

Annual Report

Fields with an asterisk (*) are required.

Project name*

Transboundary water management adaptation in the Amudarya basin to climate change uncertainties

Family/Last Name of PEER applicant*

Dukhovniy

Institution*

Scientific-Information Center of the Interstate Commission for Water Coordination of Central Asia

Reporting Period Start Date*

11/1/2015

Reporting Period End Date*

09/30/2016

Section 1: Financial Report

Financial Report*

The annual financial report ([which may be downloaded here](#)) should be prepared by your financial person and uploaded below:

Upload a file [5 MiB allowed]

Receipts Please upload below your receipts (if required) in a single document

Section 2: Technical Summary

Summary of Activities During Reporting Period*

Please describe what has been accomplished on your PEER project during the reporting period, outlining the activities that were undertaken and specifically discussing achievements in relation to the milestones or targets set in the original PEER work plan. (If this will be your final report on your project, please also include an overall summary of your results and impacts.)

This report summarizes the project results from Nov 1, 2015 till Sept 30, 2016 that included activities under Stage 1 (finished) and 2 (to be finished by Oct 30). The following key activities have been completed under stage 1:

1.1. Water management problems in the Amudarya basin investigated & logical model for WM in the basin constructed. The key characteristics of decision making in the Amudarya basin as performed by BWO Amudarya central office & its territorial branches identified. Planning & daily control are complicated by acute lack of data which is partly addressed by use of historical data & data reconstruction for certain periods. Unreliable data in combination with practiced discrete water releases from reservoirs & water intake from the river complicates overall management & affects flow regimes in middle & lower reaches. The resulting deviations of actual values from the forecasted are alleviated through regular meetings on water allocation & check measurements. The logical model of WM consists in the use of decisions derived from mathematical models of river channel & planning zones, correction of channel loss patterns,

generation of plausible flow, consideration of channel travel & application of a methodology for water re-regulation by reservoirs.

1.2. Research & scenario assessment methodology developed & integrated scenario constructed. The research methodology implies the study of various plausible climatic, hydrological & socio-economic scenarios & their combinations, with account of national strategies & regional coordination rules. It is important to assign various possible flow regulation options & assess their effects on planning zones & aquatic ecosystems. The adaptation of the ASBmm model to long-term planning tasks of the PEER project will help here.

1.3. Input information & data collected & analyzed. Data on land & water resources & on operation regimes of reservoirs & HEPS collected. In addition to ground observation data, climatic scenarios REMO in combination with long-term data series used in the model. A set of climatic, soil & hydrogeological data collected for assessment of water requirements & hydrological changes. Modeling of economic indicators in agriculture & hydropower made on the basis of anticipated trends of agricultural output & energy prices.

The main results of **stage 2** include:

2.1. Adaptation of ASBmm model. A set of models for water management in the Aral Sea basin (ASBmm) forms the basis of long-range modeling in this project (<http://asbmm.uz/>). This set of models is used for long-range planning in water-management system in ASB up to 2035. Under this project, it is planned to further develop the model set in part of planning zones, extend calculation period up to 2050 & adapt it to specifics of the Amudarya.

Water resources in planning zones assessed & river flow regulation by reservoirs & HEPS studied. Missing flow rates for some of the rivers (Pyandj, Kafirnigan, Kunduz) reconstructed. Transboundary rivers such as Vakhsh, Pyandj (together with Kokcha), Kafirnigan & Kunduz, as well as reservoirs of the Vakhsh cascade & Tuyamuyun Hydroscheme considered in the water allocation model - WAm, while the rest of streamflow & water in the reservoirs located along rivers & canals included into the planning zone model (PZm). The algorithm of PZm model updated in part of water balance & economic assessments. All changes & additions made in the model fit the requirements of US methodology for modeling complex systems (Function Modeling) & information flows (Information Modeling).

The Amudarya basin rivers' discharges clarified & the Amudarya runoff estimated at 68.97km³ for 1932/33–2014/2015. The present situation & prospects of groundwater & collector-drainage water use analyzed. The elements of water balance for all planning zones assessed for 2010–2015, flow regulation by reservoirs with hydropower & their operation for hydropower generation analyzed. The patterns of sterile spills from the Nurek HEPS identified & possibilities of operation of the reservoir cascade for long-term regulation assessed.

