Kyrgyz Republic

Department of Water Resources and Land Improvement
National Water Resources Management Project – Phase I
NWRMP/CS/QBS/C.1/01

Trip Report

April 30 – May 9, 2015

DWRLI IT Staff in the Server Room

Submitted to:

Project Implementation Unit

National Water Resources Management Project – Phase 1

Department of Water Resources and Land Improvement

Kyrgyz Republic

Prepared by:

Tom S. Sheng, Ph.D.
Senior Water Resources Data Systems Specialist
Computer Assisted Development, Inc.

May 15, 2015

ACRONYMS

CADI	Computer Assisted Development, Inc.
CSS	Cascading Style Sheets
DBMS	Database Management System
DIN	Digital Information Network
DWRLI	Department of Water Resources and Land Improvement
GIS	Geographic Information System
GPS	Global Position System
GSM	Global System for Mobile Communications
HQ	DWRLI Head Quarters in Bishkek
HTML	HyperText Markup Language
IAS	Information and Analytical System
iMoMo	Innovation Technologies for Monitoring, Modeling and Managing Water
ISF	Irrigation Service Fees
IT	Information Technology
ITS	Information Technology and System
LAN	Local Area Network
NWRMP	National Water Resources Management Project
OJT	On-the-Job Training
PHP	PHP: Hypertext Preprocessor
PIU	Project Implementation Unit
SCADA	Supervisory Control and Data Acquisition
SDC	Swiss Development Cooperation
SQL	Structured Query Language
TOR	Terms of Reference
VPN	Virtual Private Network
WG	WIS Working Group
WIS	Water Information System
WMIP	Water Management Improvement Project
WUA	Water User Association

OBJECTIVES

The primary objectives of this mission were to provide short-term technical assistance to assess progress made on the DWRLI HQ network system since the last mission in the Fall of 2013; provide advice and guidance on procuring specific computer hardware for the national Water Information System (WIS); prepare TORs for the IT specialists to be hired under the project; and meet with the iMoMo consortium members, view their field activities, and discuss ways to collaborate between the iMoMo Central Asia Project and the NWRMP.

ACTIVITIES

This was the first of nine missions under CADI's contract. The consultant carried out the following activities from April 30 to May 9:

1. Reviewed relevant reports related to national water data/information management.
2. Visited and assessed progress made on the DWRLI HQ network.
3. Reviewed the bid evaluation report for the office computer and network equipment and suggested ways to re-tender the equipment.
4. Prepared TORs for six additional national specialists (IT/LAN, GIS, database, website, CAD, and computer training).
5. Met with the iMoMo team on May 6 and visited their field activities in the Chu basin on May 7.

A list of persons met during the visit and daily activities are attached as Appendixes A and B, respectively.

OUTPUTS

1. Reviewed reports related to national water data and management information systems

(i) Inception Report: Establishment of a Sustainable National Water Information System, September 2013;

(ii) Action Plan: Establishment of a Sustainable National Water Information System, October 2013;

(iii) Bid Evaluation Report and Recommendation of Contract Award: Procurement of IT equipment and Office equipment with Preinstalled MS Office and Providing Trainings, NWRMP-Phase 1, April 2015;

(iv) iMoMo KG Phase April 2015 – March 2016, March 2015; and

(v) iMoMo Innovation HUB presentation, January 2015.

