ICWC SDC

SIC ICWC UNEP/GRID-Arendal UNECE

CENTRAL ASIA REGIONAL WATER INFORMATION BASE PROJECT

'CAREWIB'

INCEPTION REPORT

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Abbreviations

ICWC	Interstate Commission for Water Coordination of Central Asia
SDC	Swiss Agency for the Development and Cooperation
ISDC	Interstate Commission for Sustainable Development
SIC	Scientific-Information Center
GRID-Arendal	Global Resource Information Database centre
UNECE	United Nations Economic Commission for Europe
BWO	Basin Water Organization
IFAS	International Fund for the Aral Sea Saving
EC	Executive Committee
ASBP	Aral Sea Basin Program
MAWR	Ministry of Agriculture and Water Resources
USAID	United States Agency for International Development
NRMP	Natural Resources Management Project

I. INTRODUCTION

1.1 Project organization

The project beneficiary is ICWC that functions in the Aral Sea basin. A bilateral project agreement has been signed between ICWC and SDC as the parent organisations of the project. Under this agreement a project consortium have been formed by SIC, UNECE and GRID-Arendal for executing the project with SIC had leading organisation including a mechanism established for discussions within the consortium. SIC was nominated the project manager. A contract has been signed between the consortium and SDC on the basis of the project agreement. The partners of the consortium SIC, GRID-Arendal and UNECE signed an association agreement for the implementation of the project in which mutual responsibilities, obligations and rights were stipulated.

A Project Steering Committee (PSC) has been established within the framework of the project. It includes representatives from ICWC (1), SDC (1) with voting power, and SIC (1), GRID-Arendal (1), UNECE (1) without voting power. Terms of Reference, meeting schedules and agendas for the PSC meetings were developed by the consortium who was also responsible for the minutes of the meetings.

The PSC will endorse the Progress Reports and Yearly Plans of Operation (YPO), yearly accounts and budgets.

A Steering Committee Meeting will be held annually within the framework of an ICWC-meeting with the participation of all project partners.

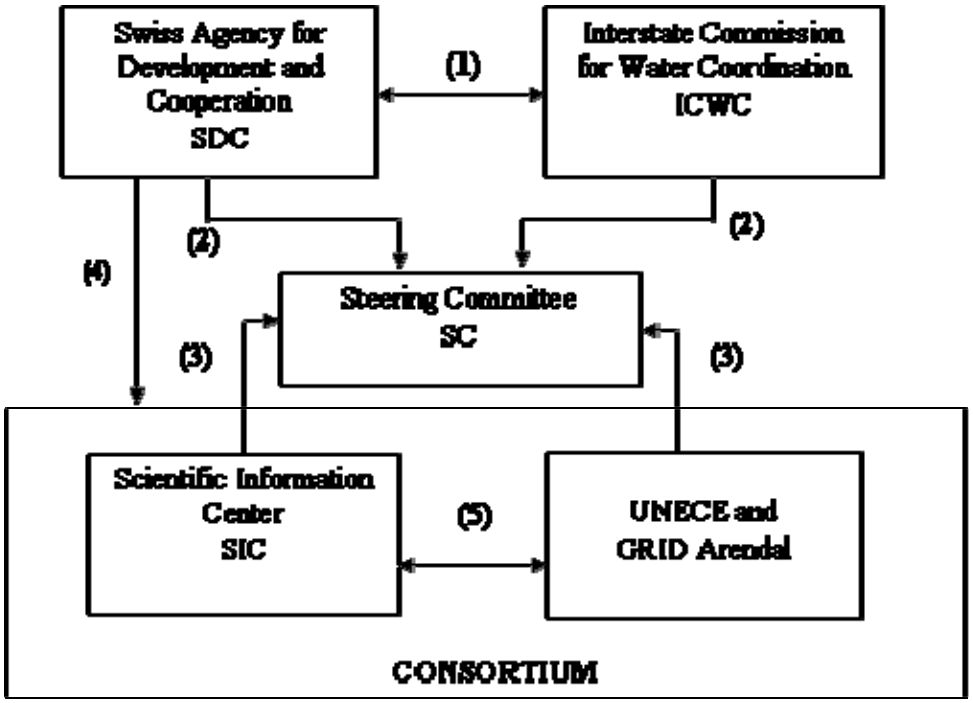
The roles of the consortium partners are foreseen as follows:

SIC is the main implementing agency, leading project activities and ensuring linkages to the regional network of its branches in Kazakhstan, Kyrgyzstan, and Tajikistan, SIC CSD in Turkmenistan, Ministries of Agriculture and Water Resources in the five countries, EC IFAS, ICWC, BWO «Amudarya», BWO «Syrdarya», donors and participants of the ASBP-2 program.

UNECE provides policy advice and linkages with respect to processes it is leading such as the Environment-for-Europe, and also SPECA and 'Water, Environment and Security in Central Asia'. UNECE is also the liaison towards the Swiss Government on project matters in Switzerland, as well as towards donors etc that are not presently active in the region.

GRID-Arendal provides technical advice and support to tasks where it has state-of-the-art knowledge and experience, namely in web site architecture and design, graphical design and publications, user consultations and feedback. GRID-Arendal ensures linkages to processes and networks delivering environmental information, such as UNEP-UNDP-OSCE's ENV&SEC, UNEP-UNDP-ADB-ISDC's Regional Environmental Action Plan, the regional network of the Ministries of the Environment, and through support to the implementation of the Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters. Main task of GRID-Arendal is together with SIC development of the ecological block of knowledge and data base.

The project organization is further outlined on the chart below.



(1) Bilateral Project Agreement
(2) Voting members of the PSC
(3) Non-voting members of PSC, report to PSC
(4) Contract for project implementation
(5) Agreement on project implementation / Association Agreement

1.2 Project scope

One of the project foreground tasks is to create a Regional Water and Ecological Web Portal with regularly updated information on water situation and ecological problems in Central Asia.

Sustainable and proper water use is the main regional environmental problem of Central Asia. This concerns both the unsolved problems: consequences of the Aral crisis, and current problems like regional water resources allocation and management. Knowledge gathering and processing – in the form of databases and trial systems – will become a key element of new information technologies. An intensive development of the Internet and communication support facilities gives an opportunity to settle problems at the top level.

The following project direction includes the creation of multi-level, inter-state, inter-sectoral information system on water and land resources in the Aral Sea basin. The system is based on water and land resources management hierarchy levels as well as on water resources formation and use levels. The main objective of this system is to create a single united information system that includes data on water resources formation, development and prediction, assessment of various aspects of water use and measures for achieving potential effectiveness, pro-

viding sustainable water management, and improving economic activity productivity, based on modern equipment, software and communication facilities.

Upgrading information maintenance of water and environmental sectors in Central Asia region, and forming the public opinion and partnership in the field of rational natural resources use are causes for creating a regional access through the "Internet window", to provide a direct access to up-to-date information concerning water situation and water problems in Central Asia. "Internet window" will be based on information, which exists, although is not always easily accessible, with the technical support of SIC and other organizations subordinate to ICWC.

Access level should be defined for all information system clients: information users (only reading), information suppliers (reading-recording), system administrator (full access). At that each user should be provided with a login password to raise the responsibility for working with data by final work protocol.

For sustainable functioning of the Regional Information Base in the Internet environment, it is necessary to define requirements to the system being developed, and analyze the existing state-of-the-art technologies for making Internet applications at the beginning of its designing.

These have been defined as the main requirements to the web module that manages the database:

- System dialog mode (through web-site);
- Absence of setup and servicing on the side of client;
- Possibility of ensuring simultaneous operation of a big number of users (through web-site);
- Compatibility of the used operational systems and platforms of clients and server of the Information Base;
- Data security against unauthorized access to them (through web-site).

Based on the certain requirements to the Information Base, the analysis of information technologies for developing web-applications, working with databases was carried out.

These are proposed:
- strengthening the existing database, integrate it with national databases such as dispatch databases of BVO "Syrdarya" and BVO "Amudarya", and gradually transform it into corporate system of accounting, analysis and use of water and land resources in the Aral Sea basin;
- enhanced information capacity, data completeness and reliability;
- extended functional capabilities and operational safety of the system;
- improved and intensified partnership between information suppliers and users;
- broad and free access to information.

During the project, it is also planned to regularly issue and disseminate a number of publications for informing decision-makers, NGOs and the public (third direction).

In this connection, all the activities under the project are implemented in two blocks, conventionally called "Portal" (includes the first and third directions mentioned above) and "Information System" (working in the second direction).

The activities on both the blocks in SIC are conducted by two teams under general leadership of Project Manager Iskander Beglov and the supervision of SIC Director Prof. Viktor Dukhovny.

1.3 Project Personnel and management

To manage the project activities, including financial activity, all the consortium partners appointed appropriate project managers.

Project manager for SIC is Dr. Iskander Beglov. He coordinates the operations of project office personnel in SIC and national coordinators with the support and under the supervision of SIC Director Prof. Viktor Dukhovny.

At present, the staff working within the project in SIC consists of:

"Portal" Block: Iskander Beglov, project manager/block coordinator/web designer; Bakhodyr Turdybayev, webmaster; Abbas Pulatov, coordinator for activity with CARs; Munojat Ishankulova, translator; Grigoriy Poltarev, expert in equipment (1/2-pay); Oybek Akbarov, technician.

"Information System" Block: Denis Sorokin, block coordinator/programmer; Aleksey Nikulin, programmer; Anastasiya Degtyareva, data and network auditor; Tatyana Poltareva, technician; Viktor Shakhov Шахов, expert in equipment (1/4-pay).
Financial manager Svetlana Obidina controls the project financial activity in SIC.

On behalf of GRID-Arendal, Nikolai Denisov, GRID-Arendal Geneva office coordinator for Central and Eastern Europe, the Caucasus and Central Asia, participates in the project. Other staff of GRID-Arendal has been involved to-date as needed, including Otto Simonett, Valentin Yemelin, Victor Novikov (management, contents and networking) and Stephen Lapointe (web design). It is envisaged that also other staff such as graphical / publications designers and web developers will be involved in the furture, i.a. in the context of join development of electronic and hard-copy information products.

On behalf of UNECE, regional advisor for the environment Bo Libert participates in the project activities.

1.4 Project partners

Partners collaborating within the project activities

The project activities are implemented within the territory of five Central Asian states, located in the Aral Sea basin. To perform the project, national coordinator for each country and two basin coordinators (for the Amudarya and Syrdarya river basins) were appointed.

National project coordinators were appointed by the Ministries of Agriculture and Water Resources of the five countries. In Kazakhstan, Director of SIC Kazakhstan office Prof. Nariman Kipshakbayev is national coordinator for activities in both the blocks. In Kyrgyzstan, Director of SIC Kyrgyzstan office Abdybay Djayloobayev fulfills the function of general work coordi-

nation. Alisher Aliyev and Latifa Bulekbayeva are the national coordinators respectively for "Portal" Block and "Information System" Block. Deputy Director of SIC Tajik branch Prof. Nabi Nosirov is the national coordinator in Tajikistan. Kurbangeldy Balliyev (SIC CSD) was appointed national coordinator in Turkmenistan. In Uzbekistan, Sharif Kuchkarov and Khajimurat Gapparov were defined national coordinators respectively for "Portal" Block and "Information System" Block (both – MAWR of Uzbekistan).

Yuldash Khudayberganov fulfills the functions of the Project Coordinator for the Amudarya river basin, and Makhmud Khamidov for the Syrdarya river basin.

The key consortium partners in CARs are:

- In Kazakhstan – SIC ICWC Kazakhstan office
- In Kyrzystan – SIC ICWC Kyrgyzstan office
- In Tajikistan - SIC ICWC Tajikistan office
- In Turkmenistan – SIC CSD
- In Uzbekistan - the project activities are implemented by the Central Board of Water Resources at the MAWR of Uzbekistan
- At basin level – BVO "Amudarya" and BVO "Syrdarya"

In addition to the above-mentioned organizations, EC IFAS and all the Hydromets in CARs are involved in the project activities. The negotiations in this direction are under way.

