday, June 24, 1996

- 09:00 Welcoming Remarks  
- Mr. Bazarbai Mambetov, Deputy Chairman, Executive Committee of the Interstate Council of the Republic of Kazakstan, the Kyrgyz Republic and the Republic of Uzbekistan, Almaty  
- Mr. Jonathan Addleton, Acting Director, USAID Regional Mission, Almaty  
- Mr. Paul Dreyer, Regional Director for Central Asia, Environmental Policy and Technology (EPT) Project, Almaty
- 09:45 Introductions
- 10:00 Overview of EPT Regional Cooperation in Water Resources Management Program and the Regional Water Pricing Policy Committee Activities (Ms. Barbara Britton, Regional Water Policy Advisor, EPT Project, Almaty)
- 10:15 Overview of Recent Water-Related Agreements among the Central Asian Republics (Mr. Mambetov)
- 11:00 Break
- 11:15 Overview of International Experience in the Management of Large River Basins  
(Dr. John Keith, Professor of Economics, Utah State University, USA, and Robert Anderson, Natural Resources Economist, International Resources Group, USA)
- 12:15 Discussion
- 13:00 Lunch
- 14:00 Setting Water Quantity and Water Quality Priorities (Dr. David McCauley, Senior Resource Economist, International Resources Group, USA)

- 14:45 Assessing Trade-Offs in Water Quantity Management: Operating Regimes for Multi-Use Dams (Dr. Richard Browning, Senior Energy Economist, International Resources Group, USA)
- 15:30 Break
- 15:45 Policy Instruments to Address Water Quality Problems (Dr. Robert Anderson, Natural Resources Economist, International Resources Group, USA)
- 16:30 Cost-Based Water Pricing and Demand Management (Dr. John Keith)
- 17:15 Implementing Water Pricing Schemes: Implications for Central Asia (Dr. Michael Boyd, Resident Environmental Policy Advisor, Harvard Institute for International Development, Almaty)
- 18:00 Discussion
- 19:00 Dinner

**Tuesday, June 25, 1996**

- 09:00 Country Presentations on Major Water Management Issues with Discussion Facilitated by Mr. Bazarbai Mambetov, Dr. Michael Boyd, and Dr. David McCauley
- 10:30 Break
- 11:00 Small Group Sessions of Representatives from the Republics to Formulate a Concrete Lists of Issues on which to Reach Consensus (Session Facilitator: Mr. Mambetov)
- Management of Water Quality: Break-Out Session for Representatives from Ministries and State Committees of Environment, Ecology, and Nature Protection.
- Water Uses and Water Pricing: Break-Out Session for Representatives from Ministries and State Committees of Water Resources Management
- Issues for Interstate Agreement on Water Management: Break-Out Session for Representatives from Ministries and State Committees of Economics or Finance
- 13:00 Lunch
- 14:00 Report from Session on Management of Water Quality
- 14:45 Report from Session on Water Uses and Water Pricing

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- 15:30 Break
- 15:45 Report from Session on Issues for Interstate Agreement on Water Resources Management
- 16:30 Discussion of Draft Resolution
- 18:00 Closing Remarks
- 19:00 Dinner

**USAID ENVIRONMENTAL POLICY AND TECHNOLOGY PROJECT  
Central Asian Regional Office**

**WATER PRICING TECHNICAL WORKING GROUP MEETING  
26-29 June 1996/ Medeo, Kazakstan**

**AGENDA**

**WEDNESDAY, 26 JUNE 1996**

17:00 Registration

19:30 Dinner

**THURSDAY 27 JUNE 1996**

**Session I--Opening**

9:00 Welcoming Remarks

- Dr. Barry Primm, Regional Environment, Energy, Agriculture and Housing Officer, USAID Regional Mission, Almaty
- Mr. Paul Dreyer, Regional Director for Central Asia, Environmental Policy and Technology Project (EPT), Almaty

9:30 Introductions

9:45 Update on EPT Water Pricing Activities (Ms. Barbara Britton, Regional Water Policy Advisor, EPT Project, Almaty)