2. Revisited the architectural blueprint for the web-based, distributed national WIS

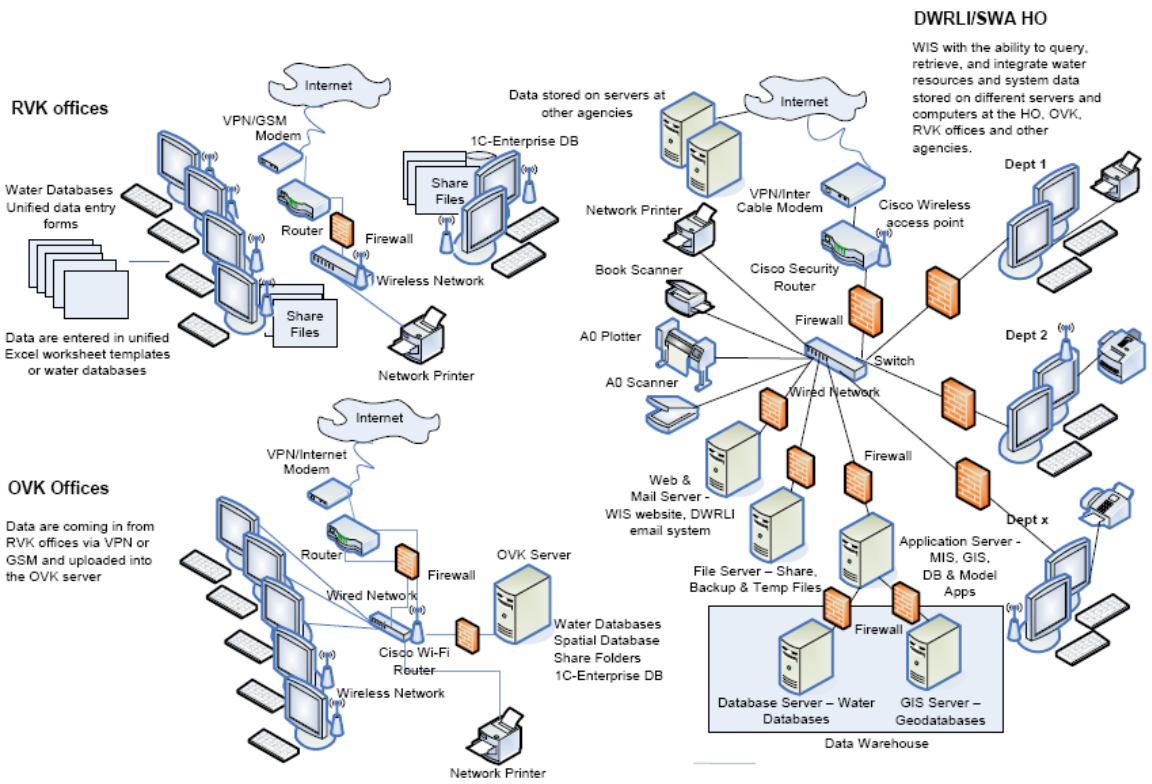
The approach to developing the WIS is to "***Phase In***" the WIS components over time (as shown on the next page). The major building blocks for the system are:

(i) A *digital information network* (DIN) to link all the computers in the HQ, Oblasts, Rayons and reservoir offices via LAN, VPN, GSM and/or Website;

(ii) A *data warehouse* consisting of: (a) relational databases in the database server (i.e., water cadastre, hydro-technical structure passports, WUAs, water user permits, resource fee collection, surface water quality, water uses, and groundwater quality and availability) and (b) a geospatial database of multi-geospatial data layers in the GIS server to strengthen WIS contents by providing geo-referenced data with dynamic links to related tabular data in the relational databases for GIS analysis, spatial modeling and thematic map generation; and

(iii) A *website* to support the distributed WIS with the ability to query and retrieve important water resource and water system information stored on different servers in DWRLI and other agencies, and to integrate them into the website so they are accessible by all stakeholders.

DIN and WIS Blueprint



DWRLI targets by the end of Phase 1 include:

(i) A DIN that links all the computers in the HQ, Oblast/BMU, Rayon and reservoir offices via mostly VPN and GSM for remote locations only. This will allow data and communication to flow electronically and securely between all offices.

(ii) All HQ servers installed and connected to the existing DWRLI wired network.

(iii) A computer server, computers and VPN/Internet installed on the existing wired network or the new Cisco wireless network at each Oblast office.

(iv) A wireless network with VPN/Internet and computers installed at each reservoir office.

(v) A wireless network with VPN/Internet and computers installed at each Rayon office.

(vi) A set of unified worksheet templates designed and constructed to facilitate "Report Automation" tasks for each DWRLI department. These unified worksheets will be utilized by the Rayons, Oblasts and HQ so the collected water data/information can be consolidated automatically and summarized at each administrative level.

(vii) A geospatial database on the HQ GIS server established with multi-geospatial data layers to enhance the WIS content by providing both geospatial data with related tabular data to support technical analysis, and modeling and thematic mapping.

(viii) A basic WIS website/portal to share water resource and system data/information, thematic maps, and reports with stakeholders. At this stage, all water data/information on the website will come from the HQ servers.

At the end of Phase 2, it is anticipated that DWRLI will have:

(i) A fully functional DIN.