Partners collaborating out the project

The CAREWIB Project is trying to make use of the results of other similar initiatives implemented in the region to the maximum. So, the project personnel participated in the negotiations with the Natural Resources Management Project (NRMP, funded by USAID) in Tashkent, Uzbekistan, and Regional Hydrologic Center (financed by SDC) in Dushanbe, Tajikistan.

Relationship with donors

Considerable attention is paid to building relations with multilateral and bilateral donor organisations, bot as providers of contents (project database), users of the information and, potentially, contributers of matching funds. Inter alia, the project management (Prof. V.A. Dukhovny) took part in two Aral Sea basin donor meetings held in Tashkent.Both UNECE and GRID-Arendal have actively promoted the project in the context of various international activities, as described in 2.2 below.

II. ACTIVITIES DURING THE REPORTING PERIOD

2.1 SIC ICWC activity

- All the project contracts and agreements were translated into Russian and sent them the ICWC members for approval.

- Detailed terms of reference for all the project executors from Central Asian region, including national project coordinators from the five states, were developed.
- To unify incoming data processing, an information material supply form for the project participants was developed.
- On February 28 in Bishkek, the project kick-off meeting and the first Project Steering Committee Meeting were held.
- Necessary specification was determined, and a tender for delivery was issued to provide 13 oblast correspondent points and project office in SIC ICWC with computer equipment.
- Contracts for information servicing were developed to transfer equipment to the executors from Central Asian states.
- Client database on the addresses of water and environmental organizations in the region, including NGOs, was developed.
- A draft of main web site of portal was designed (www.cawater-info.net)
- The web site of the Interstate Commission for Water Coordination (ICWC) of Central Asia was updated (www.icwc-aral.uz)
- The web site of Scientific Information Center of ICWC was designed (www.sic.icwc-aral.uz)
- A structure of SIC ICWC Bibliographic Database was developed to place it in the web-site.
- Issuance of "ICWC Press-Releases" is continued.
- A promotional booklet on the project has been prepared and circulated among potential information users and partners through Central Asia.
- Daily tracing of events, related to the project area, in the Internet has been organized (conferences, forums, news, etc.).
- GIS of the maps of Uzbekistan, Kazakhstan, Tajikistan, Turkmenistan, and Kyrgyzstan (with breaking into planning zones) and the Aral Sea basin as a whole were made
- Information transported from the existing DBs to the new IS DB was defined.
- A list of parameters was drawn up, according to which the new IS DB of the five Central Asian states will be filled in the future.
- By now, forms with reference information and forms for data input have been drawn up and sent to the CAREWIB Project co-executors.
- Test web module for remote work with database through the Internet was developed.

Collaboration with the USAID

Within the NRMP, the USAID equiped 21 points in oblast water organizations in Uzbekistan with computers, and paid for their e-mail during the project period.

As it became known from the talk with USAID representative A. Nazarov, all information from these points came in central dispatch point equipped at the MAWR of Uzbekistan to H.Gapparov. After the USAID project had been completed, data from oblast organizations ceased to come. It is justified by that oblast water organiozations have not money to pay for e-mail themselves. During the talk with H. Gapparov, we agreed on that under the project in Uzbekistan we would deliver equipment to 4 points, not to 6, as it had been planned earlier. We will transfer released computers to adjacent SIC project, and use gained money for paying e-mail of key oblast-level BWOs in Uzbekistan (to be defined).

2.2 GRID-Arendal and UNECE Activities

- Evaluation of SIC ICWC web-site and the proposed framework for CAREWIB portal.
- Evaluation on ToRs for 'national correspondents'.
- Production of a brainstorming paper for the kick-off meeting.
- Participation in CAREWIB kick-off meeting in Bishkek 28 February 2004.
- Discussions / presentation of CAREWIB in the context of REAP (Dushanbe, 24-25 February), Environment and Security (numerous occasions), with UNEP, UNDP, OSCE, NATO, SPECA, EC IFAS (meetings with the Chairman, Dushanbe 25 February and 2 April 2004), Regional Hydrometerological Centre in Dushanbe, Hydromets in Tajikistan and Kazakhstan. CAREWIB has also been discussed with a number of other experts within and outside the region.
- Planning/ preparation for a technical meeting between GA and SIC ICWC in Arendal (tentatively 22-24 June).

III. ANNUAL PLANNING 2004

3.1 Planned SIC ICWC activities

Common

- Establishment and adjustment of a Portal Server with domain name **www.cawater-info.net,**
- Launch of the main portal web-site, including forum and all help services – counter, search, feedback and so on
- Preparation and holding of a conference in Almaty in May
- Preparation for a technical meeting in Arendal in June
- Delivery of equipment to oblast water organizations in the Aral Sea basin

“Portal” Block

- Launch and maintenance of an on-line version of bibliographic database: at present, there are more than 1000 records to be available on-line in SIC database
- Carrying out of an advertising campaign to promote the portal web-sites, including the registration in all possible searching systems, web catalogues as well as the preparation and dissemination of advertising materials: disks with data, notebooks, calendars and so on
- Development and maintenance of the databases on addresses: at present, there are 674 addresses, including of NGOs in the region
- Information distribution to end users: at present, the e-mailing list contains 389 addressees (318 Russian-language and 71 English-language)

- Preparation, issuance and distribution of publications, including ICWC Bulletins, ICWC Press-Releases, Informative, SIC ICWC Abstract and Juridical Collections, collections of various papers, and the Regional register of projects
- Daily tracking of information in the Internet on the issues, related to the project area.

"Information System" Block

- Maintenance of the database with daily hydrological data on the Aral Sea basin
- Possibility of entering new information blocks into the operating database
- Provision of information search and retrieval by a group of parameters
- Provision of simplicity and ease of information input and updating as well as of user referring to relevant information
- Availability of an improved user interface, allowing to effectively coordinate all components of the database and organize the fulfillment of the functions given to the database

IV. OUTPUTS

It is expected that by the end of the year all the portal web sites will work actively.

Central Asian ecological NGOs will be involved in discussing the problems of the region.

It is also expected that donors will take an active part in providing the materials and data for the portal.

An intensive cooperation with Hydro Meteorological Services of the region is expected.

It is planned to use a single united information system of land and water resources accounting, formation and use in the Aral Sea basin, assess various aspects of the efficiency of their use, prediction, and measures for achieving a potential level of effectiveness, assist with implementing sustainable management and control over the use of water resources of all kinds on the basis of modern information technologies and telecommunication facilities.

At the end of May in Almaty, Kazakhstan, a conference will be held, at which the portal will be presented to the general public.

A technical meeting, dedicated mainly to solving technical issues related to the operation of web-sited, will be held at the end of June in Arendal, Norway, between SIC and GRID-Arendal.

V. LIMITATIONS AND LESSONS LEARNT

Overall the project develops in line with initial thinking, and at this stage it may yet be too early to judge results on the basis of 3-month implementation period. A few observations are however outlined below.

SIC discovered a weak feedback with Turkmenistan and water organizations of Uzbekistan.

A weak involvement of water organizations of Uzbekistan is evident by the example of USAID/NRMP: after the USAID project had been completed, data from oblast organizations ceased to come. It is justified by that oblast water organizations have not money to pay for e-mail themselves, as it was not put into their budget.

Hardware delivery to oblast water organizations was delayed. Over the reporting period, the equipment was delivered only to the project office in SIC ICWC and SIC ICWC branch in Tajikistan.

VI. OUTLOOK FOR 2004

More attention should be given to establishing relations with the "Integrated Water Resources Management in Ferghana Valley (IWRM-Ferghana)" Project, also funded by SDC. During the implementation of this project, a wide network, covering a number of oblselvodkhozs in Uzbekistan, Tajikistan, and Kyrgyzstan, was created. This network can be integrated into the CAREWIB Project not only as information recipients (as now all of them are included in the list of mailing ICWC Press-Releases and other information), but also as active information suppliers.

The CAREWIB Project can render additional assistance to the "IWRM-Ferghana" Project in the popularization of integrated water resources management in the region.

It is necessary to establish an active mutually beneficial cooperation with the Regional Hydrometeorological Center, which is funded by SDC as well.

The key direction of the project activities can become the collaboration with the new project launched by SIC, "Creation of an Information-Consultation Center for the EU Sixth Framework Program in Central Asia (INFO FP-6 EU-CA)". Within this project, it is intended to establish cooperation with Central Asian scientific organizations. These organizations can be involved in the CAREWIB Project as active information users and suppliers.

Appendix 1

"Portal" Block

SIC ICWC specialists started to work on the CAREWIB Project as early as December 2003.

We translated all the project contracts and agreements into Russian and sent them the ICWC members for approval. At the 38th ICWC regular meeting (Karshi, December 22-24, 2003) a decision was made by ICWC on beginning the project activities.

Detailed terms of reference for all the project executors from Central Asian region, including national project coordinators from the five states, were developed. To unify incoming data processing, an information material supply form for the project participants was developed.

On February 28 in Bishkek, the project kick-off meeting and the first Project Steering Committee Meeting were held, at which the obligations of all the project executors, target groups, content of activities were determined, and subsequent actions were planned. The meeting record is given in Appendix.

Necessary specification was determined, and a tender for delivery was issued to provide 13 oblast correspondent points and project office in SIC ICWC with computer equipment. Tender was won by StenAT Company LTD, which supplied all equipment to SIC ICWC in February 2004.

To transfer equipment to the executors from Central Asian states, contracts for information maintenance that suppose equipment delivery in exchange for information were developed.

Client database on the addresses of water and environmental organizations in the region, including NGOs, was developed. At present, the base contains:

- on Kazakhstan - 214 records;
- on Kyrgyzstan - 176 records;
- on Tajikistan - 103 records;
- on Turkmenistan - 73 records;
- on Uzbekistan - 108 records.

A structure of the portal, being created during the project implementation (fig. 1), was defined, and its model was prepared (fig. 2).