Optimization module for crop production and food supply in PZ was programmed using GAMS.

2.2. Analysis of national development programs. The forecast indicators of agricultural development in the Amudarya basin by 2050 developed on the basis of three scenarios: BAU (Business as Usual), FSD (Food Security and Diet Change) & ESA (Export oriented Sustainable Adaptation). Based on population growth forecasts targets for optimization of cropping patterns for major crops & crop yields for specific crop types identified. These calculations were informed by national policies on agricultural development, particularly on optimization of cropping patterns, reduction of cotton areas, increase of orchards, forage, vegetables. Tajikistan adopted a program for agricultural reforms up to 2020 that implied expansion of irrigated area on 100,300 ha over 5 years (all in the Amudarya basin). It is also focused on development of orchards & vegetables. The estimations show that crop production increases in all planning zones & reaches self-sufficiency of almost all foodstuffs by 2050 in FSD. It is expected to apply drip irrigation, film & hothouses for crop growing & portable flexible conduits to reduce water use, especially in Uzbekistan. Production of raw cotton will be reduced as well.

2.3. Modeling crop water requirements in light of climate change. The modeling tool REQWAT was developed at SIC for calculation of crop water requirements. This tool is based on the FAO CROPWAT model adapted for consideration of groundwater contribution factor, which is relevant for our conditions. By using this tool & climate change forecast from REMO-0406 (Wurzburg University), a grid of climate changes was constructed for the whole basin & corrected against observation data: www.climatservice and www.aerowether.nasa. Based on this input data and soil & hydrogeological data for nine planning zones in Amudarya basin, forecasts of unit water requirements for 15 crops in each PZ were made. This allows assessing total water requirements for 3 development scenarios in all these zones.

2.4. Modeling flow series in context of CC. Modeled river flow series for 2016-2050 in the context of CC under natural (non-regulated flow) conditions. Modeling of river flow was made by using historical cycle-series extrapolated to the future. CC was taken into account through coefficients (adjustments) derived from the NIGMI's data. Climate changes were based on REMO-0406 scenario (it should be treated as 'soft' scenario, which is feasible). Conclusions:

- No significant impact on annual river flow: the average long-term annual flow of Amudarya is expected to decrease by 1.68 km³/year for 2015/2016–2054/2050 as compared to 1932/1933 – 2014/2015; the same indicator will be 0.6 km³/year for the Vakhsh and 0.86 km³/year for the Pyandj.
- An impact on monthly river flow is more significant: river flow is expected to decrease in June-August, and to increase in April & some months during the growing season. The maximum decrease in Amudarya flow in July by 2050 may be 2.8 km³ a month (against the average flow for 1932/1933 – 2014/2015).
- If one traces flow dynamics in the Amudarya basin over 2015/2016 – 2054/2050, a series of dry years can be highlighted: 2031–49.89 km³/year (73% of norm); 2039–53.67 km³/year (78% of norm); 2043–50.98 km³/year (74% of norm). The flow in July will decrease to: 9.3 km³ (69%) in 2028, 9.4 km³ (70%) in 2009, and 7.8 km³ (58% of norm) in 2039.

Also, this research allowed constructing water series for Amudarya basin that would serve as a basis of numerical experiments planned at stage 3 (late 2016, early 2017).

2.5. Studying scenarios of HEPS operation. A regional longterm water strategy should set improved mechanisms & criteria of water distribution in combination with national development strategies in hydropower & agricultural sectors. Thus, studying scenarios of operation of the Vakhsh HEPS cascade, especially of Nurek HEPS, is of particular importance. Taking into account the future electricity demand of Tajikistan, incl. potential electricity export, we selected the following regimes of operation for numerical experiments: energy-irrigation regime of 2010-2015; energy generation regime, i.e. maximizing generation in winter; and, energy-irrigation regime, i.e. additional generation in summer (export of summer electric energy).

2.6. Study of limitations focused on estimation of water intake by Afghanistan in Amudarya basin, including Kokcha & Kunduz & assessment of ecosystem water requirements in the Prearalie (Aral Sea coastal area). The research carried out by using data provided by BWO Amudarya & Analytical Agency "Ynanch-Vepa" showed that the Prearalie's demand, i.e. maintenance of the lake system in Amudarya delta, can be fully met only in average & high-water years, when the annual inflow to the Samanbay river section exceeds 8 km³.

