**Republic of Tajikistan**

**Second Public Employment for Sustainable Agriculture and Water Resources Management Project**

**World Bank Technical Support Mission**

**January 24 – February 1, 2020**

**Water Information System Implementation**

**Prepared by Tom Sheng**

**Information Systems Consultant**

**Package C. Water Information System (WIS)**

**A. Status of WIS implementation**

A total of 24 agreed actions, of which 11 has been accomplished since October 2019, bringing to a total of 20 completed under the Component B1.The remaining four (Numbers 10, 18, 19, and 20) will be fulfilled by February. The WIS IT hardware and software for MEWR, ALRI, RBO, and regional ALRI offices are 100% installed, fully tested and functioning in the Kofarnihon Basin. The digital information network via VPN and Internet connections provided by the Babilon-Telecommunications is established linking both MEWR and ALRI headquarters to their respective field offices.

The three tabular relational database applications (Basin Planning Database Application (BPDA), Water Accounting Database Application (WADA), and Irrigation Management Information System (IMIS)) are delivered by three service providers in the past three months. In general, the IMIS and BPDA have been presented to and accepted by ALRI and MEWR, respectively. The WADA will need more work to provide basin water balance and basin water supply and demand balance computations. At present, it only provides water balance by river reach, between hydroposts. All three applications will be ready for testing by intended uses in the field offices after February.

The WIS team has completed four additional geospatial layers since October 2019, bringing to a total of 57 spatial layers (53 vector layers and four raster images) for the National Geospatial Database Application (NGDA). Furthermore, four raster images are collected for risk and hazard zones (mud-flow, avalanche, land erosion and seismic) and will be vectorized to ArcGIS shapefiles after February.

The WIS team has also completed two reports to summarize the results on (1) data/information needs assessment for basin planning and irrigation management and (2) data/database survey to identify available tabular data and databases in MEWR, ALRI and other relevant agencies (only seven of 13 agencies contacted with responses) and submitted to PMU in October 2019 and January 2020 respectively. Three more reports (map standards for the geospatial WIS component and map templates; findings of the geospatial data survey to identify available paper maps and digital geospatial layers in MEWR, ALRI, and other relevant agencies; and metadata for the 57 collected geospatial layers) were prepared and submitted to PMU in January.

The WIS website (http://wis.tj) is constructed using WordPress, a content management system that is supported by the MySQL database server, and deployed it on one of three MEWR servers with links to the four WIS database applications. Additional programming will be needed to improve the overall layout, visual appearance, color scheme, and navigation to match the MEWR website (<http://mewr.tj>), add a link from the MEWR website to the WIS website, add a link from ALRI website (<http://alri.tj>) to the IMIS, add more relevant reports and presentations, and update the site frequently with latest news on WIS activities. Furthermore, build a special water monitoring webpage for the ALRI website to show the real-time flow data from the 49 automatic gauging stations with their approximate locations on a schematic canal network diagram of the Lower Kofarnihon Basin.

**B. Next Steps and Agreed Actions**

Twenty of the 24 actions agreed have been completed as of January and tabulated details of progress were provided by the WIS team. Four actions are still in progress and scheduled for completion in February. The outstanding and completed actions and their status are detailed in the table below.