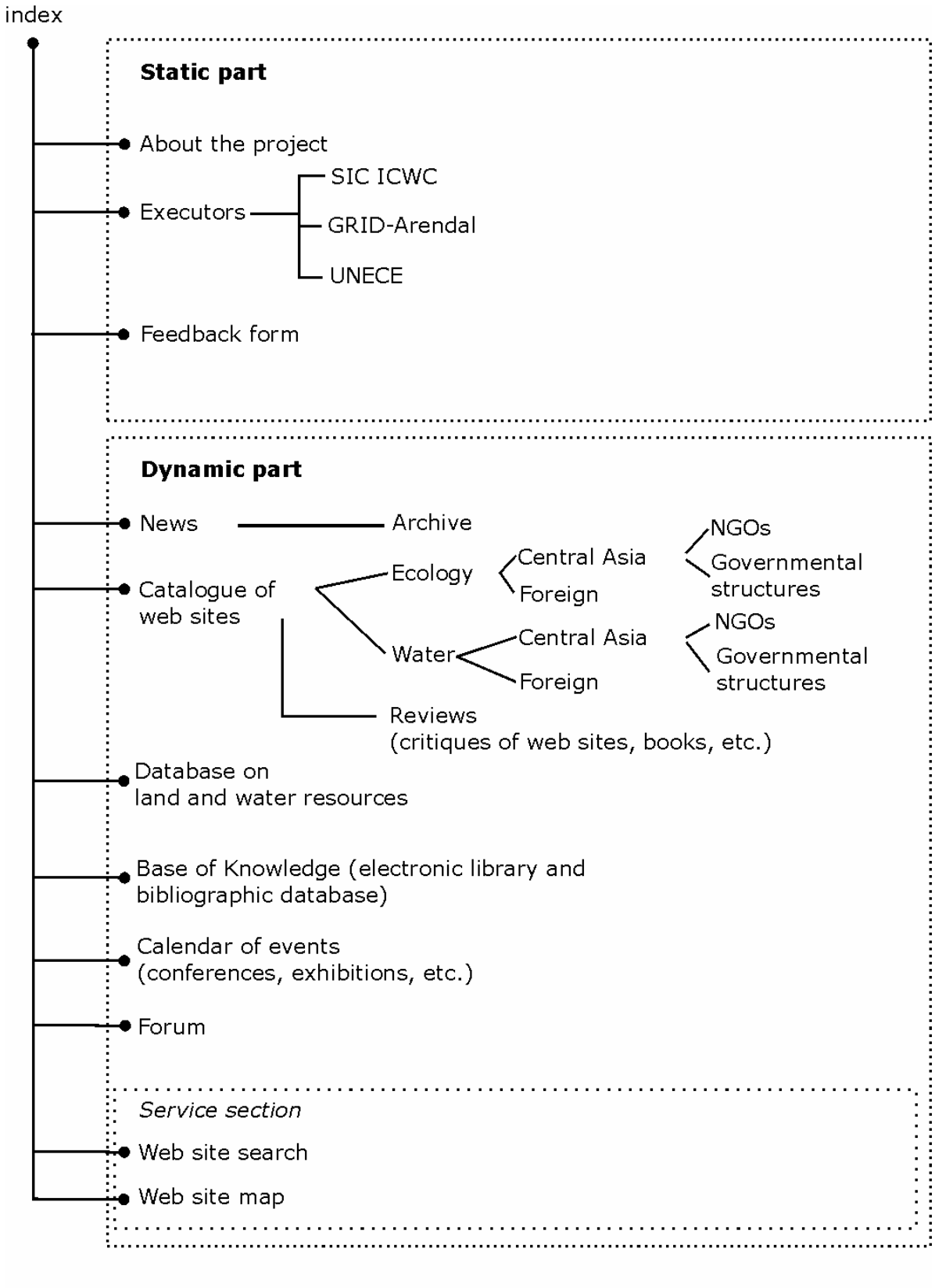


Fig.1. Structure of the main CAREWIB Project portal web-site

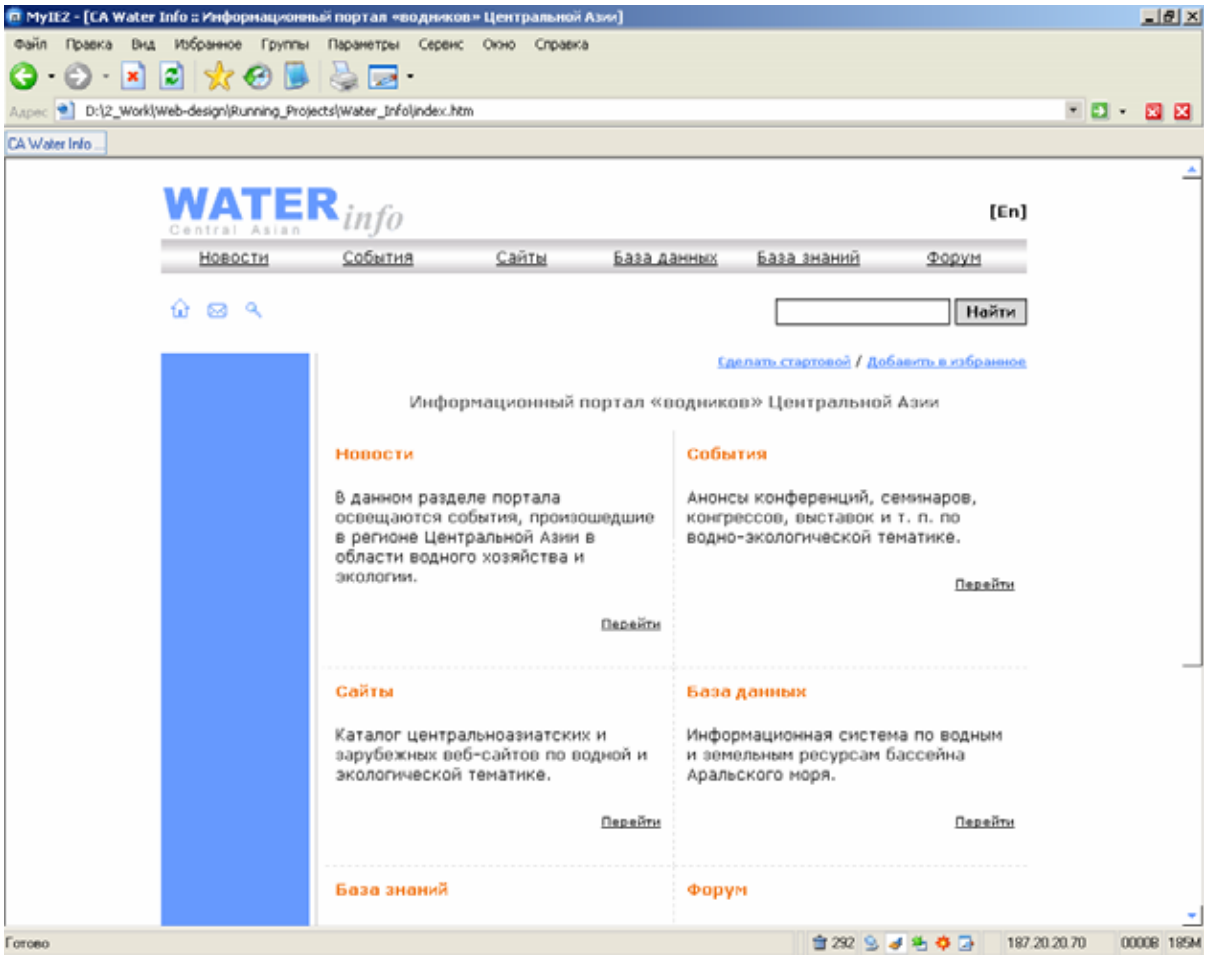


Fig. 2. Screenshot of the main CAREWIB Project portal web-site

This web-site will be a "central" portal web-site (planned domain name **www.cawater-info.net**), around which web sites similar in subject are located (each of them with its specific character):

- The web site of the Interstate Commission for Water Coordination (ICWC) of Central Asia (**www.icwc-aral.uz**) – updated in January 2004.
  It contains information on history of creating and daily activities of ICWC, brief information on all the meetings, reports on large conferences with the participation of ICWC, reference data (addresses, telephones) on all the ICWC members. The site also has "home pages" of ICWC executive bodies – BVO "Amudarya", BVO "Syrdarya" and CMC ICWC.

- The web site of Scientific Information Center of ICWC (**www.sic.icwc-aral.uz**) – designed anew; launched at the end of January 2004.
  It contains information on SIC ICWC: regional activities, international cooperation, projects, publications, reference data (addresses, telephones) of SIC and its affiliates in Central Asian states.
  The site keeps two important portal sections: "ICWC press-releases" and "Electronic library".

The electronic library consists of the following sections:

- *Declarations and Statements of the Heads of Central Asian States*
- *Intergovernmental Agreements of Central Asian States*
- *ICWC Agreements*
- *International Conventions and Agreements*
- *SIC ICWC Abstract reviews*
- *SIC ICWC Information collections*
- *ICWC Training Center Publications*
- *GWP CACENA Publications*
- *Maps*
- *Papers/Reports*
- *Books (mainly published by SIC)*
- *Miscellaneous*

- ICWC Training Center web site (**www.tc.icwc-aral.uz**)
  Information on ICWC Training Center activities is presented, including the subjects of lectures, minutes of discussions and decisions.

- Web site of the "Integrated Water Resources Management in Ferghana Valley" Project (**www.iwrm.icwc-aral.uz**)
  The site is dedicated to the outreach of integrated water resources management in Central Asia based on the case study of one of the major projects being implemented in the region in this field – "IWRM-Ferghana"

- Web site of the "Dialogue on Water and Climate: studying the Aral Sea basin" Project (**www.dialogue.icwc-aral.uz**)
  Materials of the research on climate impact on water resources in the Aral Sea basin are available in the site.

A structure of SIC ICWC Bibliographic Database was developed to place it in the web-site. Prototype version was made in MS Access. Input of bibliographic records and export to text version for MySQL has been begun. Checkout of procedures for converting to MySQL format is being carried out.

Issuance of "ICWC Press-Releases" is continued within the CAREWIB project (information gathering and editing, preparing press-releases for publication, sending printed versions by mail, sending by e-mail, and placing in SIC ICWC web site).

A promotional booklet on the project has been prepared and circulated among potential information users and partners through Central Asia.

Daily tracking of events, related to the project area, in the Internet has been organized (conferences, forums, news, etc.).

The following pages will be added to the portal (being planned):

- The activities of international organizations (UNEP, UNDP, IUCN, WWC, WSSCC, ICID, GWP, INBO) – in SIC ICWC web site
- SIC ICWC publications, including papers of ICWC members at various conferences – in SIC ICWC web site

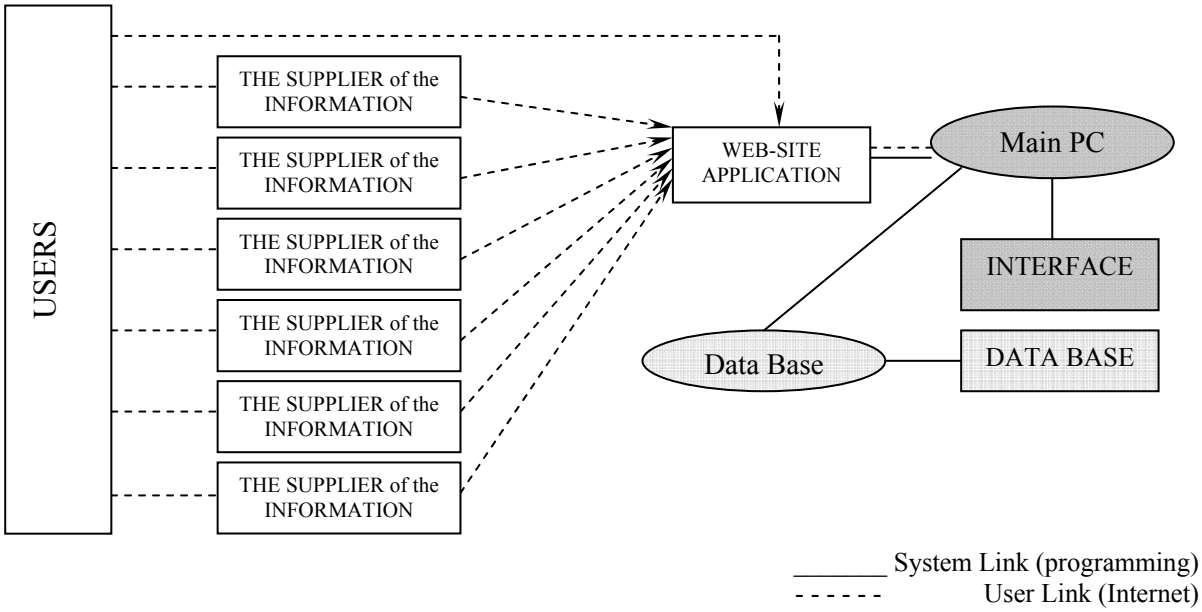
- Opinions of NGOs – in CA Water-Info web site
- Preparation for the 4th World Water Forum (continuing "Water Voice" Project, Virtual Conference /Forum, and information on the preparation progress) – in CA Water-Info web site
- Afghanistan – in CA Water-Info web site

Appendix 2

"Information System" Block

Analysis of large information systems of SIC ICWC to aggregate them in a new CAREWIB Project IS

Integrated Block Scheme of the Information System



User Block. This block consists of persons having an opportunity and an access to work with Information System (IS) through the Internet network, i.e. only review and copy data that interest them, and make out reports.