2.7. As a first step to understanding legal&institutional architecture of transboundary water governance in the Amudarya basin, resilience of water allocation system analyzed. The system resilience evaluated by ascertaining flexibility & rigidity elements embedded into the water allocation mechanism that would allow parties to respond adequately to changing circumstances. These two elements are regarded as essential components for enabling effective&adaptive management, with flexibility ensuring responsiveness & rigidity providing for predictability. The

research findings disregard assessments of water allocation system in the Amudarya as not comprising any flexibility in its design (Adelphi 2016). Rather, the existing system seems to comprise both flexibility & rigidity. Still, ICWC practices over 25 years suggest that adaptive capacity/climate resistance of the water allocation system in the basin should be further enhanced.

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Section 3: Stakeholder Events

Details of events during reporting period*

Please list all PEER project-related events that you organized and held during the reporting period (please include all events during the reporting period including those already reported in quarterly reports). Events include workshops, conferences, short courses, and stakeholder outreach events that you organized. (Please only include events you led or organized.)

Please use the following format:

Title, Date, Location, Number of Female Participants, Number of Male Participants

1. Work meeting on the PEER Project “Transboundary water management (TWM) adaptation in the Amu Darya basin to climate change uncertainties”, March 24, 2016, SIC ICWC, Tashkent

Participants:

5 Female, 15 Male

2. Field visit to Amu-Bukhara Basin Irrigation System Administration, February 24, 2016, Bukhara, Amu-Bukhara BISA,

Participants:

2 Female, 8 Male

3. Field visit to Lower Amudarya (Nizhneamudarya) Basin Irrigation System Administration, March 5-7, 2016, Khorezm, Lower Amudarya BISA,

Participants:

1 Female, 6 Male

4. Field visit to Lower Amudarya (Nizhneamudarya) Basin Irrigation System Administration, April 7-11, 2016, Karakalpakstan, Lower Amudarya BISA

Participants:

1 Female, 5 Male

During the reporting period, how many events did you organize in total?*

4

During the reporting period, how many females participated in the events you organized?*

9

During the reporting period, how many males participated in the events you organized?*

34

Section 4: Research Team

Please provide the following demographic information on the number of students involved on the project research team.

Female Undergraduate Students (BA, BSc)*

0

Male Undergraduate Students (BA, BSc)*

0

Female Master's Students (MA, MSc)*

0

Male Master's Students (MA, MSc)*

1

Female Doctoral Students (PhD)*

0

Male Doctoral Students (PhD)*

0

Female Postdoctoral Scholars*

0

Male Postdoctoral Scholars*

0

Female Research Assistants/Project Employees.*

Please do not include researchers listed above.

0

Male Research Assistants/Project Employees*

Please do not include researchers listed above.

0

Section 5: Educational Impacts

Discuss new courses or degree programs created (if any) or changes to existing course curricula.*

Please only include developments that occurred during the reporting period.

N/A

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During the reporting period how many new or updated courses or degree programs did you develop?*

0

Number of female students participating in new or updated courses.*

0

Number of male students participating in new or updated courses.*

0

Section 6: Research Outputs

Please provide the number of international patent applications submitted in the past year.*

0

Please provide the number of national patent applications submitted in the past year.*

0

Please list the patent details.*

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Peer-reviewed Publications and Proceedings*

Please list the research products you authored or co-authored about your PEER project. The list should be limited to **peer-reviewed** products that were published or accepted for publication during the reporting period. Provide full reference citations for all journal articles, technical reports, books or book chapters (written or edited). Please include the list of authors, full title of item and publication in which it appeared, volume number, page numbers, and date.

N/A

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For each type of published technical document, please list the number of each type and the full references in the boxes provided below:

Peer-reviewed Journal Articles*

0

Of this total, **number of journal articles published with U.S. PEER Partner.***

0

Journal References

N/A

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Peer-reviewed Proceedings*

This is defined as manuscripts that went through a panel review process and were published as part of a technical conference.

