## Quarterly Project Summary*

**Please provide a brief summary of project activities carried out between January 1 and March 31, 2016, including specific events, ongoing research, planning, and data-gathering activities. You should include PEER project-related events from before January 1, 2016, only if you did not include them in your previous quarterly report or if this is the first report you have submitted on your project.**

Over the reporting period, main activities of the first stage (preparatory period) were finished and the research work of the second stage was started. The following activities were completed: study of water management challenges (Task 1.1) and work on development of research methodology (Task 1.2); data analysis and collection (Task 1.3). A work meeting (Task 1.4) of project participants was held. Besides SIC ICWC experts, the expert from BWO Amu Darya and the consultant on climate and adaptation from the Center of Hydrometeorological Service at the Cabinet of Ministers of Uzbekistan took part in this meeting. Based on the meeting findings, the Plan for activity coordination was drafted. The Plan lists obligations of the project personnel regarding due time for data exchange. Some changes were made in the list of project personnel – the two new young programmers that have experience in modeling complex systems and working with Web-technologies, including work experience in Germany (University of Wurzburg, CAWa Project), have been involved in the project.

As part of research work in the second stage, for adaptation of ASBmm we decided to apply the American methodology for modeling the complex systems (Function Modeling) and information flows (Information Modeling) (Task 2.1). The period of work on adaptation of ASBmm was prolonged as we started to use the new ICAM (Integrated Computer-Aided Manufacture) methodology developed in the U.S. that was not earlier planned in the Project. The task of ASBmm adaptation as envisaged in the PEER project comprises revision of the functions of individual elements of the basin, the algorithms, and the information flows in addition to research (rethinking of functioning of some elements and the system as a whole, more precise definition of functions, input of new factors and variables). In this context, we refined the functional model of planning zone in ASBmm, made changes in the algorithm calculating water balance and in the DB structure and user menu (Interface). We carried out an assessment of water resources in planning zones and of losses in Amu Darya river, as well as evaluated river flow regulation by hydropower reservoirs.

The work is carried out on Task 2.2 (analysis of national development program) and Task 2.3 (modeling crop water requirements). Preparatory work was done on Task 2.3 (processing and correction of climate data from the REMO-scenario, calibration against evapotranspiration), and all planning zones were adjusted to calculate crop water requirements of the following crops: cotton, wheat, corn, rice, vegetables and cucurbits, fruits and grapes, forage crops (alfalfa, maize); crops grown in homestead plots; other (industrial crops, excluding cotton); double crops (rice, forage, vegetables), with their specific irrigation timing.

We started collection of information and analysis of available legal and institutional framework for transboundary water management in Amu Darya basin (Task 2.7).

Project presentations were made at: the International Conference on Eurasian Food Security and Nutrition Network (29 February – 2 March, 2016, Bishkek, Kyrgyz Republic); the meeting of Central Asian regional organizations (10-11 March 2016, Almaty, Kazakhstan); and, during the 29 March meeting with Economic Development Office Director Ms. Amy Lovejoy from the USAID/CA Regional Mission in Almaty.

The PEER project website was designed. 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/.

All work items planned by 1st of April 2016 were completed, except for collection of information on the area of Karakum canal (Turkmenistan). The missing water and economic data on this area will be collected and analyzed by the end of May.

**Project Events**

**Using the template available here, please provide, if applicable, the requested information for each event held to support the project during the quarter (brief description, dates, number of participants and cost breakdown) as indicated in the template, including (but not limited to) meetings with local officials or community groups, teaching opportunities with schools or universities, and symposia. Internal meetings only involving project team members should not be included as training events. Please upload your completed event template below.**

| | | | | | | Costs of event | | |
|---|---|---|---|---|---|---|---|---|
| Event Title | Brief Description of Event | Date(s) | Description of Participants | Female Participants | Male Participants | Instruction | Travel | Expenses |
| Work meeting on the PEER Project "Transboundary water management (TWM) adaptation in the Amu Darya basin to climate change uncertainties" | During the meeting, which was held in SIC ICWC premises, the participants discussed project progress, agreed on the coordination of actions among the project key personnel and the approaches to be used for scenario building and modeling | 24 March 2016 | PI, project partners from SIC ICWC, BWO Amu Darya, Turkmenistan and invited persons | 5 | 15 | - | - | - |

**Major Equipment Purchased**

**Please list any major equipment purchased during the quarter, such as computers, lab equipment, etc. It is not necessary to list supplies or reagents purchased.**

Two personal computers and two laptops Asus X751L and Lenovo Y50 were bought for the project staff from SIC ICWC.
Two laptops Asus K556U were bought and passed to the project staff from BWO Amu Darya

**Challenges**

**Please give explanations on any particular difficulties that have arisen during the quarter (visas, funds transfers, problems purchasing equipment, etc.).**

**Future plans***

**Please give a detailed summary of your plans on the project for the coming 3-6 months (including training or outreach events, field work, exchange visits, purchasing of equipment, etc.). Please note: if your project is scheduled to end in the next 3-6 months and you will need a no-cost extension, please include that request in this section and make sure to e-mail your grant manager as well regarding the extension request.**

The task in hand is to analyze the agriculture and water development strategies for the long-term perspective in the riparian countries of the Amu Darya basin and, based on this, build scenarios of cropping patterns in each planning zone (Task 2.2). Given scenarios will be a reflection of national agrarian policies on food security, agricultural export, and innovations to improve productivity (crop yields) and save water (by reducing irrigation rates and water losses). As part of Task 2.2, we will make: a) evaluation of return flow generated in Turkmenistan's planning zones in light of "Golden Age" Lake, which is under construction; b) analysis of hydropower development program in Tajikistan. Here we will analyze probable scenarios of electricity demand in Tajikistan (winter and summer) and the options for meeting this demand; the findings from the World Bank's study of this issue will be also used and analyzed (Daryl Fields et al., 2013).