Information Supplier Block. This block includes persons that have an opportunity to work with IS through the Internet (ICWC IS Server), i.e. review, edit, and, above all, introduce new information according to the existing IS rules (project correspondents of the five republics, Ministries, Hydro Meteorological Services, BWOs, Technical centers and others). Each information supplier should have an individual access password and obligation to introduce information by the protocol.

Web-site Application Block. Web-site, which has along with the existing description of IS a capability to download IS interface through the Internet.

Interface Block. The interface represents a web server, managing Database (DB) through the Internet. The IS interface lets user (depending on access level) work with DB. The interface will have a capability to change interactive language, and will be provided with electronic question-answering system. User will have an opportunity to choose from the ready requests

available in the system, link relevant information in regard to the selected parameters, fill and edit information.

Database Block. The database will have several data levels: basin, state, planning zones (PZ), and consist of such blocks as Economy, Energy, Water, Land, Climate, Ecology, and Socio-Economic Aspects. The DB will have Internet architecture, and the database will be accessed from the browser by standard protocol. This makes minimum claims on client equipment. In this case, it is not required to develop special client programs and own specifications of data exchange between server and client sites. It will be possible to work with the IS DB in multi-user mode.

Several Information Systems and Databases were developed in SIC ICWC with the support of various projects. All of IS DBs were designed based on the following basic principles:

- Providing capability to re-organize and expand when changes in domain limits occur;
- Providing opportunity of shared user access to information;
- All objects have certain properties (characteristics), i.e. information of various types, through which the object is presented in database;
- The main studied objects are encoded by using the method of compound coding, and additional ones – using the method of level-by-level coding as a particular case of compound coding. Selection of these methods is based on that they allow not only to uniquely determine objects on a set of domain objects, but also to reflect their hierarchy and sequence order.

1. Possibility of entering new information blocks into the operating databases;
2. Providing information search and retrieval according to a group of parameters;
3. Providing simplicity and ease of information input and updating as well as of user referring to relevant information;
4. Availability of developed user interface, allowing to efficiently link all the components of the database, and organize the performance of the functions given to the database;
5. All data domain is presented as objects, which are elements of domain information that have certain properties;
6. The main studied objects are encoded by using the method of compound coding.

At present, the IS of SIC ICWC has a sufficiently great information content. It is necessary to provide a broader and freer access to this information, and also regularly supplement and update the DB with fresh information. That is why it is necessary to create a new IS, which we have started to develop under the CAREWIB Project, and which will include:

1. Opportunity for user to create own queries to link necessary information in regard with the selected parameters through the interface;
2. Opportunity for directly remote user to fill and edit information through the interface;
3. Interface, being a web server that manages DB through the Internet;
4. Opportunity to export and import data to diverse ICWC ISs,
5. Technical equipment for five centers in Central Asia for inter-computer information exchange and organization of this exchange through the Internet;
6. Providing successive and regular filling of IS DB.

The main task of the Information System being developed is to use a single united information system of land and water resources accounting, formation and use in the Aral Sea basin, assess various aspects of the efficiency of their use, prediction and measures for achieving potential level of effectiveness, assist with implementing sustainable management and control of various water resources use on the basis of modern information technologies and telecommunication facilities. The CAREWIB IS will be a multilevel inter-state, inter-sectoral system, based on water and land resources management hierarchy levels and related water use objects as well as on water resources formation and use levels.

The main component of the Information System will be a DB, designed for centralized storage and management of a interrelated data collection, adequately reflecting the status of objects in the given domain (domains) and relations between them.

Conducted operations

GIS of the maps of Uzbekistan, Kazakhstan, Tajikistan, Turkmenistan, and Kyrgyzstan (with breaking into planning zones) and the Aral Sea basin as a whole were made and transferred to the GIS developers on the following sections:

1. Rivers;
2. Administrative centers (of towns, villages);
3. Canals;
4. Gauging stations;
5. Irrigation zones;
6. Reservoirs, lakes.

In connection with that operations for creating layers of collectors throughout Central Asia were not conducted in GIS earlier, only layer of collectors in Ferghana, Andijan, and Namanghan oblasts of Uzbekistan is given in this work.

In Visual Basic 6.0, GIS form was developed with opportunity to create maps necessary to user on computer display with selection of GIS sections by user request. A technology for saving obtained map in file, in various formats (BMP, JPG, WMF) on computer hard disk by the request of user was developed. A technology for printing out file, containing the saved map, in color and balck-and-white format was developed. GIS of maps of Uzbekistana, Kazakhstana, Tajikistana, Turkmenistan, and Kyrgyzstan (with breaking into planning zones) and the Aral Sea basin as a whole are connected to Visual Basic 6.0 form:

1 Rivers;
2 Administrative centers (of towns, villages);
3 Canals;
4 Gauging stations;
5 Irrigation zones;
6 Reservoirs, lakes.

Information transported from the existing DBs to the new IS DB was defined. During the implementation of this stage of work, information, filling the existing DBs of the main SIC ICWC models, was analyzed.

Information review structure:

Information	State	Objects	Step (annual, Monthly)	Period of information availability

As a result of the review, a list of parameters was drawn up, according to which the new IS DB of the five Central Asian states will be filled in the future.

Input information for a complex of Aral Sea basin management models (step = decade, the period starts from 1980):

1. River water resources series (volume - km^3, and salinity – gr./l)

Amudarya basin	Syrdarya basin
Vakhsh river upper reaches (inflow to Ro-gun)	Naryn river (inflow to Toktogul)
Lateral inflow to Vakhsh	Lateral inflow to Naryn
Pyanj river upper reaches	Karadarya river (Andijan)
Lateral inflow to Pyanj	Lateral inflow to Karadrya
Kunduz river (inflow to the Amudarya)	Lateral inflow to Syrdarya
Kafirnigan river	Akhangaran river (upper reach)
Surkhandarya river upper reaches	Chirchik river (inflow to Charvak)
Sherabad river upper reaches (Korasu)	Keles river (upper reach)
Kashkadarya river	Arys river (upper reach)
Zaravshan river upper reaches	

2. Actual water intake for planning zones* (volume - km^3)**

3. Return flow from planning zones to rivers* (collector-drainage flow volume - km^3, and salinity – gr./l).**

Input information for a complex of Aral Sea basin management models (step = season, the period starts from 1980):

4. Parameters of reservoirs and lakes in the Aral Sea basin at the end of season (volume - km^3, and salinity - gr./l)

5. General hydro power requirements in the Aral Sea basin at the end of season (output – million kWh)

6. Net cost of electric power produced by hydro-electric stations in the Aral Sea basin: operation cost, incoming and outgoing prices ($ / kWh)

Input information for a complex of Aral Sea basin management models (step = year, the period starts from 1980):

7. Consortium tariffs for Naryn hydro plants (Kyrgyzstan)

Natural gas for Kyrgyz hydro plants (m^3 / kWh)
Coal for Kyrgyz hydro plants (t / kWh)
Limit of electric power output for selling to Uzbekistan and Kazakhstan according to agreements (April-September) (billion kWh)
Allocating electric power to Uzbekistan for sale (%)
Return of energy produced by Uzbekistan to Kyrgyzstan (% of energy bought)
Return of energy produced by Kazakhstan to Kyrgyzstan (% of energy bought)
Kyrgyz electric power price for Uzbekistan ($ billion)
Kyrgyz electric power price for Kazakhstan ($ billion)
Benefit for Kyrgyzstan from purchase and sale (% of energy sold)

8. Effectiveness of 1 km^3 of water for each planning zone ***
(productivity - $ / km^3).

Socio-Economic Model input information on the planning zones* **
(step = year, the period starts from 1990):

1. Demography
- Urban population (at the end of year, per mille)
- Coefficients of natural progress: born, dead (per mille)

2. Economy
- GDP ($ billion)
- Employment: (average annual) number of labor resources, economically active population, employed in economy, employed in agriculture (thousand)

3. Living standard
- Population income ($ billion)

4. Industry
- Share in GDP ($ billion, %)
- Output volume ($ billion)

5. Agriculture
- Share in GDP ($ billion, %).
- Output volume ($ billion).
- Forms of farms: private farms, dekhkan farms (quantity).
- Average farm command area: shirkats, private farms, dekhkan farms (ha).
- Irrigated lands (thousand ha).
- Rain-fed lands (thousand ha).
- Personal plots (ha).
- Area crop structure (irrigated, rain-fed)
- Average crop capacity (irrigated, rain-fed)
- Specific water consumption (thousand m^3/ ha).
- Secondary production volume ($ thousand).
- (Purchasing, market) prices for agricultural products ($).
- Livestock: cattle, sheep and goats (thousand heads).

6. Fishery
- Catch (thousand t).
- Average cost ($/kg).

7. Food
Food consumption in compliance with the basket of goods

8. Energy
- Energy generation (kWh).
- Hydro plants (%).
- Thermal plants (%).
- Energy consumption: agriculture, industry, municipal economy (kWh)
- Cost (kWh /$).

9. Water resources
- Water consumption by industry (thousand m^3).
- Water consumption by municipal economy (thousand m^3).
- Assignments to water services ($ thousand).

10. Investments
- Investment amount ($ million).
- Foreign investments ($ million).
- Private investments ($ million).
- Investments in agriculture ($ million).
- Requisite investments in agriculture ($ million).
- Specific investments ($ million).

11. Recreation and tourism
- Amount of boarding houses and recreation zones
- Amount of places
- Number of people visiting recreation zones (thousand men)

Input information of climatic stations on the Aral Sea basin (step = decade, the period starts from 1990):

Mean air temperature (°C)
Maximum mean temperature (°C)
Minimum mean temperature (°C)
Absolute maximum mean temperature (°C)
Average relative humidity (%)
Average absolute humidity (%)
Pressure deficit (mb)
Average wind speed at a height of... (m/sec)
Mean soil temperature at a depth of 5 cm (°C)
Mean soil temperature at a depth of 20 cm (°C)
Average monthly precipitation (mm)
Mean light day duration (hour/day)
Average total solar radiation (W/m^2/day)
Average solar diffuse radiation, (W/m^2/day)
Radiative balance (W/m^2/day)

Average water surface evaporation (mm/day)
Mean temperature
Maximum temperature
Minimum temperature
Mean soil temperature
Maximum soil temperature
Minimum soil temperature
Relative humidity (average)
Relative humidity (minimum)
Atmospheric pressure (gPa) at station level
Atmospheric pressure (gPa) at sea level
Wind speed
Wind direction
Precipitation (mm)
Dew point
Saturation deficit
Cloudiness
Snow cover
Solar radiation duration
Solar radiation intensity

Priaralie and Aral Sea Model input information on the Aral Sea (step = year, the period starts from 1990):

Precipitation (P, km^3)
Water surface evaporation (E, km^3)
Level, (H, m)
Water mass volume (W, km^3)
Water surface area (F, km^2)
Salinity (%)
Precipitation (P, km^3)-Big
Precipitation (P, km^3)-Small
Water surface evaporation (E, km^3)-Big
Water surface evaporation (E, km^3)- Small
Level, (H, m)-Big
Level (H, m)- Small
Water mass volume (W, km^3)
Water surface area (F, km^2)
Salinity (%)
Overflow from Small Sea to Big Sea (km^3)

Priaralie and Aral Sea Model input information (step = year, the period starts from 1990):

River flow value (km^3)	Amudarya
	Samanbay
	Syrdarya

Priaralie and Aral Sea Model input information (reference, the period starts from 1990):