0

Of this total, **number of proceedings published with U.S. PEER Partner.***

0

Proceedings References

N/A

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Peer-reviewed Books/Book Chapters*

0

Of this total, **number of books published with U.S. PEER Partner.***

0

Book References

N/A

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Other peer-reviewed publications*

0

Other Publication References

N/A

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Other Research Outputs

Please describe other research outputs (not peer-reviewed) *This could include white papers, blogs, web platforms, or other tools they are using to disseminate your research.*

The PEER project website was designed for project popularization and enhanced visibility. It contains several sections, such as “Home”, “About”, “Database” (water resources, infrastructure), and “Knowledge base” (maps, monographs, papers, reports, references) in Russian and English.

The project website is hosted by the CAWater-Info Portal on: www.cawater-info.net/projects/peer-amudarya.

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Technical Research Presentations*

Please list research presentations made at conferences or technical meetings on projects or work funded under your PEER project. After your description, please enter the total number of presentations below. Please include all technical presentations given during the reporting period including those already reported in quarterly reports; provide the title and date for each.

The following presentations by the research team included work funded under this PEER project:

- “*Status of information on the Aral Sea Basin: on the way toward the single information space*” (Prof. V.A.Dukhovniy) at the WB “Central Asia Water Future Forum and Expo”, 19-23 September 2016, Almaty, Kazakhstan;
- “*Studying alternative water and hydropower development scenarios in the Aral Sea riparian states through computer modeling*” (A.Sorokin) at the WB “Central Asia Water Future Forum and Expo”, 19-23 September 2016, Almaty, Kazakhstan;
- «*Introduction to the PEER project on Transboundary Water Management Adaptation in the Amudarya Basin to Climate Change Uncertainties and its preliminary findings*» (Prof V. Dukhovniy) at the High-Level Symposium on SDG6 and Targets: Ensuring that no one is left behind in access to water and sanitation, 9-11 August 2016, Dushanbe, Tajikistan;
- “*An overview of two global water conventions: 1992 UNECE Water Convention and 1997 UN Watercourses Convention*” (Dr. Ziganshina) at a national seminar for water professionals and experts from other relevant ministries and parliamentarians on ‘The role of two global water conventions for promotion of integrated water resources

management and transboundary cooperation in Central Asia”, 22 May, 2016, Tashkent, Uzbekistan;

- “An introduction to international water law” (Dr. Ziganshina) at a training workshop organized by GIZ for representatives of basin water organizations from Tajikistan, Uzbekistan and Turkmenistan, 17 May, 2016, Tashkent, Uzbekistan;
- “An introduction to international water law” (Dr. Ziganshina) at the 7th Central Asian Leadership Programme on Environment for Sustainable Development, 27 September, 2016, Almaty, Kazakhstan.

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Number of technical presentations made*

6

Section 7: Professional Development

Research Grant Details Please list grants received in the past year, including the source and amount.

SIC ICWC:

- continued the project “Support to the network of Russian speaking water management organizations and organization of an information water conference” with the support of UNECE, 1.12.2015-31.08.2016, \$ US 21,980;
- since 2015, has been implementing the project “Assessing land value changes and developing a discussion-support-tool for improved land use planning in the irrigated lowlands of Central Asia” (LaVaCCA). 57,810 Euro were used in 2015 for project purposes;
- since 2015, has been implementing the project “CAWA 3 – The Water Use Efficiency Monitor for Central Asia (WUEMoCA)” together with the University of Wurzburg under support of the German Federal Foreign Office; 47,319 Euro were used in 2015 for project purposes;
- implemented E-Learning short-term course on legal and policy issues related to water resources management in Central Asia and ways for its improvement; WB, 2014-2015, \$ US 12,000;
- implemented the project CRP 1.1 “Improving water use efficiency through innovative technologies in irrigation and farming in cereals, potato, vegetables, horticultural and fodder crops”, ICARDA CAC, 2014-2015, \$ US 96,900;
- implemented the project “CRP on water, land and ecosystems/Managing irrigation-drainage systems to sustainably enhance productivity in Fergana Valley, Central Asia”, ICARDA CAC, 2014-2015, \$ US 47,440.

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Please provide the number of new research grants you received in the past year.