| **Activities** | **Deadline** | **Responsibility** |
| --- | --- | --- |
| 1. Update the combined roadmap to coordinate the implementation of  Packages B (including for sub-components MEWR and ALRI)  and C. | Aug 2019 | Component II Manager, WIS Coordinator |
| 2. Complete installation of computer hardware & software for MEWR and ALRI head offices in Dushanbe and field offices in the Kofarnihon Basin. | Jul 2019 | Local IT Consultant and equipment suppliers |
| 3. Complete installation of VPN and LAN in MEWR and ALRI headquarters in Dushanbe and field offices in the Kofarnihon Basin. | May 2019 | Local IT Consultant and service provider |
| 4. Install ArcGIS software with Spatial Analyst extension at MEWR and ALRI headquarters in Dushanbe and field offices in the Kofarnihon Basin. | Jul 2019 | Local IT Consultant |
| 5. Install MySQL-PHP software at MEWR and ALRI headquarters and field offices in the Kofarnihon Basin. | Sep 2019 | Local IT Consultant, Local Database Consultant |
| 6. Deploy the wis.tj website to share water data/information from MEWR and ALRI. | Aug 2019 | Local Database Consultant and PMU |
| 7. Complete the data/information needs assessment for basin planning and irrigation management with the database development contractors and prepare a report to summarize the findings. | Jan 2020 | WIS Coordinator, Local Database Consultant |
| 8. Complete a data/database survey to identify available tabular data and databases in MEWR, ALRI, and other relevant agencies and prepare a report to summarize the findings (only 7 out of 13 agencies responded to the MEWR’s questionnaire for data survey). | Oct 2019 | WIS Coordinator, Local Database Consultant |
| 9. Build database links to share available water data collected by MEWR with other participating agencies via DIN. | Aug 2019 | Local IT and Database Programmer |
| 10. Add WOC to spatial layers provided by Inventory of Irrigation  Systems work in the Kofarnihon Basin.  Note: WOC for the Lower Kofarnihon completed. WOC for three of the six districts in the Upper Kofarnihon sub-basin completed. The WIS team just received the irrigation inventory data for the remaining three on January 23. | Feb 2020 | Local GIS Consultant |
| 11. Complete the geospatial data survey to identify available paper  maps and digital geospatial layers in MEWR, ALRI and other  relevant agencies, and prepare a report to summarize the findings. | Jan 2020 | Local GIS Consultant |
| 12. Establish map standards and share them with Package B and other basin projects. | Jan 2020 | Local GIS Consultant |
| 13. Collect and digitize the required paper maps and harmonize 57 spatial vector and 4 unclassified raster files from MEWR, ALRI, and other relevant agencies for the NGDA. | Jan 2020 | Local GIS Consultant |
| 14. Complete the 37 partially completed layers for the NGDA. | Sep 2019 | Local GIS Consultant |
| 15. Build 3 more required geospatial layers to complete a total of 57 layers for the NGDA. | Jan 2020 | Local GIS Consultant |
| 16. Finalize metadata report for the 57 geospatial data layers | Jan 2020 | Local GIS Consultant |
| 17. Publish 57 spatial layers from the NGDA online via GeoNode (for testing only) | Jan 2020 | Local GIS Consultant |
| 18. Deploy the BPDA for testing by intended users. | Feb 2020 | Local Contractor, Local Database Consultant |
| 19. Deploy the WADA for testing by intended users. | Feb 2020 | Local Contractor, Local Database Consultant |
| 20. Deploy the IMIS for testing by intended users. | Feb 2020 | Local Contractor, Local Database Consultant |
| 21. Add provision for the WOC data to BPDA, WADA and IMIS to enable links to the NGDA. | Jan 2020 | Local Contractor, Local GIS Consultant, Local Database Consultant |
| 22. Complete basic computer training for MEWR and ALRI staff at the headquarters and field offices. | Aug 2019 | WIS team |
| 23. Complete advanced computer training for MEWR and ALRI staff at the headquarters and field offices. | Dec 2019 | WIS team |
| 24. Complete special training sessions on the collection and analysis of relevant data at the headquarters and field offices. | Dec 2019 | WIS team |

**C. Database Applications (DBA)**

**1. Basin Planning Database Application (BPDA)**

The BPDA can only store 11 of 30 sets of typical data collected during a basin planning exercise. It covers most of the water supply, demand and use data, but not social, economic and environmental data. At the present stage of the database, data collected from a basin plan preparation cannot all be stored for future integrated basin planning and water resources management. The detailed findings are presented in the following table.