Level (m)	Big Aral, Big Aral (Eastern bowl), Big Aral (Western bowl), Small Aral (Northern bowl), Chibas
Attached area (m^2)	
Area at given level (m^2)	
Volume at given level (m^3)	
Maximum reservoir level (m)	Amudarya, Sudochie Wetlands: Mezhdurechie, Rybachiy, Muynak, Raushan, Mashankul, Makpalkul, Dumalak, Djiltyrbas, Djil_polder, Ak-darya, Ajibay, Ajibay2, Urdabay, Akkay.
Minimum reservoir level (m)	
Full reservoir level (m)	
Maximum surface level fluctuation in winter (m)	
Maximum water salinity (gr./l)	
Free surface altitude	Amudarya Sudochie Wetlands: Mezhdurechie, Rybachiy, Muynak, Raushan, Mashankul, Makpalkul, Dumalak, Djiltyrbas, Djil_polder, Ak-darya, Ajibay, Ajibay2, Urdabay, Akkay.
Free surface area	
Water volume	
Maximum water depth	
Average depth	
Water salinity	
Water temperature	
Water density	
Dissolved oxygen content	
Ice thickness	
Area under reed	
Vertical temperature gradient	
Vertical salinity gradient	
Biomass density	
Water body altitude (m)	Sudochie, Amudarya, Wetlands: Mezhdurechie, Rybachiy, Raushan, Mashankul, Makpalkul, Dumalak, Djiltyrbas, Djil_polder, Akdarya, Ajibay, Ajibay2, Urdabay, Akkay, Muynak.
Surface area (m^2)	

Input information for the PZ Model on planning zones *** (step = decade, the period starts from 1980):

Precipitation (mm)
Basic values on ZP local sources (volume - km^3, salinity – gr./l)
Basic values on ZP transboundary sources (volume - km^3, salinity – gr./l)

Input information for the PZ Model
on planning zones * (step = year, the period starts from 1990)**
by the following parameters:

Investments in ZP*** ($ billion)
Population growth rates (%)
Drainage system characteristics of (operation costs - $/ha, leaching - m^3/ha)
Irrigation system characteristics (on-farm irrigation network efficiency, irrigation technique efficiency, operation costs - $/ha)
Land characteristics (total area – thousand ha, (gross) irrigated area - thousand ha, (net) irrigated area – thousand ha
Population (total – million people, urban – million people)
Investments (in development of new lands -$ thousand/ha, in irrigated lands growth - $ thousand/ha, in drainage -$ thousand/ha)
Soil fertility class (100-81 – thousand ha, 80-61 – thousand ha, 60-41 – thousand ha, 40-21 – thousand ha, 20-00 – thousand ha)
Soil salinity (non-saline – thousand ha, poor saline – thousand ha, moderately saline – thousand ha, strongly saline – thousand ha, under salt control – thousand ha)
Market prices for agricultural** produce ($/t)
Governmental prices for agricultural** produce ($/t)
Irrigated areas under agricultural ** crops (%)
Agricultural ** crops characteristic, yield capacity (t/ha)
Agricultural ** crops characteristic, requirement for irrigation (m^3/ha)
Agricultural ** crops characteristic, costs ($/ha)
Local irrigation canals characteristics (cost per 1 m^3 of water - $/$m^3$, electric energy - kW/$m^3$, costs - $, technical efficiency), for PZ***
Transboundary irrigation canals characteristics (cost per 1 m^3 of water - $/$m^3$, electric energy - kW/$m^3$, costs - $, technical efficiency), for PZ***
Limits for transboundary water resources of PZ*** (volume in non-vegetation period, volume in vegetation period - km^3, salinity in non-vegetation period, salinity in vegetation period – gr./l)
Drainage flow from PZ *** (volume of return flow in non-vegetation period, and volume of return flow in vegetation period - km^3 , volume of return flow to river in non-vegetation period - %, volume of return flow to river in vegetation period - %)
Local water resources in PZ ***, (volume in non-vegetation period, volume in vegetation period - km^3, salinity in non-vegetation period, salinity in vegetation period – gr./l)

Input information on administrative regions for the Drainage Model
aggregated by Planning Zones ***
(step = year, the period starts from 1980):

Total area, thousand ha
Suitable for irrigation, thousand ha
(Gross) irrigated area, thousand ha
(Net) irrigated area, thousand ha
Water intake for irrigation, million m^3
Irrigation water salinity, gr./l
Salt influx, thousand t
Gross specific water supply, thousand m^3/ha
Specific salt influx, t/ha
Total drainage flow, million m^3
including net drainage flow, million m^3
Drainage modulus, l/sec/ha
Specific water disposal, thousand m^3/ha: from irrigated area and drained area
Drainage flow salinity, gr./l
Total salt removal, thousand t
Specific salt removal, t/ha

Proportion of drainage flow in water intake, %
Efficiency of irrigation systems, expressed as a decimal fraction
Irrigated area under reclamation control, thousand ha
Area requiring drainage, thousand ha
Irrigated area provided with drainage, thousand ha
Irrigated area not provided with drainage, thousand ha
Area provided with open horizontal drainage, thousand ha
Area provided with closed horizontal drainage, thousand ha
Area provided with vertical drainage, thousand ha
Area irrigated from creeks, springs, etc., thousand ha
Area irrigated from river intakes, thousand ha
Irrigated area classification by use type, thousand ha
Irrigated area, thousand ha
Specific water supply, thousand m^3/ha (net)
Specific drainage flow, thousand m^3/ha
Specific salt removal, t/ha
Net drainage modulus, l/sec/ha
Proportion of net drainage modulus in water supply D:W, %
(Net) leaching norms: established, thousand m^3/ha
(Net) leaching norms: actual, thousand m^3/ha
Salt removal rates: by surface water balance, t/ha
Salt removal rates: by aeration balance, t/ha
Irrigation leaching regime coefficient K = B + A/ET
Area with salinity above middle category, thousand ha
Yield capacity of major crops, centner/ha
Area under major crops, thousand ha
Gross major crop harvest, t
(Net) water use per unit of harvest, m^3/centner
Water productivity, kg/m^3
Average groundwater vegetation level, m
Allowable groundwater table, m
Irrigated area classification by soil fertility, thousand ha
Specific length of collector-drainage network on irrigated area, running meter/ha
Specific length of collector-drainage network on drained area, running meter/ha
Length of inter-farm collectors, km
Specific length of inter-farm collectors, running meter/ha
Length of on-farm network, km
Specific length of on-farm network, running meter/ha
Length of inter-farm collectors, being in satisfactory or unsatisfactory condition, requiring cleaning and/or reconstruction, where cleaning was carried out, where reconstruction was carried out, km
Length of on-farm network, being in satisfactory or unsatisfactory condition, requiring cleaning and/or reconstruction, where cleaning was carried out, where reconstruction was carried out, km
Open horizontal drainage
Drained area, thousand ha
Length of open horizontal drainage, km
Closed horizontal drainage
Drained area, thousand ha
Length of closed horizontal drainage, km
Vertical drainage
Drained area, thousand ha
Amount of wells
Amount of wells under exploitation
Content of surface collector-drainage network
Inter-farm collectors
Relation between cleaned length and total length, %
Cleaning volume, thousand m^3

Cleaning costs
On-farm collectors and drains
Relation between cleaned length and total length, %
Cleaning volume, thousand m^3
Cleaning costs
Specific open drainage cleaning volumes
Specific inter-farm network cleaning volumes, m^3/m
Specific on-farm network cleaning volumes, m^3/m
Cost per 1 m^3 of cleaning
Irrigated area classification by salinity degree, thousand ha
Area with non-saline soil, thousand ha
Area with poor saline soil, thousand ha
Area with moderately saline soil, thousand ha
Area with strongly saline soil, thousand ha
Classification of area, provided with drainage, by salinity degree, thousand ha
Area with moderately saline soil, thousand ha
Area with strongly saline soil, thousand ha
Area with very strongly saline soil, thousand ha
Classification of area, not provided with drainage, by salinity degree, thousand ha
Area with moderately saline soil, thousand ha
Area with strongly saline soil, thousand ha
Area with very strongly saline soil, thousand ha
Collector-drainage water discharge and flows
Groundwater transit inflow
Discharge, m^3/sec
Flows, million m^3
Total collector-drainage water flows
Discharge, m^3/sec
Flows, million m^3
including to irrigation source, million m^3
out of them: irrigation source, million m^3
directly to irrigation, million m^3
outside irrigated lands, million m^3

Input information on administrative regions for the Drainage Model aggregated by Planning Zones *** (step = month, the period starts from 1980):

Dynamics of groundwater table, m
Groundwater salinity, gr./l
Water intake, million m^3 (at the border of regions)
Irrigated area classification by groundwater table, thousand ha
Area with groundwater table (< 1.0 m), thousand ha
Area with groundwater table (1.0-1.5 m) , thousand ha
Area with groundwater table (1.5-2.0 m), thousand ha
Area with groundwater table (2.0-2.5 m), thousand ha
Area with groundwater table (2.5-3.0 m), thousand ha
Area with groundwater table (3.0-5.0 m), thousand ha
Area with groundwater table (> 5.0 m), thousand ha
Irrigated area classification by groundwater salinity degree, thousand ha
Area with groundwater salinity of < 1 gr./l, thousand ha
Area with groundwater salinity of (1 <> 3) gr./l, thousand ha
Area with groundwater salinity of (3 <> 5) gr./l, thousand ha
Area with groundwater salinity of (5 <> 10) gr./l, thousand ha
Area with groundwater salinity of (10 <> 25) gr./l, thousand ha

Area with groundwater salinity of > 25 gr./l, thousand ha

Input information on administrative regions for the Drainage Model aggregated by Planning Zones *** (reference, the period starts from 1980):

Minimum closed and open drainage laying depth (m)
Distance between drains at closed and open drainage (m)

** *(agricultural crops)*

Cotton
Grain
Rice
Fodder crops
Corn
Gardens
Vineyards
Vegetables
Sugar beet
Potato
Cucurbitaceous
Truck crops
Other

*** *(Planning Zones and Regions)*

Amudarya basin		**Syrdarya basin**	
Planning Zones	**Regions**	**Planning Zones**	**Regions**
Afghan (Afghanistan)	Afghan region	Upper Naryn (Kyrgyzstan)	Tyan-Shan Jumjal Atbashi Aktala
Garm (Tajikistan)	Garm, Jirgatal Komsomolabad Tavildarin Tajikabad.	Middle Naryn (Kyrgyzstan)	Toktogul Toguz-Tarauz Uch-Terek
Vakhsh (Tajikistan)	Bokhtar Vakhsh Gazimalik Dangarin Kolkhozabad Kuybyshev Nurek Yavan	North Ferghana (Kyrgyzstan)	Suzak Nooken Aksy Bazarkurgan Alabuka
Pyanj (Tajikistan)	Vosey Kulyab Kumsangir Moskovskiy Muminabad Pyanj Sovetskiy Khovaling Shurabad	Namangan-Naryn (Uz-bekistan)	Yangikurgan Chust Chartak Uchkurgan Uychi Turakurgan Pap Naryn Namangan Kassansay
Gorno-Badakhshan (Ta-	Vanchin	Andijan (Uzbekistan)	Bulagbashi