The next important task of the near-future period is the modeling of crop water requirements (Task 2.3). The series of required amounts of water (by 2050) to be delivered for irrigation of various crop species in each planning zone are to be derived. Climatic parameters for fulfillment of this task will be taken based on the data of the regional scenario REMO (University of Wurzburg), projected for individual planning zones and averaged for them. This work will allow using given trends for calculation of crop water requirements in the considered national agricultural development (cropping pattern) scenarios of riparian countries.

The work on adaptation of ASBmm (Task 2.1) will be continued: based on the new algorithms and the actual data (2010-2015), water balances will be drafted for pilot planning zones that cover all riparian countries; the algorithms and DB structure of the ASBmm planning zone model will be refined on the blocks, such as Planning zone productivity and Socio-economic indicators. Water balances of planning zones will be studied in combination with water balances of the basin's river reaches (with account of losses in river channel). This will help to define more precisely and augment information on development patterns of water balance's elements and correctly adjust the tool of ASBmm for numerical experiments – calculation of planning zone development scenarios (2016- 2050).

The information gaps on Turkmenistan will be filled in April and May through the data collected by the project expert from Turkmenistan and the open source data.

In the course of the project, the DB and the project website will be added by new sections (climate, water requirements, productivity, HEPS operation regimes, socio-economic indicators, etc.), tabular and GIS data generated by the project, and the reports showing project progress in general and by its stages and tasks.

**Additional information**

**Please include additional information that you would like to share with us, for example if you have published any journal articles or made conference presentations on your project results.** Please list reference citations, but **please do not include detailed research analysis or raw data.**

The work on refinement of the functional model of planning zone in ASBmm, the DB structure, and the user menu (Interface) was done pursuant to the requirements of the American methodology for modeling the complex systems (Function Modeling) and information flows (Information Modeling). We have defined context (abstract description of the system as a whole)

and developed a context diagram, which was divided into three large segments (modules): “Water balance calculation”, “Irrigated agriculture production calculation”, and “Social-economic evaluation”. Decomposition of the diagram into smaller segments (with necessary detailing) means division of the module “Water balance calculation” into the blocks, such as Input data processing, Calculation of water requirements, Calculation of usable water resources, Water balancing, and Output data processing and reporting. The input data of the planning zone model were classified as: control actions (user’s data); information from DB (scenarios, trends, historical (retrospective) and reference information); outputs from other models (Cropwat, WAm ASBmm, REMO). Variables of the model are grouped as endogenous variables (model-determined) and exogenous variables – “Parameters” in GAMS terminology. Such detailing allowed specifying information flows between blocks and modules and starting analysis of planning zones’ water balances based on the developed algorithm.

The analysis of the existing climate change and water models for the Amu Darya River basin for the long-term (2050) carried out within the PEER Project highlights the following:

- Climatic characteristics of the Amu Darya basin are simulated less well by the global climatic models than by regional ones as multiple regional special characteristics need to be taken into account; the same relates to hydrological characteristics (river flows and their variability).
- The three-dimensional numerical general circulation models (GCM) are considered to be the most reliable tool for modeling of physical processes that drive climate changes. Climatic models use different input data and scenarios of greenhouse gas emissions and produce different results; therefore, given the significant uncertainty of estimations, at the regional level (Amu Darya basin) we usually select several scenarios and models and build regional climatic scenarios using the method of averaging for the results of models from the world’s leading climate centers. One of the recent research – regional research project “Central Asian Water” (CAWa, 2014) – gets climate changes from the regional scenario REMO 0406 (University of Wurzburg), which is a projection for CA of the average warming scenario, which, in turn, is based on A1B and calculated in the general circulation model ECHAM 5. This scenario is taken as the base one for Amu Darya basin in the PEER project.
- The SANIGMI Institute’s flow generation mathematical model, which allows assessing the role and contribution of different sources to river flow, is used as the main tool for calculation of river flow in Central Asia. An alternative approach to the hydrological models of SANIGMI includes modeling of river flow by using historical cycle-series adjusted for the future with account of climate change. This approach applied in the ASBmm package and tested against actual data for the last decade is based on the concept of the cyclical nature of natural process variations. Such cyclical nature is viewed as progressive development on which climate-caused changes have an impact rather than as simple periodical repetition of observed phenomena; the series are corrected by coefficients derived from the SANIGMI model’s assessments. Thus, the concept of cyclical nature (which takes into account all special characteristics of local flow generation) in given approach (adopted for PEER) is enhanced by hydrological modeling.

One of the problems encountered is the shortage of input data on hydrology, water management and economy of Turkmenistan over the last 5-7 years and the lack of information on national agriculture development plans of Turkmenistan after 2020. The information gap on Lebap and Dashovus veloyats (planning zones) – middle and lower reaches of Amu Darya – was filled by the data from BWO Amu Darya (water distribution and use); the information was received from the Dashovus branch and Srednedarya (Turkmenabad) department of BWO Amu Darya and passed to information-analytical team for analysis and population of DB. The missing data on the Karakum canal zone will be collected by the project expert from Turkmenistan and also from open sources, such as official scientific serials of Turkmenistan and international publications.

Analysis and scenario building for 2016-2050 will be done by the project economist from SIC ICWC.