### BPDA

|  |  |  |  |
| --- | --- | --- | --- |
| **No.** | **Recommended data sets for basin planning** | **BPDA is ready to hold the data sets as of Jan 2020 (Yes/No)** | **Remarks** |
| 1 | Daily average water level and water discharge from the Hydro-posts for the last five years | Yes |  |
| 2 | Daily average air temperature, precipitation, evaporation, snow cover from the meteorological stations for the last five years | No | Basic information about glaciers (Form 20).  The rest of the data to be added under ZRMIP. |
| 3 | Surface water qualitative monitoring from the water quality sampling posts for the last five years | Yes |  |
| 4 | Groundwater quantity and quality for the last five years | Yes |  |
| 5 | Daily water allocations from the river to the main canals for the last five years | Yes | Import the data from IMIS |
| 6 | Daily water allocations from the main canals to irrigation systems for the last five years | NA |  |
| 7 | Daily water allocations to WUAs for the last five years | Yes | Import the data from IMIS |
| 8 | Yearly amount of drinking water supply  (per “vodokanal”) and average supply in networks (l/capita/day) | No | Import the data from WADA after the water use by sector module is built and populated. |
| 9 | Wastewater treatment facilities (annual amount of communal sewage) | No | To be added under ZIRMIP |
| 10 | Daily wastewater discharge sites (m³) | No | To be added under ZIRMIP |
| 11 | Daily water use by water use purpose for the last five years | No | Import the data from WADA  (see remarks under Item no. 8) |
| 12 | WUA water requests for the last five years | Yes | Import the data from IMIS |
| 13 | Drinking water demand for the current year (by administrative units or sub-basins) | No | Import the data from WADA  (see remarks under Item no. 8) |
| 14 | Irrigation water demand for the current year (by administrative units or sub-basins) | Yes | Import the data from IMIS |
| 15 | Industrial water demand for the current year (by administrative units or sub-basins) | No | Import the data from WADA  (see remarks under Item no. 8) |
| 16 | Use of groundwater by water use purpose for the last five years | Yes |  |
| 17 | Ecological flow in the rivers of the river basin for the last five years | Yes |  |
| 18 | Areas of arable land, irrigated land, rain-fed land, pasture land, forest land (in hectares or km2) | No | To be added under ZIRMIP.  The land data are available in NGDA |
| 19 | Hydropower generation in the river basin (including hydro-power plants) for the last five years | No | To be added under ZIRMIP |
| 20 | Hydro-technical facilities of the river basin (state, annual operation and safety) | Yes |  |
| 21 | Drainage water network (state, intakes, quality) | Yes |  |
| 22 | Fish stock bred in the river basin | No | To be added under ZIRMIP |
| 23 | Socio-economic development indicators of the Oblasts/Rayons located in the river basin | No | To be added under ZIRMIP |
| 24 | Main industry in the river basin (light industry, heavy industry, fisheries, recreation, etc.) | No | To be added under ZIRMIP |
| 25 | Recent census data on population in the river basin | No | To be added under ZIRMIP |
| 26 | Natural hazards (floods, mudflows, areas, extent) for the last five years | No | Water, coastal and special protection zones are available (Forms 32 and 33) |
| 27 | Land use patterns in the river basin for the last five years | No | To be added under ZIRMIP |
| 28 | Projections of socio-economic development in the basin until the year 2030 | No | To be added under ZIRMIP |
| 29 | Projections of the impact of climate change on water resources in the river basin until 2030 | No | To be added under ZIRMIP |
| 30 | Projections of changes in demography of the river basin until 2030 | No | To be added under ZIRMIP |
| **B.** | **Static/Reference Data** |  |  |
| 1 | Basin Management Area/Zone | Yes | 5 basin management areas are available in the BPDA. |
| 2 | River basins | Yes | 8 river basins are available in the BPDA. |
| 3 | Rivers | Yes | Import the river attributes from NGDA (4591 rivers including 45 main rivers in Tajikistan). |
| 4 | Gauging stations | Yes | Import the station attributes from NGDA (64 gauging stations including 49 automatic stations in the Lower Kofarnihon). |
| 5 | Lakes | Yes | Import the lake attributes from NGDA (1,072 lakes in Tajikistan). |
| 6 | Reservoirs | Yes | Import reservoir attributes from NGDA (36 reservoirs in Tajikistan). |
| 7 | Canals/Channels | Yes | Import the canal attributes from NGDA (243 canals in the Kofarnihon). |
| 8 | Pump Stations | Yes | Import the station attributes from NGDA (267 pump stations in the Kofarnihon). |
| 9 | Collectors | Yes | Import the collector attributes from NGDA (205 collectors in the Kofarnihon. |
| 10 | Water management areas | Yes | Import the area attributes from NGDA (two water management areas – Upper and Lower Kofarnihon). |
| 11 | Hydro-technical structures (HTC) | Yes | Import the HTC attributes from NGDA (10 main canal intakes in the Lower Kofarnihon). |
| 12 | Groundwater wells | Yes | Import the groundwater well attributes from NGDA (25 wells in the Lower Kofarnihon). |
| **C** | **Database functions** |  |  |
| 1 | Data input, edit and delete | Yes |  |
| 2 | Data import and export utilities | Yes | Text or worksheet formats |
| 3 | Data collection forms | Yes | 38 forms per MEWR instructions |
| 4 | Reports | Yes | 38 reports per MEWR instructions |
| 5 | Maps | Yes | Basin management areas/zones |
| 6 | Figures | Yes | Basin zone indicators (catchment areas, water availability, water uses) and quantitative indicators of water bodies. |
| 7 | User administration | Yes | Organization, roles (administrator, operator, view only, OBRU operator) and users |

Recommendations for improving the BPDA are:

1. Make sure BPDA login is compatible with all major browsers. Presently, only Windows Internet Explorer can be used to access the BPDA.
2. Update the TJ logo and MEWR script on the login page to match the size of the IMIS login page and add an appropriate background photo for the page by February.
3. Replace “Copyright © 2019 Министерство энергетики и водных ресурсов Республики Таджикистан”at the bottom of the database with Copyright © 2020 Министерство энергетики и водных ресурсов Республики Таджикистан by February.
4. The menu “Отчет по реестру” (Registry Forms/Reports) is where stakeholders could enter, view, edit, delete, import and export data, as well as generate graphs using stored data. Replacing the menu name with a more intuitive title (such as Data Management) will help the user navigate the database by February.
5. Populate the BPDA with the data collected under Component B, Kofarnihon Basin plan preparation. The staff members from the two RBO offices will perform the data entry tasks under the supervision of the WIS team after February.
6. Design and add more database tables to accommodate the 18 additional data sets to ensure the BPDA is fully functional for storing and managing most if not all the basin planning data. This database programming task can be carried out by the WIS team after February.
7. Build additional forms/reports as needs arise later.

**2. Water Accounting Database Application (WADA)**

The WADA has limited use in its present state. It can only compute water balance by river reach between two hydroposts. Due to lack of perception, evaporation, water use and basin outflow data, it is impossible to carry out the basin water balance analysis and water supply and demand balance computations. Moreover, this database design is not as flexible as the other two because the basin management zones are fixed at five (see the main menu on the left). If the MEWR decided to regroup the river basins other than the exiting five in the future, this database would require major programming to accommodate the changes.