Number of new international grants/research funding*

2 (CAWA 3 and LaVaCCA)

Number of new local research grants/research funding*

0

Total Amount Awarded (USD).*

In 2015, 117,744 Euro were used for the purposes of the projects CAWA 3 and LaVaCCA.

Was your PEER grant helpful in securing this additional funding?*

No

If so, please describe how the PEER project contributed.

N/A

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Personal Development*

Please list the awards or other form of public recognition received, professional associations joined, and leadership positions during this reporting period.

- Prof. Dukhovniy was awarded the commemorative badge “Ozbekiston mustaqilligiga 25 yil” (the 25th Anniversary of Uzbekistan’s Independence) established by the presidential decree date 1 July 2016 and given for the substantial contribution to strengthening of independence, building of economic, political, social, scientific, and intellectual capacities and defense potential of the country; for maintaining integrity of national frontiers; for democratic reforms, maintenance of friendship and harmony between nations, peace and stability; development of national culture and arts; fostering of good-health and comprehensively advanced generation, etc.
- At the 7th session of the Meetings of the Parties to the UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes in November 2015 Dr. Ziganshina was elected to serve as a member of the Implementation Committee under this Convention from 2015 till 2018.
- In March 2016 Dr. Ziganshina became a member of the Asian Society of International Law.

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Number of awards/public recognition recieved.*

2

Number of professional societies joined.*

1

Section 8: Outreach and Potential Development Impacts

Outreach and Collaborations*

Please describe any collaborations, connections, or activities developed with USAID, government agencies, community groups and nongovernmental organizations, or private companies interested in implementing the results of your project.

The ways of fostering collaboration in areas addressed by the PEER project were discussed with potential partners during many large events such as International Conference on

Eurasian food security and nutrition network (29 February - 2 March, 2016, Bishkek, Kyrgyz Republic), a meeting of Central Asian regional organizations (10-11 March, 2016, Almaty, Kazakhstan), and the High-Level Symposium on SDG6 and Targets: Ensuring that no one is left behind in access to water and sanitation (9-11 August 2016, Dushanbe, Tajikistan).

Project activities and preliminary findings were discussed with Amy Lovejoy (Director of the Economic Development office at USAID/Central Asia in Almaty) during the meeting at SIC ICWC on 29 March 2016. There are ongoing negotiations with USAID's Regional office in Almaty on potential implementation of the project "Monitoring of the Aral Sea dried bed and Prearalie".

We also revitalized contacts with our partners from the Netherlands (UNESCO-IHE and Water Partners Foundation) in cooperation with whom the ASBmm model – the main analytical tool of our project - has been developed. Our partners are interested to learn on new developments introduced into the model by the PEER project and its adaptation to the Amudarya basin specifics.

Seeing great potential in the updated version of the ASBmm to assess and simulate various development options for the Amudarya with a view of assisting stakeholders to create mutually acceptable and sustainable solutions, SIC ICWC in a consortium with local and international partners submitted a project proposal to the Bureau of Oceans and International Environmental and Scientific Affairs' Office of Conservation and Water at the U.S. Department of State for a program on international water cooperation. The overall goal of the proposed project is to restore trust and facilitate shared understanding among key stakeholders to reinforce cooperative processes over shared waters in the Amudarya basin (water diplomacy). A primary objective is to lay the groundwork for enabling inclusive transboundary water governance arrangements in the Amudarya basin through strengthening key institutions involved (BWO "Amudarya", its territorial units and provincial water management organizations in Tajikistan, Turkmenistan and Uzbekistan) and creating platforms for multi-stakeholder engagement on IWRM.

The project team also collaborates with the UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes (UNECE Water Convention) under the implementation of its Programme of work for 2016–2018, in particular programme area 4 "Adapting to climate change in transboundary basins". Of particular relevance for this area will be the findings of the legal and institutional analysis of transboundary water governance in the Amudarya in the context of changing climate undertaken under the PEER project.

There is an initial agreement and great potential in the future cooperation and joint implementation of the ADB-funded program on water security improvement in the Amudarya basin aimed at increased water saving. This program can be enriched by the work of the PEER project experts (Dr. Stulina and Mr. Solodkiy) on gaining positive benefits from the changing climate through adjusting crop patterns and vegetation period to grow double-season cash crops. The principal investigator Prof. Dukhovniy updated top officials from the Ministry of Agriculture and Water Resources of the Uzbekistan on the positive impacts of this collaboration.