Amudarya basin		Syrdarya basin	
Planning Zones	**Regions**	**Planning Zones**	**Regions**
jikistan)	Darvaz Ishkashim Murgab Roshtalin Rushan Shugnan		Khojaabad Pakhtaabad Shakhrikhan Markhamat Assaka Kurgantepa Ulugnar Izbaskan Jalalkuduk Boz Balykchi Andijan Altynkul
Upper Kafirnigan (Tajikistan)	Varzob Gissar Kafirnigan Lenin Fayzobad Shakhrinav	Namangan-Syrdarya (Uzbekistan)	Mingbulak
Lower Kafirnigan (Tajikistan)	Baljuvan Beshkent Kabodiyen Shaartuz	Ferghana (Uzbekistan)	Sokh Akhunbabayev Bagdat Buvaydi Besharyk Kuva Altiaryk Rishtan Kuvasay Tashlak Uzbekistan Furkat Ferghana Dangarin Yazyavan Uchkuprik
Karatak-Shirkent (Tajikistan)	Tursunzade	Khojent (Tajikistan)	Khojent Nau Matchi Kanibadam Zafarabad J. Rasulov Asht
Surkhandarya (Uzbekistan)	Altynsay Angor Bandikhon Baysun Muzrabad Denau Jarkurgan Kumkurgan Kizirik Sariasi Termez Uzun Sherabad Shurchin	Kampyr-Ravat (Kyrgyzstan)	Uzgen Karakulji
Mary (Turkmenistan)	Bayramaly Vekilbazar	South Ferghana (Kyrgyzstan)	Kadamji Naukat

Amudarya basin		Syrdarya basin	
Planning Zones	**Regions**	**Planning Zones**	**Regions**
	Yeloten Garagum Gushgyn Mary Murgap Niyazov Sakarchyagin Tagtabazar Turkmengalyn		Lyaylyak Karasu Batken Aravan
Akhal (Turkmenistan)	Ashgabat Gyavers Bakherden Gekdepin Kakin Babadaykhan Sarakh Tejen	Syrdarya (Uzbekistan)	Khavast Syrdarya Mekhnatabad Mirzaabad Sharaf-Rashidov Gulistan Saykhunabad Bayaut Akaltyn
Lebap (Turkmenistan)	Darganatyn Boyniuzyn Dyanev S.Niyazov Garabekvyul Kerkin Sakar Sayat Farap Khalach Khojambaz Chardjev Charshangyn	Jizak (Uzbekistan)	Yangiabad Farish Pakhtakor Zafarabad Mirzachul Zarbdar Zamin Dustlik Jizak Gallyaaral Bakhmal Arnasay
Kashkadarya (Uzbeki-stan)	Guzar Dekhkanabad Kamashin Kitab Chirakchin Shakhrisabz Yakkabag	Hunger Steppe (Kazakhstan)	Makhtaaral Kirov
Karshi (Uzbekistan)	Bakharistan Karshi Kasan Mubarek Nishan Kasbi Usman-Yusupov	Tashkent-Syrdarya (Uzbekistan)	Bekabad
Zaravshan (Tajikistan)	Aynin Gornaya Matcha Penjikent	Tashkent-Chirchik (Uzbekistan)	Yangiyul Chinaz Tashkent Urtachirchik Пскентский Parkent Kibray Yukorichirchik Zangiata Kuyichirchik Buka Bostanlyk Akhangaran

Amudarya basin		Syrdarya basin	
Planning Zones	**Regions**	**Planning Zones**	**Regions**
			Akkurgan
Samarkand (Uzbekistan)	Akdarya Guzalkent Bulungur Jambay Ishtykhan Kattakurgan Koshrabad Narpay Payaryk Chelek Pastdargom Pakhtachi Samarkand Taylak Nurabad Urgut	Chatkal (Kyrgyzstan)	Chatkal
Navoi (Uzbekistan)	Kanimekh Kyzyltepa Navbakhor Navoi Nurata Tamdyn Khatyrchi Uchkuduk	CHAKIR (Kazakhstan)	Chatkal Kazygurt Keles Sariagach
Bukhara (Uzbekistan)	Alat Bukhara Vabkent Gijduvan Kagan Karaulbazar Karakul Peshkun Romitan Jondor Shafirkan	ARTUR (Kazakhstan)	Sariagach Turkestan Sayram Tolebi Otrar Ordabasi Tyulkubas Shymkent city
Khorezm (Uzbekistan)	Bagat Gurlen Druzhba Koshkupyr Urgench Khazarop Khanka Khiva Shavat Yangiaryk Yangibazar	Kzylkum (Kazakhstan)	Arys Suzak Baydibek Kentau Chardara Arys
South Karakalpakstan (Uzbekistan)	Amudarya Beruni Turtkul Ellikkala	Kzylorda (Kazakhstan)	Kzyl-Orda Shiyeli Kzyl-Orda city Syrdarya Zhanakorgan Chiili Terenozek Karmakchi Kazali Djalagash Aral

Amudarya basin		Syrdarya basin	
Planning Zones	**Regions**	**Planning Zones**	**Regions**
North Karakalpakstan (Uzbekistan)	RK-Severnaya Karauzyak Kegeyli Kungrad Kanlykul Muynak Nukus Takhtakupyr Khojeyli Chimbay Shumanay		
Dashkhovuz (Turkmenistan)	Gubadag Dashkhovuz Tagtyn S.Turkmenbashi Akdepa Keneurgench Boldumsaz Yilanly		

By now, forms with reference information and forms for data input (according to ToR) have been drawn up and sent to the CAREWIB Project co-executors (K.B. Balliyev, A.Sh. Djay-loobayev, Kh.K. Gapparov, N.K. Kipshakbayev, N.K. Nosirov)

Structure of distributed reference information:

List of Planning Zones (with rayons and oblats)

Planning Zone	Oblast	Rayons

Local water resources
List of transboundary rivers

Withdrawal from transboundary rivers

Planning Zone	Withdrawal	River

Withdrawal from local sources

Planning Zone	Withdrawal

Canal releases to river

Planning Zone	Releases

Collector-drainage network releases

Planning Zone	Releases

Water disposal from planing zone (transfers)

Planning Zone	Transfers

Reservoirs and lakes

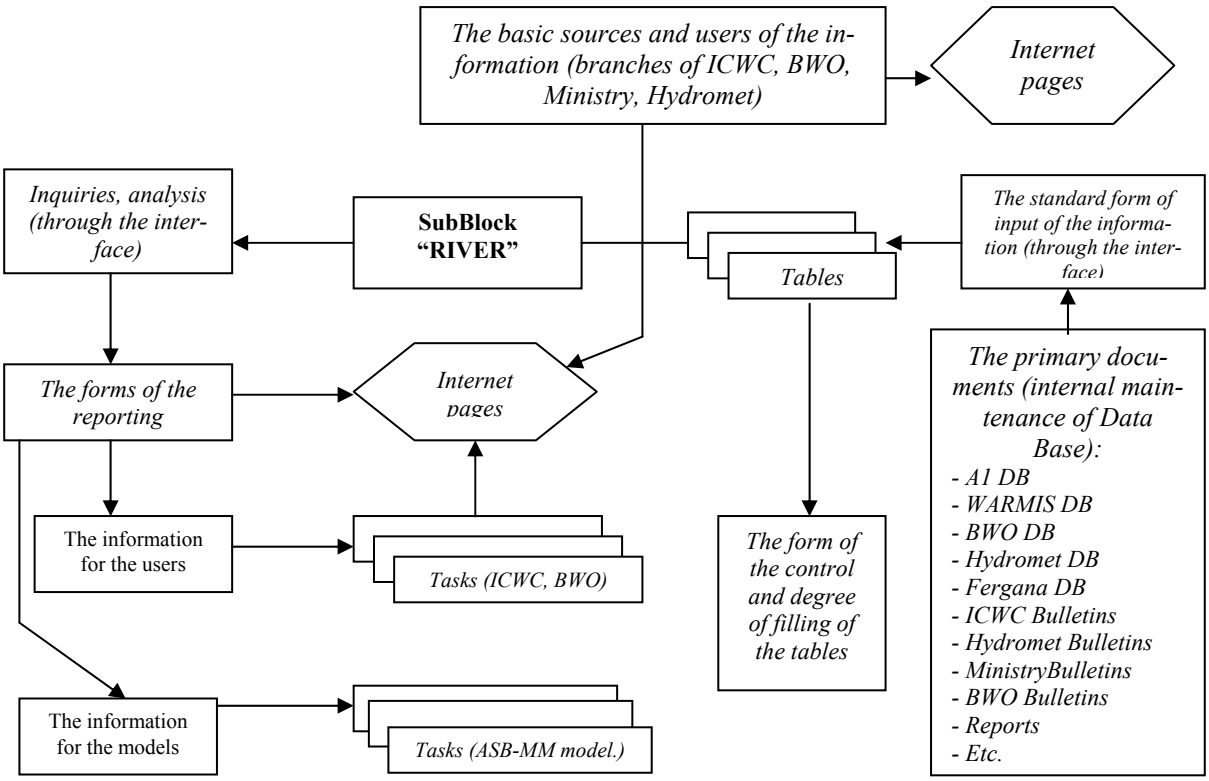
Reservoirs	Type

List of gauging stations

Gauging Station	River	Planning Zone

Test web module for remote work with database through the Internet was developed.

First Stage of Database Upgrading
Activity on "River" Subblock of "Water" Block

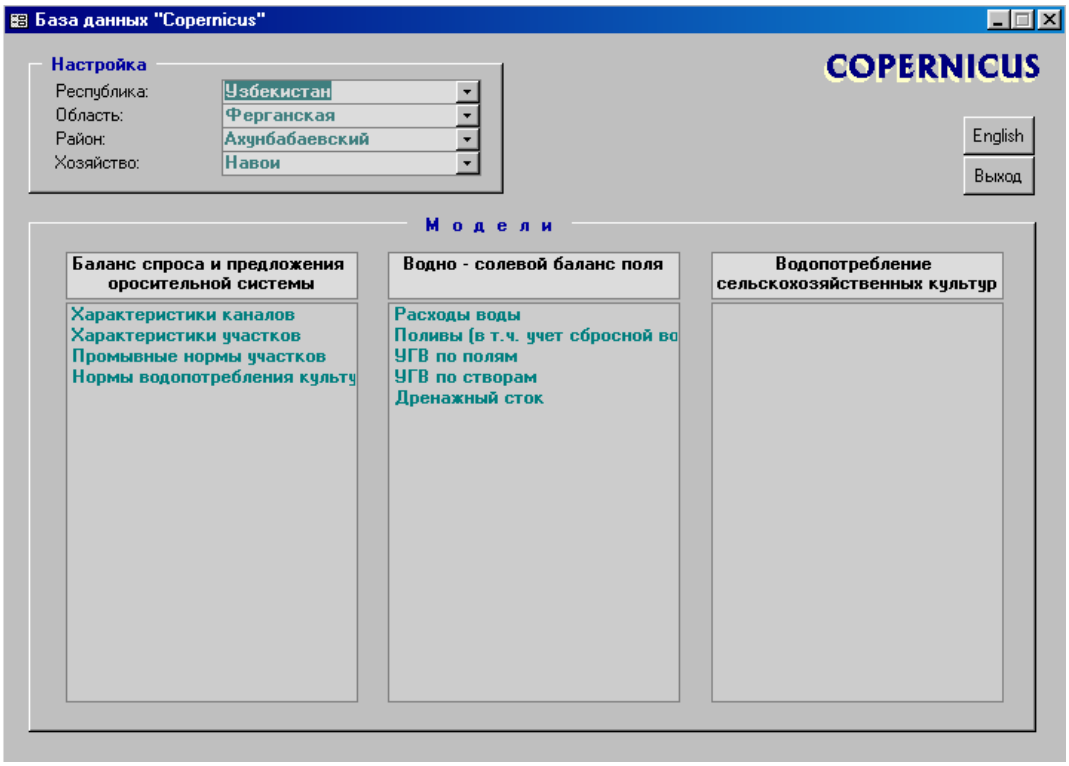


Analysis of the main objects, information structures, information flows, function relations of WARMIS, WUFMAS, IWRM-Ferghana databases for further linkage with Information System, definition of the main information flows, their function relations, development of information structure of the main objects

COPERNICUS DATABASE ANALYSIS

The main purpose of the database under the Info-Copernicus project is to provide information to three models, being developed within the project, on the basis of data collection on the selected households, as well as on the results of field operations, performed by co-executors.