### WADA

|  |  |  |  |
| --- | --- | --- | --- |
| **No.** | **Recommended data for the WADA** | **WADA is ready to hold the data sets as of Jan 2020 (Yes/No)** | **Remarks** |
| **A** | **Dynamic/Time Series Data** |  |  |
| 1 | Daily average water level and water discharge from the hydroposts on rivers, canals and collectors | Yes | Import the data from BPDA and IMIS. |
| 2 | Main canal details | Yes | Import the data from NGDA or BPDA |
| 3 | Irrigation system details | Yes | Import the data from IMIS. |
| 4 | Water use by sector (i.e., agriculture, drinking, industry and mining) | See remarks | Import the use data from BPDA and IMIS later under ZIRMIP. |
| 5 | Precipitation | No | Import the data from Hydromet and/or BPDA later under ZIRMIP. |
| 6 | Evaporation | No | Import the data from Hydromet and/or BPDA later under ZIRMIP. |
| 7 | Water balance analysis by river reach | Yes |  |
| 8 | Water accounting – water supply and demand balance | No | To be added under ZIRMIP. |
| 9 | Water balance by basin | No | To be added under ZIRMIP. |
| **B.** | **Static/Reference Data** |  |  |
| 1 | Rivers | Yes | Import the river attributes from NGDA |
| 2 | River hydroposts | Yes | Import the river hydropost attributes from NGDA |
| 3 | Main canal water intakes | Yes | Import the intake attributes from NGDA |
| 4 | Collector hydroposts | Yes | Import the collector hydropost attributes from NGDA |
| 5 | Reference materials | Yes |  |
| C | **Database functions** |  |  |
| 1 | Data input, edit and delete | Yes |  |
| 2 | Data collection forms | ---- | Not necessary |
| 3 | Data import and export utilities | Yes | Data import and export utilities (text or worksheet formats) |
| 4 | Reports | No | Water balance by river reach report will be available by Feb 2020 |
| 5 | Maps | Yes | River hydroposts, main canal intakes, collector hydroposts |
| 6 | Graphs and charts | Yes | Hydropost data (i.e., water level, discharge, volume, temperature) |
| 7 | Calendar | Yes |  |

Recommendations for improving the WADA are:

1. Update the TJ logo and MEWR image of the login page to match the style and size of the IMIS login page.
2. Replace the “Welcome” page with a “Main” page with a photo of a river basin on the left and a short description of the database application on the right, similar to the BPDB main page by February.
3. Add a new menu item – “Water balance” with sub-menus – River Reach Balance, Supply and Demand Balance and Basin Balance and move the “Water balance of the Kofarnihon river Tartki section - Pyanj river” under the River Reach Balance submenu by February.
4. Replace “© VIS 2020, with the support of Dusti-A LLC” on the bottom of the page with Copyright © 2020 Министерство энергетики и водных ресурсов Республики Таджикистан by February.
5. Build a database report for “water balance by river reach” by February.
6. Populate the application with actual data from the Kofarnihon Basin, not just a sample set. The staff members from the two RBO/Kofarnihon offices will perform the data entry tasks under the supervision of the WIS team after February.
7. Carry out additional database programming and data collection to perform the intended water accounting and balance computations after February.
8. Build two water use reports (similar to the ones used by the ICWC) – annual water use by sector and 10-day water use by sector during a vegetation period after February.
9. Build additional database reports as needs arise later.

**3. Irrigation Management Information System (IMIS)**

The IMIS is now operational but is missing data export functions and the main canal conveyance efficiency computations. Both of these will be provided by the developer in February/March. After that, the IMIS can test the IMIS in the Lower Kofarnihon and Zarafshon basins.

**IMIS Application**

|  |  |  |  |
| --- | --- | --- | --- |
| **No.** | **Recommended data for the IMIS** | **IMIS is ready to hold the data sets as of Jan 2020 (Yes/No)** | **Remarks** |
| **A** | **Dynamic/Time Series Data** |  |  |
| 1 | Proposed cultivated area by crop for each WUA per vegetation period | Yes | Import the data from the WUA billing system. |
| 2 | Computed water demand of each WUA per vegetation period | Yes | Import the data from the WUA billing system. |
| 3 | Actual daily water delivered to each main canal (volume) | Yes | Collect the data from the gauging stations. |
| 4 | WUA water demand vs. actual water delivered to each WUA | Yes |  |
| 5 | Computed efficiency for each main canal per vegetation period | No | It will be added in Mar 2020 |
| **B.** | **Static/Reference Data** |  |  |
| 1 | Basin management zones | Yes | Import the attributes from NGDA ( 5 total in Tajikistan). |
| 2 | Main Rivers | Yes | Import the attributes from NGDA (3 in the Kofarnihon Basin). |
| 3 | Lakes | Yes | Import the attributes from NGDA. |
| 4 | Reservoirs | Yes | Import the attributes from NGDA. |
| 5 | Catchments | Yes | Import the attributes from NGDA. |
| 6 | Main canals | Yes | Import the attributes from NGDA (11 main canals in the Lower Kofarnihon) |
| 7 | Canal gauging stations | Yes | Import the attributes from NGDA (64 total and 49 are automated in the Lower Kofarnihon). |
| 8 | Irrigation systems | Yes | Import the attributes from NGDA (9 irrigation system in the Lower Kofarnihon). |
| 9 | Drainage canals | Yes | Import the attributes from NGDA |
| 10 | WUAs | Yes | Import the attributes from the WUA billing system. |
| 11 | Regions | Yes | 1 – Khation |
| 12 | Districts | Yes | 3 – Shahrituz, Hosiri Hisrav and Kabaiyan |
| **C** | **Database functions** |  |  |
| 1 | Data input, edit and delete | Yes |  |
| 2 | Data collection forms | --- | Not necessary |
| 3 | Data import and export utilities | See remarks | Data import utility – Yes  Data export utility - Feb 2020 |
| 4 | Reports | See remarks | WUA water demand vs. actual water supply report – Feb 2020.  Main canal efficiency report - Mar 2020. |
| 5 | Maps | Yes | Hydropost and WUA locations (points) |
| 6 | Graphs and charts | Yes | Basin zones/management areas  Indicators and quantitative indicators |
| 7 | User administration | Yes | Users and roles (super administrator, editor) |
| 8 | Settings by user | Yes | Profile and change password |