(ii) A fully functional data warehouse designed, constructed and deployed consisting of: (a) relational databases in the database server (i.e., water cadastre, hydro-technical structure passports, WUAs, water user permits, resource fee collection, surface water quality, water uses, and groundwater quality and availability); and (b) a geospatial database on the GIS server with links to related tabular data from the relational databases.

(iii) An enhanced WIS website designed, constructed and deployed with the ability to query and retrieve water resource and water system data/information stored in the DWRLI data warehouse and databases in other agencies, and the ability to share database information via interactive maps, tables, and/or reports.

The **long-term target** beyond Phase 2 is to have in place:

(i) A fully functional sub-WIS operating in each Oblast/BMU office to feed data to the HQ WIS, with the Oblasts responsible for maintaining basin-specific information in their relational and geospatial databases. At this stage, the HQ data warehouse will mainly serve as a back-up system for the Oblasts/BMUs.

(ii) A web-based, distributed WIS, with the ability to post available water resource and system data/information from the Oblast/BMU servers directly to the WIS Website.

3. IT Staffing Requirements

To successfully implement the WIS, PIU will need to hire no less than six additional national specialists as described below.

No	Major Tasks	Specialist
1	DIN, LAN and server configuration, administration and operation and maintenance. Responsible for DIN day-to-day operation and LAN and server administration.	IT/LAN Specialist with 5-10 years experience installing and configuring servers with software such as Microsoft SharePoint Server, Exchange Server, Softline DeskWork 4, UserGate Proxy and Firewall, cloud-based Office 365 Enterprise package, plus LAN network hardware such as Wi-Fi routers, VPN and GSM.
2	Relational database design, construction, and deployment. Responsible for all database operation and maintenance in the data warehouse.	Database Specialist with 5-10 years experience in database applications with Microsoft SQL Server, and/or PostGreSQL enterprise database, and SQL programming.
3	Geospatial database design, construction, and deployment. Responsible for geospatial database management, and spatial analysis and modeling in the data warehouse.	GIS Specialist with 5-10 years experience in GIS applications with ArcGIS 10.x, ArcGIS for Server, QGIS, PostGIS/PostGreSQL, Mapserver, and/or Openlayer software and programming with SQL, Python, C++, Java or Javascript, Flex and/or PHP.
4	Website design, construction, and deployment. Responsible for building, posting and maintaining the WIS website to serve water data to all users.	Website Specialist with 5-10 years experience in web design software and programming languages such as Adobe Creative Suite 6 Design & Web Premium, and web programming languages such as HTML, CSS, JavaScript, PHP, Java, Python, Ruby, and/or Perl.
5	CAD drawing and mapping. Coordinate all CAD activities within the DWRLI and collaborate	CAD Specialist with 5-10 years experience in engineering drawing and canal system mapping with Autodesk

	with the GIS specialist on file conversion.	AutoCAD and/or AutoCAD Map 3D.
6	Computer training coordination, management, monitoring and evaluation. Responsible for managing all computer training activities at all three administrative levels and providing feedback to improve the training courses.	Computer Training Specialist with 5-10 years experience in coordinating, providing logistic support for, managing schedule for, monitoring and evaluating a large number of computer courses.

To make sure the WIS will be sustainable after the NWRMP ends, DWRLI should consider hiring junior IT staff members to be trained by working directly with the PIU IT specialists over the project duration.

Accomplishing the goals of the WIS will mainly depend on the specific technical skill sets of the IT specialists in PIU. The final selection of the database management system, GIS, computer server, and website development software packages should only be made after consulting with the WIS development team.

With the Ministry's salary cap of $700/month on national professionals, it is difficult, if not impossible to recruit well qualified and experienced IT people from the market place with a much higher rate of $1,500 - $2,000/month. The PIU needs to resolve this issue soon. Otherwise, the WIS component will only provide computers and LAN equipment to HQ, Oblast and Rayon offices.