10:15 Break

**Session II- Overview of Economic Instruments for Water Quality and Water Use**

10:30 Policy Instruments for Managing Water Quality and Water Use  
(Dr. Robert Anderson, Natural Resources Economist, International Resources Group (IRG), USA; Dr. John Keith, Professor of Economics, Utah State University, USA; and Dr. David McCauley, Senior Resource Economist, IRG, USA)

11:15 Building a River Basin Decision-Support System to Consider Water Pricing and Pollution Charges (Dr. KyeongAe Choe, Public Finance Economist, Research Triangle Institute, USA)

11:45 Comparative Analysis of Water Pricing and Water Measurement Schemes in Central Asia (Dr. David McCauley)

13:00 Lunch

**Session III--Irrigation-Energy Trade-Offs**

14:00 Recent Agreements in Central Asia (Mr. Bazarbai Mambetov, Deputy Chairman, Executive Committee of the Interstate Council of the Republic of Kazakstan, the Kyrgyz Republic and the Republic of Uzbekistan, Almaty)

14:30 Energy and Water: Trade-Offs in Developing Operational Regimes for Dams and Reservoirs (Dr. Richard Browning)

15:00 Discussion

15:30 Break

16:00 Team Presentation--Scientifically Based Methods of Water Pricing  
Led by Dr. Dyushen Mamatkanov, Director, Institute of Water Problems and Hydropower,  
Kyrgyz Republic. Team members: Dr. Amirkhan Kenshimov, Dr. Kuzma Shavva, Dr. Victor  
Boltov, Dr. Omar Niyazov, and Dr. Albert Rafikov

17:00 Feedback and Discussion

19:00 Dinner

## **FRIDAY, 28 JUNE 1996**

### **Session IV--Implementing Water Pricing**

9:00 Cost-Based Pricing: Methods for Application in Central Asia (Dr. John Keith)

9:45 Demand Management and the Role of Water Users Associations in Implementation of  
Water Pricing Schemes (Dr. Michael Boyd, Resident Environmental Policy Advisor,  
Harvard Institute for International Development, Almaty)

10:30 Discussion

10:45 Break

11:00 Team Presentation--Water Pricing in Transition to Paid Water Use  
Led by Dr. Victor Dukhovny, Director General, Interstate Coordinating Water Com-  
mission of Central Asia, Tashkent. Team members: Dr. Mier Pinkhasov, Dr. Nobi  
Nosirov, Dr. Ibadulla Umbetaev, Dr. Moses Sarkisov)

12:00 Feedback and Discussion

13:00 Lunch

### **Session V--Economic Instruments for Improving Water Quality**

14:00 Effluent Charges, Damage Assessment and Other Instruments (Dr. Robert Anderson)

14:30 Current and Potential Applications of Economic Instruments in Central Asia (Dr. Mi-  
chael Boyd)

15:00 Discussion

15:30 Break

15:45 Presentation--Economic Damage Evaluation in Water Use (Dr. Moses Sarkisov, Di-  
rector, Turkmengiprovodhoz)

16:15 Feedback and Discussion

16:45 Group Discussion: Opportunities for Water Pollution Charges in the Region (Dr.  
Robert Anderson)

18:00 Closing Comments

19:00 Closing Banquet

**SATURDAY, 29 JUNE 1996**

10:00 Working Sessions

1. Economic Instruments for Improving Water Quality  
Session Leader: Dr. Robert Anderson
2. Energy-Irrigation Trade-Offs  
Session Leader: Dr. Rick Browning
3. Cost-Based Pricing and Demand Management  
Session Leader: Dr. John Keith
4. Data for the River Management Decision Support System (RIMDESS)  
Session Leader: Dr. KyeongAe Choe

13:00 Lunch

## Appendix F Participant Lists

**USAID Environmental Policy and Technology Project  
Executive Committee of the Interstate Council of the Republic of Kazakhstan, the Kyrgyz Republic  
and the Republic of Uzbekistan  
Regional Water Pricing Policy Committee Meeting  
June 23-25, 1996 / Almaty, Kazakhstan**

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Almaty, Kazakstan  
June 26-29, 1996**

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