Recommendations for improving the IMIS are:

1. Add an appropriate background photo for the login page by February.
2. Change the banner color of “Agency for Land Reclamation and Irrigation under the Government of Tajikistan” from black to white to make it more readable by February.
3. Replace the “Main” page with a photo of an irrigation canal structure on the left and short description of the database application on the right, similar to the BPDB home page by February.
4. Fix the Indicator chart with actual information on the Main page by February.
5. Redo the menu on the left – Planning with submenus: WUA crop info and WUA water requests; Water Supply – Same as before; Gauging Stations – Same as before; Performance – Actual water delivery to WUA, WUA water supply and demand, Main canal efficiency by February.
6. Build the Data Export utility (text and worksheet formats) by February.
7. Program the database to compute canal conveyance efficiency for each main canal by March.
8. Build the WUA water supply and demand report by February.
9. Build the main canal conveyance efficiency report by March.
10. Test the IMIS in the Lower Kofarnihon and Zarafshon after February.
11. Populate the application with actual data from the Lower Kofarnihon, not just a sample set. The staff members from the ALRI regional office in the Lower Kofarnihon will perform the data entry tasks under the supervision of the WIS team after February.
12. Build additional database reports per ALRI instructions after February.

**4. WIS Geospatial Database Application**

The WIS GIS specialist has completed 57 layers of geospatial layers – 53 vector and 4 raster layers. There are 31 layers cover entire Tajikistan, 38 layers for the Syrdarya Basin, 50 layers for the Zarafshon Basin, 56 layers for the Kofarnihon Basin, 29 layers for the Vakhsh Basin and 29 layers for the Panj Basin. A detailed breakdown of the 57 geospatial layers is provided in Annex A.

Using open source GeoNode, publishing the geospatial data online has been initiated with all 57 spatial layers and only three WIS team members can access it for testing at this time. Once MEWR gets a license or agreement from the Department of Land Management and Geodesy for publishing and sharing the digital and printed maps, additional registered and authorized users with different privileges will be added.

Recommendations for improving the NGDA are:

1. Clarify the hydropower plant locations and attribute details with the Barqi Tojik and update the attribute data by February.
2. Update attribute data and delete unnecessary attributes of all 53 vector layers by February.
3. Vectorize the risk and hazard raster images (mud-flow, avalanche, land erosion and seismic zones) after February.
4. Provide the required attribute data in Excel worksheets to populate the three tabular database applications after February.

**D. WIS Website (**[**wis.tj**](http://www.tj)**)**

The design of the website is rudimentary, not as professional as it could be. The website is lack of authority. It is not clear on authorship - who developed the site; credentials - the author should state qualifications, credentials, or personal background that gives them authority to present information; and who is supporting the site. The purpose of the information presented in the site is unclear. The main page goes right into databases, news, reports, login, calendar, etc. without stating the purpose of the website first. The site coverage is not comprehensive - not all internal links are working properly, lack of external links to relevant agencies and international development organizations on the left side, and limited news, resources and reports.

Recommendations for improving the website by February, except item no. 14:

1. Change the green-white color scheme to match the mewr.tj color scheme (blue-white).
2. Add “Ministry of Energy and Water Resources of the Republic of Tajikistan" on top of the web banner and Water Information System as the second line. Add the TJ government logo on the right side and keep the WIS logo on the left side.
3. Remove the DBAs green banner on top of the Main page.
4. Replace the Main page with the WIS framework diagram and a WIS introduction (see Annex B for the WIS introduction write-up).
5. Replace the DBA icons with relevant photos and add a short description for each DBA on the “RESOURCES – DATABASE selection (see ANNEX C for short DBA descriptions). When you select a DBA on that page, it should go directly to the DBA login page, no need for the <https://www.wis.tj/?p=12> page.
6. Delete the Report section on the left of the Main page. REPORTS link is already there on the top navigation bar.
7. Remove ENTRANCE on the right of the main page for Login, if it is not needed.
8. Keep RESOURCES-MAPS if it is for thematic maps. Otherwise, remove it.
9. Change DOWNLOAD under RESOURCES to DOCUMENT DOWNLOAD. Add more reports and documents such as WIS scoping study final report (13Feb2017 version), WIS concept paper, and WOC final report.
10. Update PRESENTATIONS with more presentations such as the WIS scoping study (Dec 2016-v3) and WOC for Tajikistan.
11. Update REPORTS with reports prepared by the WIS team members under the project.
12. Replace the WIS copyright with the MEWR copyright - Copyright © 2020 Министерство энергетики и водных ресурсов Республики Таджикистан.
13. Update the website with the latest news weekly.
14. Add FLOW MONITORING under RESOURCES to show the real-time flow data from the 49 automatic gauging stations in the Lower Kofarnihon after February.