4. WIS Working Group Formation

A list of data usually included in a WIS was prepared in 2013. It was noted that several datasets on the list are not available within the DWRLI but could be provided by other agencies as follows:

No.	Agency	Data
1	**Agency of Hydrometeorology**	
	- Department of Communication and Information	Water levels, discharges, meteorological parameters.
	- Department of Hydrological Forecasting	River levels, discharges, meteorology info, water supply, hazard warnings.
2	**Ministry of Emergency Situations**	
	- Department of Emergencies Monitoring and Forecasting	Mud flow, landslide, avalanche, flash flood, and earthquake events. Hazard and risk zones.
3	**Agency of Geology and Mineral Resources**	

	- Hydrogeological Expedition	Groundwater quality, level and abstraction. Licenses for use of groundwater.
4	**Agency of Environmental Protection and Forestry**	
	- Ecological Expertise and Use of Natural Resources Division	Wastewater permits, risk classes and standards. Environmental protection zones.
	- Monitoring Division	Waste water quality.
5	**Ministry of Agriculture**	
	- Design Institute of Land Management	Land uses, soils, salinity maps, and irrigation and Rayon maps.

It is essential that a WIS working group (WG) is formed with members from the other five water and land agencies. This will allow the DWRLI to build a more comprehensive WIS with data from all agencies and publish them in the annual water cadastre report through the DWRLI Information and Analytical Sector. It has been noted that DWRLI has not published the annual cadastre report since 1996, mainly due to a lack of coordination and support from the other agencies.

5. HQ Wired Network

As of May 2015, the HQ wired network system - cables, modem, router, patch panel, switch, four servers, two UPS', and a power distribution unit (PDU) provided by the I WMIP - has been installed on a server rack in an air-conditioned room. DWRLI hired an IT/LAN administrator to operate and maintain the system.

The HP Proliant DL580 G7 server is not yet working and must be repaired. The other three servers (Lenovo ThinkServer RD 330–16GB Ram, Lenovo ThinkServer RD330–8 GB Ram, and Fujitsu Primergy RX600) are on-line. One of the Lenovo RD 330 servers is used for sharing Internet service. Most of the computers at the HQ are connected to the wired network and have Internet access. Web, email and share file services will be available later as a part of the WIS development.

6. VPN/Internet Connection

Recent experience with the Land and Real Estate Registration Project shows that VPN and JET Internet are both reasonable options for DIN. Kyrgyz Telecom provides VPN via phone line. Discounts of 5% to 25% are available for multiple VPN/Internet connections with 8 to 50 points, respectively. For more details on the Kyrgyz Telecom VPN and JET Internet, please visit www.kt.kg. As soon as the WIS team in place, the IT/LAN specialist should follow-up with Kyrgyz Telecom and make sure VPN is still the best option for DIN application.

7. Computer Hardware Procurement

The bid evaluation report for procurement of IT and office equipment with preinstalled MS Office, including providing training, shows that only three companies submitted bids and all three are disqualified for one reason or another. Re-tendering is recommended by DWRLI. It appears the main reason for limited bidders is the equipment lots are improperly divided. Most of the small hardware companies in KG may be unable to bid

due to the high quantity and high cost equipment in Lot 1. After several meetings about this procurement, the Consultant recommends dividing items in Lots 1 and 2 into three Lots, as shown below, in order to draw more national bidders including smaller vendors.

Lot 1: Notebooks – 185 units; Wireless routers – 44 units; MFD – 44 units; Wireless adapters - 90 units; Wireless adapters for working stations with USB ports– 45 units; MFD with WiFi – 5 units; MFD – 1 unit; and UPS' – 11 units.

Lot 2: Servers for each Oblast – 7 units; GIS Notebooks for Oblasts – 7 units; Backup servers for HQ – 4 units; GIS Notebooks for HQ – 4 units; Plotters A0 for HQ - 2 units; and Scanners A0 for HQ – 2 units.

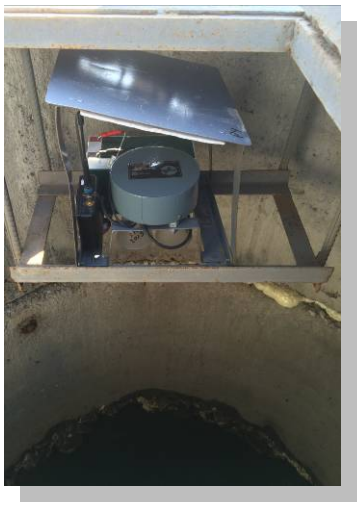
Lot 3: GPS receivers – 120 units.