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Please indicate the number of meetings with the following organizations that took place with regard to applications of your research during the reporting period:

Private Companies*

0

Please provide the names of the companies you met with.

N/A

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Community Groups or Non-Governmental Organizations*

0

Please provide the names of the organizations you met with.

N/A

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Government Agencies*

0

Please provide the names of the government agencies you met with.

N/A

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Local USAID Mission*

1

Potential Development Impacts (Evidence to Action)*

Please describe your progress toward achieving development impacts from your PEER project.

The main approaches and outcomes of this project are aligned with USAID's development objectives, which are to build resilience in the Amudarya basin countries to climate change impacts on transboundary water management and to enhance regional water cooperation through generation of better data and knowledge, influence policy and decision making, improve understanding and awareness on functional adaptation practices, build capacity and enhance partnerships with research institutions and local communities.

To this date, the project made some progress towards achieving these impacts by:

- updating data and information system on the Amudarya basin in cooperation with national and local partners,
- clarifying the main challenges to be tackled to build trust and working relations between the countries,
- promoting a brand new adaptation approach to transboundary water management in the Amudarya that ensures maximal approximation to real conditions during modeling and filling of data gaps,
- presenting preliminary results of the project to improve understanding and awareness among policy makers and practitioners of functional adaptation practices as well as their national policy linkages to transboundary and global levels,
- presenting practice-oriented results of adaptation to climate change for end-water users to allow them mitigate (and even benefit) from changing climate.

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During the reporting period, was your data or research used to inform a policy or program?*

For example, a new product was developed as a result of your PEER research, a policy document was developed based on your research, your research informed a private sector strategy document or NGO program, or the local USAID mission incorporated activities related to your research into their programming.

- Yes
 No

Please describe in what way your data or research was used to inform a policy or program.

Example 1: Based on the results of your research, you identified methods for conserving tuna fisheries in your region. An NGO in your region has written a conservation strategy that reflects the findings from your research. In January 2016, the NGO hired a new staff member to oversee the implementation of the fishery conservation recommendations.

Example 2:(Technology)Through your research you have been able to identify the optimal substrates to digest and clean wastewater and create energy, leading to the creation of a very robust bioreactor. Seeing the preliminary results of the bioreactor, the national government, with support from a consortium of palm oil companies, funded you to design a similar reactor for use in the palm oil industry.

Example 3: You are training agricultural extension workers how to implement farming practices that prevent erosion.

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Please indicate at what level the program or policy change is being made.*

- Village or community level
 Local or municipal level
 Regional level
 National level
+Not Applicable

Section 9: Additional Information

Problems Encountered

Please provide information on any problems you may have encountered in making progress on your project objectives and describe steps you are taking to resolve the problems.

Although the Project activities have been implemented according to the agreed action plan, there were also some challenges in its implementation. The Project seeks to analyze social, economic, political, environmental and agricultural situation and future trends in the Amudarya basin in a systemic way. To this end, pieces of information from different sources on various subjects have to be accumulated, processed, and converged into a coherent picture to illustrate possible transformation trends in the Amudarya river basin. This proved to be a challenging task for a number of reasons.

First of all, there is a lack of open source access to data related to hydrology, soil, hydrogeology, climate and other natural conditions; even when data exists; it has to be double checked due to its low accuracy and reliability. Degree of openness and transparency of information differs from a country to a country that makes it difficult to compare data across the countries and present its findings in a coherent way. Complications in access to information at the national level also created some delays in its collection.

Second, assessment of information related to the strategic directions of country development was complicated by a large degree of uncertainty in political, financial and economic conditions. This is especially so with respect to the planned construction of hydropower facilities on transboundary rivers such as the Roghun dam and a number of smaller projects and the dependence of their construction on foreign investment and riparian's non-objections.

Third, the future trends in agricultural development of the countries were difficult to grasp through the single analytical approaches due to still ongoing process of agricultural restructuring and lack of long-term systems for perspective planning in agriculture development in almost all countries of the basin. The situation in planning zones (administrative units divided according to their specific natural and socio-economic characteristics) across Uzbekistan is more or less clear in terms of hydrology and land restructuring that allows predicting future trends and recommending innovations in reducing growing season for certain crops. The situations in Tajikistan and Turkmenistan are less predictable (even more so in Afghanistan) that hampers the sound computing future options.