**Annex A. WIS Geospatial Database (as of Jan 2020)**

| **No.** | **Layer name** | **Description** | **Object type** | **Available Layers** | **All Basins** | **Syrdarya** | **Zarafshon** | **Kofarnihon** | **Vakhsh** | **Panj** | **Note** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **A** | **Administrative / Basin Characteristics** | **Administrative / Basin Characteristics** |  |  |  |  |  |  |  |  |  |
| 1 | Admin border state | Administrative Border of the Republic | Polygon | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| 2 | Admin border 1 level | Regions | Polygon | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| 3 | Admin border 2 level | Districts | Polygon | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| 4 | Admin border 3 level | Jamoat | Polygon | 1 | 0 | 0 | 1 | 1 | 0 | 0 |  |
| 5 | Settlements Point | Settlements | Point | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| 6 | Settlements Poly | Settlements | Polygon | 1 | 0 | 0 | 1 | 1 | 0 | 0 |  |
| 7 | Cities | Cities | Point | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| 8 | Roads | Road network | Line | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| 9 | Railroads | Railway network | Line | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| 10 | River basins | River basins (hydrological basins) | Polygon | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| 11 | Water basins zones (based on hydrological boundaries) | Watersheds | Polygon | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| 12 | River basin organizations offices | River basin organization office locations | Point | 1 | 0 | 1 | 1 | 1 | 0 | 0 |  |
| 13 | ALRI field offices | ALRI field office locations | Point | 1 | 0 | 1 | 1 | 1 | 0 | 0 |  |
| 14 | WUAs offices | WUA office locations | Point | 1 | 0 | 0 | 1 | 1 | 0 | 0 |  |
| **B** | **Water features** | **Water objects** |  |  |  |  |  |  |  |  |  |
| 15 | Main rivers | Main rivers | Line | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| 16 | River network | River network | Line | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| 17 | Lakes | Lake locations | Polygon | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| 18 | Reservoirs | Reservoir locations | Polygon | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| 19 | Glaciers | Glacier areas | Polygon | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| 20 | Catchment areas | Catchment areas | Polygon | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| **C** | **Land** | **Land** |  |  |  |  |  |  |  |  |  |
| 21 | Hydrogeology zones | Hydrogeological zones | Polygon | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Not available |
| 22 | Hydro morphology zones | Hydro morphological zones | Polygon | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Not available |
| 23 | Geological fault zones | Geological Fault Zones | Polygon | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Not available |
| 24 | Soils | The soil | Polygon | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| 25 | Land use/cover classes | Land Use/Cover Classes | polygon | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| **D** | **Risk and hazard zones** | **Risk and hazard areas** |  |  |  |  |  |  |  |  |  |
| 26 | Mud-flow zones | Mud flow zones | polygon | 1 | 0 | 1 | 0 | 1 | 0 | 0 | Nationwide raster image available |
| 27 | Landslide zones | Landslide zones | polygon | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Not available |
| 28 | Avalanche zones | Avalanche zones | polygon | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Nationwide raster image available |
| 29 | Ecological disaster zones | Environmental disaster zones | polygon | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Not available |
| 30 | Land erosion zones | Earth erosion zones | polygon | 1 | 0 | 1 | 0 | 0 | 0 | 0 | Nationwide raster image available |
| 31 | Seismic hazard zones | Seismic hazard zones | polygon | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Nationwide raster image available |
| 32 | Saline soil areas | Salinization Zones | polygon | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Not available |
| **E** | **Infrastructures** | **Infrastructure** |  |  |  |  |  |  |  |  |  |
| 33 | Airports | Airport locations | Point | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| 34 | Canals | Channels | Line | 1 | 0 | 1 | 1 | 1 | 0 | 0 |  |
| 35 | Irrigation systems | Irrigation Service Areas | polygon | 1 | 0 | 0 | 1 | 1 | 0 | 0 |  |
| 36 | Irrigators | Sprinklers | Line | 1 | 0 | 0 | 1 | 1 | 0 | 0 |  |
| 37 | Drainage system | Drainage system | line | 1 | 0 | 0 | 1 | 1 | 0 | 0 |  |
| 38 | Pumping stations | Pumping station locations | Point | 1 | 0 | 1 | 1 | 1 | 0 | 0 |  |
| 39 | WUAs service areas | WUA service areas | polygon | 1 | 0 | 0 | 1 | 1 | 0 | 0 |  |
| 40 | Hydropower plants | Hydroelectric plant locations | Point | 1 | 1 | 1 | 1 | 1 | 1 | 1 | Require verification |
| 41 | Fisheries | Fish pond locations | Point | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Not available |
| 42 | Mining operations and other major industrial users | Mining and other large industrial locations | Point | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Not available |
| 43 | Municipal water supply systems | Municipal Water System locations | Point | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Not available |
| 44 | Municipal water supply systems | Municipal Water Systems | Line | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Not available |
| 45 | Municipal wastewater treatment facilities | Municipal wastewater treatment plant locations | Point | 1 | 0 | 0 | 0 | 1 | 0 | 0 | Dushanbe city only |