8. Computer Training

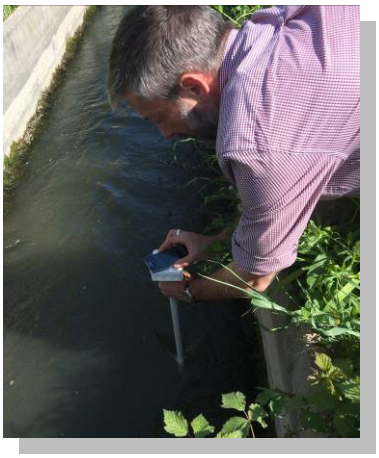
Computer training needs to start in 2015. WMIP conducted six computer training courses/workshops with a total of 154 trainees by the end 2013. Most of the trained staff members are no longer working for DWRLI. At present, staff members that use the computers at the HQ, Oblasts and Rayons are mostly self-taught.

Training courses on basic computer use (Operating System; Office: Word, Excel, and Access; Anti-Virus and Outlook) and basic computer maintenance will be provided at HQ, Oblasts and Rayons as part of the computer hardware procurement package. Additional training courses such as LAN, DIN operation, database, website design, CAD, GIS, GPS, and WIS will be scheduled and coordinated by the Computer Training Specialists, and designed and taught by the PIU subject area specialists.

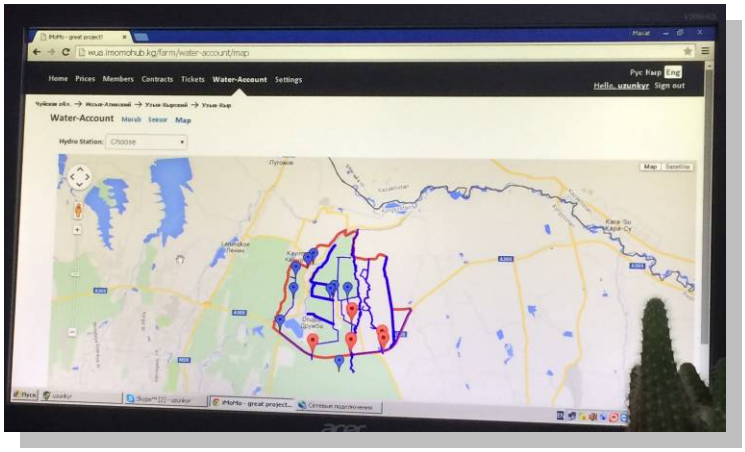
9. IMoMo Visit



The Consultant and the iMoMo team visited two field canals with GSM-based water level data loggers in the Uzun Kyr WUA. Dr. Tobias Siegfried, HydroSolutions, also demonstrated use of the Smart Sticks to measure the water level in one of the field channels. Mr. Alexander Artuhin, Head of the Water Automation and Metrology Unit, described how the data logger operates. He explained that it is comprised of an ultrasound sensor to measure water levels and has a built-in memory chip to store data, a GSM modem to send data to the WUA and Rayon offices every two hours, and a battery to power the sensor and modem that lasts up to one year. The data logger is mounted in a concrete stilling well with a steel locking lid to prevent theft.



The type of water level data logger in the demonstration has been built by the Constructional and Technological Institute for years and is part of the SCADA system used by the Chu Water Department. The cost of the data logger is about $1,200 per unit. The stilling well structure is bit more expensive at about $2,500 each. The costs of Smart Sticks are not particularly high: one with a read-out window is about $20, and one with smart phone interface but without the read-out window is about $30. GSM data transmissions cost for seven data logger sites is approximately $5 per month.



The team also visited the Uzun Kyr WUA office and viewed their web-based water accounting software, which was developed by Constructional and Technological Institute and iMoMo. The software is cloud-based and the WUA's water accounting data and software are stored and backed-up by the Amazon Cloud Computing Services. The software receives near real-time water level data from the automated gauging stations every two hours and is linked to a financial accounting package to help the accountant prepare irrigation water service fees (ISF) for each farmer based on the number of waterings, planted crops, and/or land area. Note that the ISF is currently not calculated based on the recorded volume of water used by each farmer.

The group then visited the Issyk-Ata Rayon office to examine their web-based water accounting software, but the Internet connection was down.

The Director of Rayon likes the remote water level collection concept and wants the iMoMo team to install the water level data loggers at all hydropost locations in the Rayon, which consists of 1,086 sites. At $3,700 per site, it will cost over $4 million, in addition to a GSM data communication cost of $775 per month for all sites.