To address these challenges, the project team had several informal face-to-face meetings to collect and verify existing data and information. Thanks to close collaborative relations with colleagues from other countries and aspiration to get the whole picture, the project team did its best to collect as much reliable information as possible.

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Plans for Activities during the Coming Year*

Please provide details on project activities during the next year, including planned exchange visits, training events, and ongoing research efforts.

To accomplish the work plan for **Year 1** following activities will be done by Oct 30.

In October 13-23, 2016, our software engineer Khafazov Ruslan will visit the Morton K. Blaustein Department of Earth and Planetary Sciences, Johns Hopkins University (Baltimore, Maryland, USA) to present to the US partners our methodological approach, exchange experiences and get advice on improving our approaches. In particular, it is envisaged:

- to present IDEF methodologies (IDEF0, IDEF1X) to deal with research tasks of the PEER Project on adaptation of the planning zone model (PZM) of the ASBMM system to the Amudarya basin;
- to study modeling methodologies and instruments used at the Morton K. Blaustein Department of Earth and Planetary Sciences;
- to study possibilities to apply the gained knowledge for the PEER Project purposes;
- to establish scientific collaboration between SIC ICWC and the Morton K. Blaustein Department of Earth and Planetary Sciences.

It is planned to conduct a workshop to discuss the results of stages 1 & 2 with key researchers and partners late October.

The work will be completed on changing the planning zone model in order to extend the simulation period up to 2050 (architecture, database, algorithms) and on model adaptation (position 2.1)

A report summarizing the results of the first year of the project implementation will include the updated version of the planning zone model, the data on development strategies for agricultural, irrigation, hydropower, and ecosystem sectors (position 2.2), assessment of crop water requirements in context of climate change (REMO scenario and data) for 9 provinces (planning zones) in Amudarya basin (position 2.3), modeling of river flow series in context of effects of climate change (position 2.4), alternative scenarios of HEPS operation in Amudarya basin for 2020-2050 (position 2.5), main limitations for future development of Amudarya basin, including demands of Afghanistan, Amudarya delta lakes, and the Aral Sea (position 2.6), and the survey of the legal and institutional framework for transboundary water management under climate change (position 2.7).

Year 2 of the project will start on November 1st and will include activities under stage 3 “Numerical experiment” and stage 4 “Dissemination”.

In late December – early January it is planned to hold a larger workshop for a wide circle of participants, such as U.S. partners, students, and decision-makers in order to train the research team and key partners in the modeling approaches in order to start the stage of numerical experiments.

For numerical experiments the following activities are planned:

- series of model calculations for various combinations of scenarios & boundary conditions in the Amudarya basin (climate, water, flow regulation by hydropower, crop water requirements, Afghanistan’s water demand, nature’s demands) for 2020-2050; the calculations will be made for assessment of the integral impact of CC and hydropower station operations on basin’s water, evaluation of their variability, distribution of water deficit in space & time, & assessment of the possibilities of deficit compensation through multiyear flow regulation & water demand management (lowering of unproductive losses in irrigation infrastructure, reduction of crop water requirements by applying water conservation innovations & changing crops),

- development of proposals on the principles of TWM & directions of sustainable development in the Amudarya, including hydropower, irrigated agriculture & environment under conditions of growing water scarcity caused by climatic and anthropogenic factors. These proposals will include legal aspects. By the end of this stage, the outputs of numerical experiment will aggregated into the database.

For dissemination a final workshop is planned to bring together the key stakeholders, students & research team and partners. The project’s webpage will be maintained and existing databases on the Amudarya will be updated. In addition, conference presentations, scientific journal articles & other publications will be prepared to share the project approaches & findings, and a follow-up dissemination plan will be prepared to maintain a dialogue on TWM & sustainable development in the Amudarya basin.

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Additional Comments

Please note any other comments you have regarding your PEER project or the PEER program itself.

N/A

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Supplementary Information If applicable for this reporting period, please attach copies of project-related workshop or conference agendas, course curricula developed, summaries of research data collected, or articles about the project appearing in newspapers, journals, or web sites.

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