| 46 | Sewage networks | Sewer network | Line | 1 | 0 | 0 | 0 | 1 | 0 | 0 | Dushanbe city only |
| F | Monitoring | Monitoring |  |  |  |  |  |  |  |  |  |
| 47 | Hydroposts | Gauging post locations | Point | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| 48 | Meteo stations | Weather station locations | Point | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| 49 | Surface water quality sampling sites | Water quality sampling site locations | Point | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| 50 | Groundwater sampling sites | Groundwater quality site locations | Point | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Not available |
| 51 | Drinking water quality monitoring sites | Drinking water quality monitoring site locations | Point | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Not available |
| **G** | **Hydrology** | **Hydrology** |  |  |  |  |  |  |  |  |  |
| 52 | Risk catchments | Risk areas (catchment areas that are at risk of water shortages) | Polygon | 1 | 0 | 0 | 0 | 1 | 0 | 0 |  |
| 53 | Possible Risk Catchments | Potential risk zones (catchment areas that are in the zone of the potential risk of water shortages) | Polygon | 1 | 0 | 0 | 0 | 1 | 0 | 0 |  |
| 54 | Flow module zones | Zone Flow Modules | Polygon | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Not available |
| 55 | Water quality zones | Water quality zones | Polygon | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Not available for all basins |
| 56 | Abstractions | Water intake locations | Point | 1 | 0 | 0 | 1 | 1 | 0 | 0 |  |
| 57 | Wastewater return flows | Wastewater return locations | Point | 1 | 0 | 0 | 1 | 1 | 0 | 0 |  |
| 58 | Trans-boundary deliveries | Trans-boundary water supply locations | Point | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Not available |
| 59 | Groundwater aquifers | Groundwater aquifers | Polygon | 1 | 0 | 1 | 1 | 1 | 0 | 0 |  |
| 60 | Groundwater deposits and recharge zones | Groundwater deposit and recharge zones | Polygon | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Not available |
| **H** | **Water permits** | **Water permits** |  |  |  |  |  |  |  |  |  |
| 61 | Surface water withdrawal points | Surface water intake points | Point | 1 | 0 | 0 | 1 | 1 | 0 | 0 |  |
| 62 | Groundwater withdrawal points | Groundwater Intake Points | Point | 1 | 0 | 0 | 1 | 1 | 0 | 0 |  |
| 63 | Wastewater and pollutant discharge points | Sewage and disposal points | Point | 1 | 0 | 0 | 1 | 1 | 0 | 0 |  |
| **I** | **Environment, Meteorology** | **Environment, Meteorology** |  |  |  |  |  |  |  |  |  |
| 64 | Swamps | Wetland areas | Polygon | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| 65 | Forests | Forest areas | Polygon | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| 66 | Landscape zones | Landscape areas | Polygon | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Not available |
| 67 | Protected areas | Protected areas | Polygon | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Not available |
| 68 | Climate zones | Climatic zones | Polygon | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Not available |
| 69 | Precipitation zones | Precipitation zones | Polygon | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| 70 | Annual Mean Temperature | Average annual temperature zones | Polygon | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| 71 | Temperature zones January | Temperature zones - January | Polygon | 1 | 1 | 1 | 1 | 1 | 0 | 0 |  |
| 72 | Temperature zones July | Temperature zones - July | Polygon | 1 | 1 | 1 | 1 | 1 | 0 | 0 |  |
| **J** | **Irrigation** | **Irrigation** |  |  |  |  |  |  |  |  |  |
| 73 | System water inflow locations | Irrigation system water intake points | Point | 1 | 0 | 0 | 1 | 1 | 0 | 0 |  |
| 74 | System water outflow locations | Irrigation system water drainage points | Point | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Not available |
| 75 | WUA water inflow locations | WUA water intake points | Point | 1 | 0 | 0 | 1 | 1 | 0 | 0 |  |
| 76 | WUA water outflow locations | WUA water drainage points | Point | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Not available |
| **K** | **Raster imagery** | **Bitmap images** |  |  |  |  |  |  |  |  |  |
| 77 | Topography | Digital elevation model | raster | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| 78 | Hillshade | Shaded relief | raster | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| 79 | Population density | Population density | raster | 1 | 0 | 0 | 0 | 1 | 0 | 0 |  |
| 80 | Satellite imagery | Space imagery | raster | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | **Total** | **57** | **31** | **38** | **50** | **56** | **29** | **29** |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
| **Note: 1 - Yes/Available; 0 - No/Not available** | | |  |  |  |  |  |  |  |  |  |

**Annex B. WIS Website Introduction**

Data for informed management decisions on water resources in Tajikistan is fragmented and data accuracy and reliability needs improvement. Therefore, it cannot be used for evidence-based decisions on water resource and irrigation system management and water use permitting. Additionally, data analysis tools that translate the data to assist stakeholders with decision making do not function at full scale. To address these issues, a comprehensive reliable information system with basin and national applications is needed to improve water resources and use monitoring, provide timely and accurate water data, and introduce information technology and analytical tools to support informed decision-making in the water sector.