The "Copernicus" Database consists of a number of functional blocks (separate functional block for each model), reflecting structure and content of studied domain, namely Block "Model of demand and supply balance for irrigation system", Block "Model of field water-salt balance", Block "Model of crop water consumption".



The database was designed based on the following basic principles:

- Openness – possibility to connect to the functioning databases of new blocks of information, tables and forms for processing them;
- Providing information search and retrieval according to a group of parameters (features);
- Providing capability to re-organize and expand when changes in domain limits occur;
- Providing simplicity and ease of information input and updating as well as of user referring to relevant information (on the basis of user interface);
- Providing possibility of shared user access to information;
- Availability of developed user interface, allowing to efficiently link all components of database (blocks, tables, forms and so on) into a single integral system, and organize performing the duties given to database;
- All data domain is presented as objects, which are elements of domain information that have certain properties;
- All objects have certain properties (characteristics), i.e. information of various types, through which the object is presented in database;
- The main studied objects are encoded by using the method of compound coding, and additional ones – using the method of level-by-level coding as a particular case of compound coding. Selection of these methods is based on that they allow not only to uniquely determine objects on a set of domain objects, but also to reflect their hierarchy and sequence order.

In the process of analyzing domain, various objects being studied were identified. For individually and uniquely determining them on all set of studied domain objects, it is necessary to give them appropriate codes. Coding used in this system meets certain requirements, namely:

- Univocacy, i.e. only one code is given to each object, and only one object corresponds to each code;
- Possibility to expand and include. A set of coded objects can increase. Thus, it is necessary that a set of codes and coding function let give codes to new objects;
- Conciseness. Object is usually encoded in order to avoid the need to denote it by a name long and difficult in use. Therefore, the codes should be short, but at the same time the length of code should be defined in view of requirements for expanding and including;
- Mnemonic presentation, i.e. the applied codes should characterize the denoted objects from meaningful side.

Three ways are used as coding procedures in the database, namely:

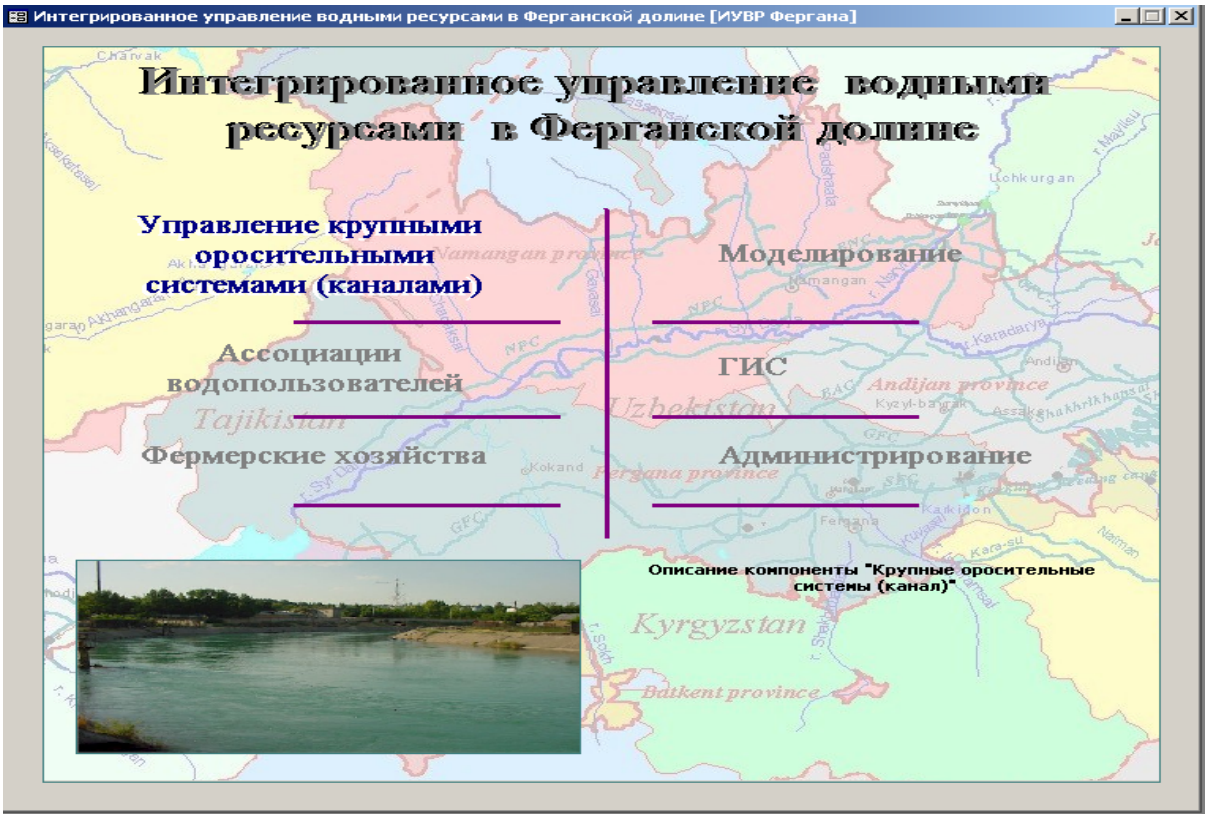
- Serial coding. According to this procedure, the objects, belonging to some set of objects, are given sequential numbers;
- Compound coding. Object codes consist of several zones, called *descriptors*, each of which has a concrete informative significance;
- Level-by-level coding. This coding procedure is based on setting codes, consisting of several zones (levels), at that each of these zones presents some set of objects. These zones, viewed from left to right, usually present more and more limited sets of objects.

For maximum information linkage with regard to corresponding information objects, the system of object coding, used in the given database, takes into account the coding system, put in the WARMIS.

IWRM-FERGHANA DATABASE ANALYSIS

In “Integrated water resources management in Ferghana Valley” Project the database is regarded as an element, ensuring cross information coordination of activities under three components like “Large irrigation systems management”, “WUAs”, "Private farm” with “Mathematical models” and “GIS”. The main purpose of the database is to store and manage on a centralized basis a collection of interrelated data, adequately representing the status of the studied objects in the given domain and relations between them, and also service (in the context of providing relevant information) various users, objects and processes of management.

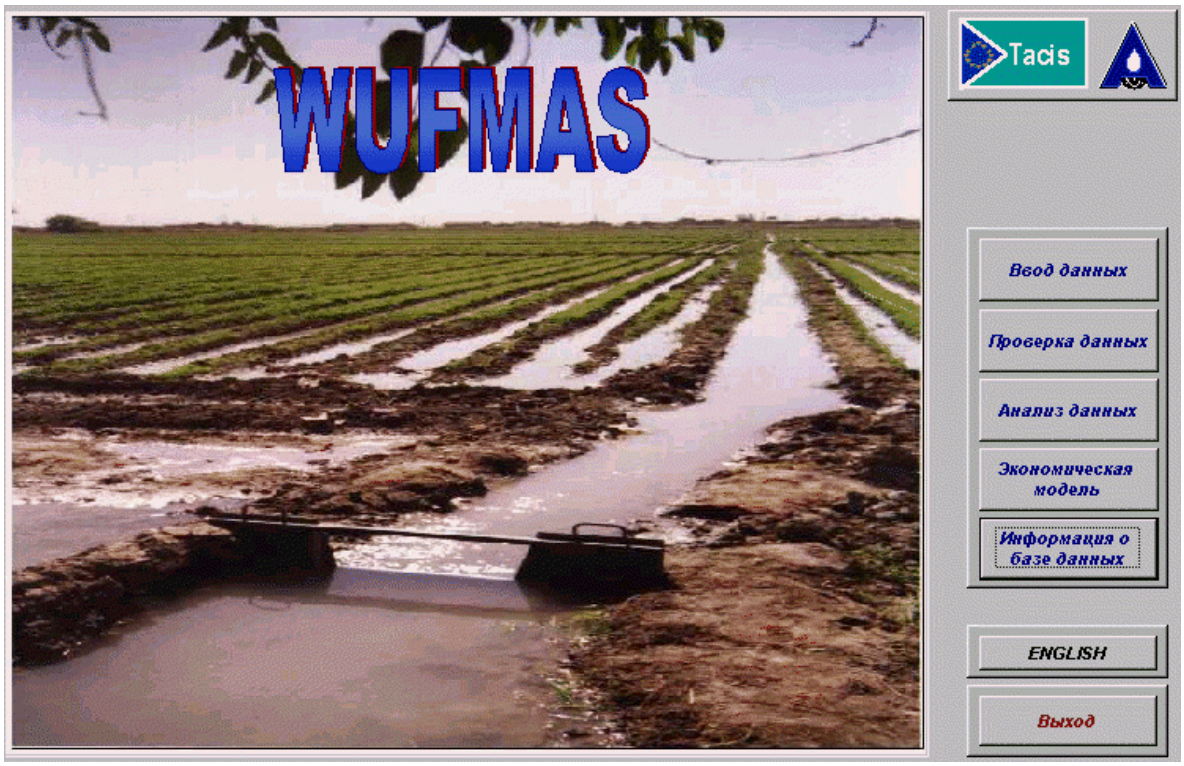
Central concepts of database being developed are “Information point” and “information object”.



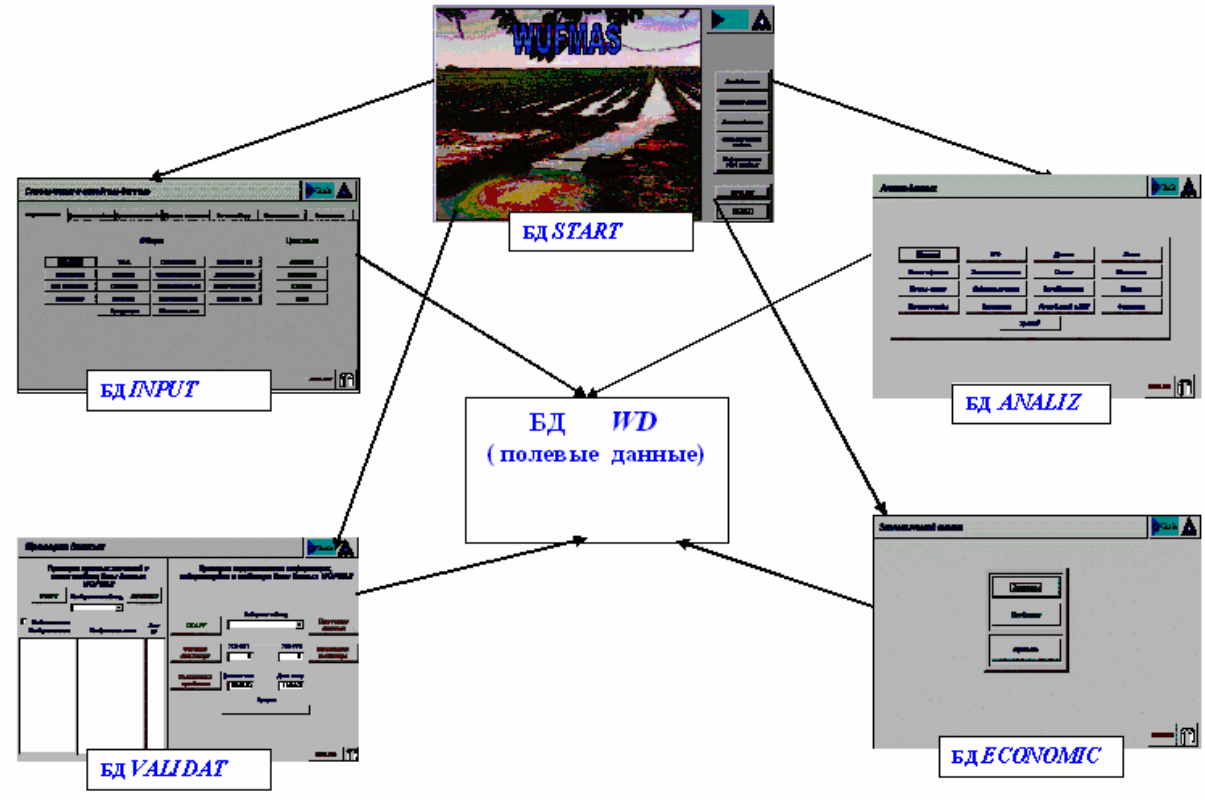
Adequate coding system is applied for individual and unique determination of diverse studied objects in all set of studied domain objects. Coding, used in database being developed, meets univocacy requirements, i.e. each object is given one code, and one object corresponds to each code, and also envisages possibility of expansion and inclusion, i.e. a set of coded objects can increase. Object coding relies on the theory of networks, where each structural relation *p* forms due to a pair of information points *(j,k)p*, where *k* is a key of this object, and *j* is a key of an object, from which flow is received. Such approach let reflect hierarchical structure of information objects correctly, and fulfill *p* – navigation between them - in algorithmic way. In particular, if *p* corresponds to water resources, then network of water resources allocation between information objects is built. Serial and compound coding techniques are used as the main coding procedures.