The Chu Oblast Water Department was our last stop. A staff member showed us the Chu Webmapping site developed by the Component 2 team under the iMoMo Central Asia Project. The site has rivers, canals, reservoirs and hydroposts overlay on top of a Google map. The website is capable of retrieving near real-time water level data for a number of hydroposts and generated hydrographs for selected hydroposts with the available data.

The iMoMo team is doing a great job demonstrating what could happen in the future with new technology in Kyrgyz Republic.

SHORT-TERM RECOMENDATIONS

The consultant's recommendations for the next six months are:

1. Re-tendering the computer hardware with three lots and revised technical specifications to be provided via email.
2. Increasing the monthly salary rate from $700 to $1,500/month for national IT specialists.
3. Installing computer hardware and software at HQ, Oblasts and Rayons under close supervision and inspection of the WIS Coordinator.
4. Conducting general computer training at HQ, Oblasts and Rayons under the supervision and participation of the Computer Training Specialist.
5. Collaborating with the iMoMo Central Asia Project on water management software development for the WUAs and Rayons, and if possible, GIS-based website development for the Chu river basin and other basins in KG. A closer look at both items by the WIS team will be necessary before making a final decision.

APPENDIX A. KEY PERSONS MET

Name	Title	Organization
Mr. Baratali Turanovich Koshmatov	Director	PIU, National Water Resources Management Project – Phase I, DWRLI
Mr. Kydykbek Beishekeev	Deputy Director	PIU, National Water Resources Management Project – Phase I, DWRLI
Ms. Natalia Manchenko	Procurement Specialist	PIU, National Water Resources Management Project – Phase I, DWRLI
Ms. Ekaterina Sahvaeva	Director	Information and Analytical Sector, DWRLI
Ms. Matushkina Olga	GIS Specialist	Scientific and Research Institute of Irrigation
Ms. Lyubov Gerashenko	GIS Specialist	Scientific and Research Institute of Irrigation
Mr. Alexander Artuhin	Head	Water Automation and Metrology, Project –Constructional and Technological Institute
Mr. Bakyt Makhmutov	Assistant Regional Director	Swiss Development Cooperation
Dr. Tobias Siegfried	Partner	Hydrosolutions, Switzerland
Ms. Julia Titova	Interpreter	Computer Assisted Development, Inc., USA

APPENDIX B. ACTIVITIES (April 30 – May 9, 2015)

Date	Location	Activity Description
04/30/15 Thursday	Fort Collins	Travel
05/01/15 Friday	Dubai	Travel
05/02/15 Saturday	Bishkek	Arrive Bishkek Review NWRMP reports.
05/03/15 Sunday	Bishkek	Review iMoMo Central Asia Project reports.
05/04/15 Monday	Bishkek	Meet with Ms. Julia Titova, Interpreter Meet with Mr. Beishekeev and Ms. Manchenko, PIU to discuss hardware procurement issues. Meet with Aman, PIU to discuss WUA maps and asset management/inventory using GPS. Visit Ms. Matushkina Olga and Ms. Lyubov Gerashenko, SRII to discuss data sharing, CAD file to GIS file conversion for the WUA maps, and their participation in the iMoMo project. Visit the DWRLI server room and review progress made since September 2013.
05/05/15 Tuesday	Bishkek	Review the computer hardware tender document and bid evaluation report for computer hardware and software. Prepare TORs for the national specialists for the WIS component.
05/06/15 Wednesday	Bishkek	Meet Mr. Koshmatov, PIU Director to discuss the computer hardware and software procurement issues, salary cap issue with the national specialists, and iMoMo Central Asia project activities. Visited Ms. Salvaeva Ekaterina, IAS to discuss data sharing via WIS and her involvement with the iMoMo project. Meet with the iMoMo team and Mr. Bakyt Makhmutov, Assistant Regional Director, SDC for dinner at Arsu.
05/07/15 Thursday	Chu Basin	Sent Mr. Bakyt Makhmutov a copy of report on river coding system implemented in the South Caucasus. Field trip with the iMoMo team to Chu Basin. Visited two field canals, one WUA office and one Rayon Water Department.
05/08/15 Friday	Bishkek	Debrief Mr. Koshmatov on my field trip with the iMoMo team, computer hardware procurement, salary cap on national specialists, data sharing via WIS, water atlas production, and water cadastre report generation. Send Mr. Bakyt Makhmutov a copy of report on canal coding system implemented in Armenia.
05/09/15 Saturday	Bishkek – Fort Collins	Travel Return home