The WIS Team under PAMP II with the assistance of the World Bank team designed, constructed and deployed a national water information system (WIS) to store, manage, and share water data/information using three major information and communication technologies (database management, geographic information, and wide-area telecommunication systems). The WIS can access, extract, harmonize, display and download water data/information from multiple database applications in the River Basin Offices (RBO), ALRI regional offices, and other agencies in Tajikistan that collect relevant water-related data by data type and/or spatial location. Presently, the WIS is hosted, operated and maintained by MEWR for the water resources data and ALRI for the irrigation data in Dushanbe. A total of four online WIS database applications are available via the wis.tj website to support integrated water resources management and improved irrigation water management.

1. Basin Planning Database Application (BPDA).
2. Basin Water Accounting Database Application (BWAD).
3. Irrigation Management Information System (IMIS).
4. National Geospatial Database Application (NGDA).

The four database applications have been developed by the WIS team over the last 24 months. Others can be added as needs arise and the capacity to develop and use information applications expands.

**Annex C. Four Database Application Descriptions**

**1. Basin Planning Data Database Application (BPDA)**

This database application consolidates and houses all of the tabular information collected and retrieved in the preparation of the first basin plan in each basin. The RBOs will continually collect and populate the required planning data using the forms defined by the MEWR annually. The BPDA is installed and implemented initially in the Kofarnihon Basin and will then rolled out in the other four river basins. This application resides in the Upper Kofarnihon RBO office and MEWR/Dushanbe at this time and will be deployed on other RBO servers at a later date. The RBO offices in the Kofarnihon and Zarafshon are and the rest of the three RBO offices in the country will be linked to the BPDA in MEWR/Dushanbe via VPN to make the data/information available to all other authorized users.

**2. Water Accounting Database Application (WADA)**

This database application accounts for surface water inflows, uses and outflows in a basin. It draws on data provided by the Hydromet, ICWC and RBO offices. The WADA can compute and provide water balance by river reach and basin, and water accounting (supply and demand) reports for 10-day, vegetation season, and 12-month periods plus options to compare water accounting data from different years. The WADA is deployed initially in the Kofarnihon Basin and will then used in other four river basins. This application is housed in the Upper Kofarnihon RBO office and MEWR/Dushanbe at this time and will be installed on other RBO servers at a later date. The RBO offices in the Kofarnihon and Zarafshon are and the rest of the three RBO offices in the country will be linked to the WADA in MEWR/Dushanbe via VPN to make the data/information available to all other authorized users.

**3. Irrigation Management Information System (IMIS)**

This database application store, manage and provide irrigation data for individual main canals, including data on irrigated areas, planned and actual cropping patterns, target and actual flows in main canals, crop water requirements, Water User Association (WUA) water requests and actual water deliveries to each WUA. It also computes main canal conveyance efficiency figures and water supply and demand volumes per vegetation period for each WUA to evaluate and compare the performance of individual main canals. The IMIS is installed and operational in the Lower Kofarnihon ALRI regional office and the ALRI/Dushanbe in the Lower Kofarnihon. The ALRI regional offices in the Kofarnihon and Zarafshon are and the rest of the ALRI offices in the country will be linked to the IMIS in ALRI/Dushanbe via VPN to make the data/information available to all other authorized users.

**4. National Geospatial Database Application (NGDA)**

This geospatial database application consolidates and houses all of the relevant spatial data collected for three tabular databases applications such as administrative boundaries, river basins, catchments, rivers, land use/cover, risk and hazard zones, irrigation and drainage systems, canals, water quantity and quality monitoring sites, groundwater aquifers, WUA service areas, surface and underground water withdrawal points, wastewater and pollutant discharge points, system and WUA water inflow and outflow locations, and satellite imagery A total of 57 geospatial layers are available in the NGDA as of January 2020 (31 layers cover the entire country, 38 layers cover the Syrdarya Basin, 49 layers cover the Zarafshon Basin, 56 layers cover the Kofarnihon Basin, 29 layers cover the Vakhsh Basin and 29 layers cover the Panj Basin). Most of the geospatial layers are processed, harmonized and coded so that they can be integrated into the WIS with the three tabular database applications. This application is hosted and managed by the MEWR/Dushanbe and RBO and ALRI offices will have access to all the geospatial layers plus generated thematic maps online via GeoNode, once MEWR gets a license or agreement from the Department of Land Management and Geodesy.

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