All information in the database is stored in the form of relevant information structures (tables), characterizing various studied (water) objects, their types (canals, WUAs, private farms, experimental field, etc.), and also various relations between each other. Object (family of objects), as a rule, is presented in the form of one or several interrelated tables, each of which contains certain set of object properties (characteristics).

WUFMAS DATABASE ANALYSIS



Hierarchical scheme of interaction between WUFMAS Project databases



WUFMAS Database is divided into several functionally independent files such as WD.MDB, INPUT.MDB, VALIDAT.MDB, ANALIZ.MDB, ECONOMIC.MDB, and START.MDB with a view to rise information storage safety.

WUFMAS Database is designed to collect, store, and process data on investigating the use of irrigation water and management of agricultural objects, located in the five republics in the Aral Sea basin. WUFMAS Database structure consists of the main WD information base, containing all database tables, and a range of control databases with forms, queries and reports. Working with the base begins from database "Start" file, which contains form view from the menu of all database control files.

In the initial stage of the WUFMAS Project, an information coding system was developed, which became the basis for creating field information collection forms that, in turn, served as prototype for developing database tables. The list of the main information groups, used in "WUFMAS" Database is given.

01	Farm codes
02	Machine-and-tractor fleet
03	Farm operations
04	Managerial personnel
05	Salinity and natural soil drainage
06	Crop codes
07	Products from harvest
08	Irrigation equipment and systems
09	Seed treatment codes
10	Agrochemicals and biological pest control
11	Types of canals supplying water to fields

Description of spatial and temporal levels of information

Farm level information:
Information, describing the characteristics of farm as a whole, pertains to farm level. For example, total area, irrigated area, number of houses on farm, farm demand for irrigation water and so on.

Field level information:
Information, describing events in concrete field, pertains to field level. For example, field area, planted crop, planting date, harvest date, applied pesticides and so on.

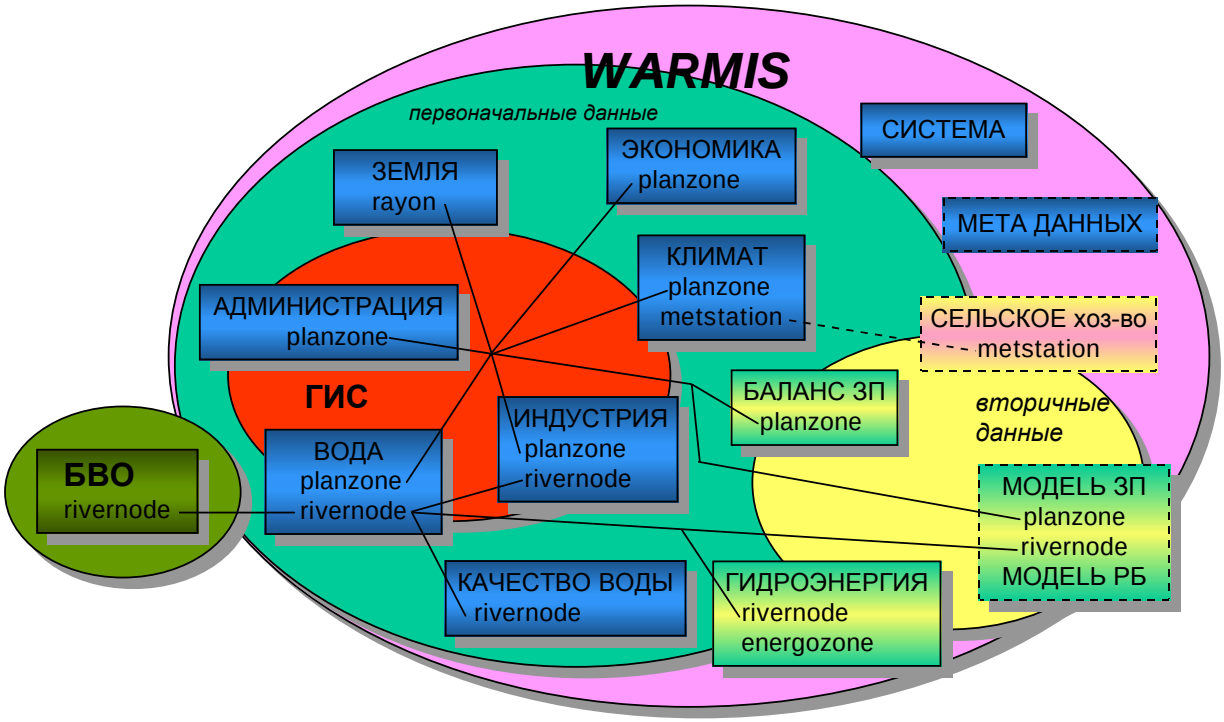
Registration plot level information:
To control data on field and conduct phenological observations in each field, registration (phenological) plots, located in four corners and center of field, were organized. In these plots, harvest registration was conducted, groundwater level in the drilled wells was defined, soil and water sampling for chemical analyses was carried out, observations over plant development were conducted and so on.

Year level information:
Information collected under the WUFMAS Project along with spatial breakdown has also temporal scale. In particular, year level information describes observations, gathered once a year, as a rule, by April 1. For example, farm geographical coordinates, population and number of houses, number and types of farm water supply canals and so on

Month level information:
It is accepted to conduct part of agricultural production observations with monthly frequency. These are dynamics of manual labor use, pesticide and fertilizer application, and water use.

Current information:
Information collected by fact, i.e. with indication of registration date is of an operational value. As a rule, such information is bound to field or registration plot, and describes agricultural production process in a real time scale. For example, sowing, harvesting, applying pesticides and fertilizers and so on.

WARMIS DATABASE ANALYSIS



The WARMIS Database is a relative database, consisting of tables with text data. The database contains information on water and land resources and use, climate, economic indicators, and water quality. In compliance with the data source, data can be divided into the following levels: primary, secondary and tertiary (see below). Data can be grouped on the basis of the features of the object, to which they belong.

The main spatial (basin) unit of WARMIS database is a planing zone. Thus, various tables of the database can be tied together through this common unit. The main time unit is month.
Within the WARMIS, the following information levels will be differentiated:

1. Primary data; factual field measurement data or data, obtained by calculations using field measurement data through simple arithmetic operation s (addition, subtraction, multiplication, division).

2. Secondary data; factual data, based on primary data, but calculated by using certain algorithm (complex mathematical operations, models of balances), or calculated by using primary data updating and without it, including calculations of missing primary data.

3. Tertiary data; data, obtained as a result of incorporating primary and secondary data by expert (calculations, strategies, scenarios), which do not necessarily reflect the current situation.

Empirical reference data available in WARMIS database can be referred to primary data, because they are used for directly putting into the WARMIS. However, in itself such information is usually based on primary and secondary data of other databases. In order to denote difference, empirical data can be classified as the forth category of data.

Attention should be paid to that at present WARMIS database contains mainly primary data in the partial presence of secondary data in diverse places that is a result of data verification procedure.

Database and information required for CAREWIB IS

The main task of Information System being developed is to use a single information system of land and water resources accounting, formation and use in the Aral Sea basin, assess effectiveness of their use, prediction and measures for achieving potential level of effectiveness, assist with implementing sustainable management and control of various water resources use on the basis of modern information technologies and telecommunication facilities. The Information System will be a multilevel inter-state, inter-sectoral system, based on water and land resources management hierarchy levels and related water use objects as well as on water resources formation and use levels.

The main component of the Information System will be database, designed for centralized storage and management of interrelated data collection, adequately reflecting the status of objects in the given domain (domains) and relations between them.

In the database information on the following subject areas should be collected:

№	Aspects	Parameters	Steps	Hierarchy levels
1	Economic	Description of parameters	Month, season, year	Basin, State, Planning zone
2	Energy			
3	Water			
4	Land			
5	Environmental–Climatic			
7	Socio-Economic			

Structure of the main hierarchy level tables:

BasinCode	Basin name
1000	Aral Sea Basin
2000	Amudarya Basin
3000	Syrdarya Basin

RepublicCode	Name of republic
100	Afghanistan
200	Kazakhstan
300	Karakalpakstan
400	Kyrgyzstan
500	Tajikistan
600	Turkmenistan
700	Uzbekistan

Aggregation of oblasts (PZ) by states and basins:

BasinCode	RepublicCode	Oblast (PZ) Code	Oblast Name
2000	100	2101	Afgan
2000	300	2301	South Karakalpakstan
2000	300	2302	North Karakalpakstan
2000	500	2501	Lower Kafirnigan
2000	500	2502	Vakhsh
2000	500	2503	Pyanj
2000	500	2504	Zarafshan
2000	500	2505	Upper Kafirnigan
2000	500	2506	Karatag-Shirkent
2000	500	2507	Garm
2000	500	2508	Gorno-Badakhshan
2000	600	2601	Dashkhovuz
2000	600	2602	Mary
2000	600	2603	Lebap
2000	600	2604	Akhal
2000	700	2701	Kashkadarya
2000	700	2702	Bukhara
2000	700	2703	Karshi
2000	700	2704	Navoi
2000	700	2705	Samarkand
2000	700	2706	Surkhandarya
2000	700	2707	Khorezm
3000	200	3201	Talas
3000	200	3202	Shu
3000	200	3203	Kzylorda
3000	200	3204	Hunger Steppe
3000	200	3205	ChAKIR
3000	200	3206	ARTUR
3000	200	3207	Kzylkum
3000	400	3401	Chu
3000	400	3402	Talas
3000	400	3403	Middle Naryn
3000	400	3404	Chatkal
3000	400	3405	North Fergana (Kyr)
3000	400	3406	Upper Naryn
3000	400	3407	Kochkor
3000	400	3408	Kampyr-Ravat
3000	400	3409	South Ferghana (Kyr)
3000	400	3410	Alay
3000	400	3411	Batkent
3000	500	2501	Isfara
3000	500	2502	Khojent
3000	500	2503	Shakhristan-Lakkatsavat
3000	600	3601	Balkan
3000	700	3701	Andijan
3000	700	3702	Jizak
3000	700	3703	Namangan-Naryn
3000	700	3704	Namangan-Syrdarya
3000	700	3705	Syrdarya
3000	700	3706	Tashkent-Chirchik
3000	700	3707	Tashkent-Syrdarya
3000	700	3708	Fergana