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RIVERTWIN

A regional model for integrated water management in twinned river basins

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Priority: Sustainable development, Global Change and Ecosystems

D9: Hydrological base of modeling (schemes, links) in the Chirchik basin

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*Lead contractor: Scient. Information Center of Interstate Commission Water Coordination
Prof.V.A. Dukhovny, A. Sorokin*

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1. Introduction

In the report we used data provided by:

- BWO “Syrdarya” – on structure and characteristics of the objects controlled by Verkhnechirchik Administration of BWO’s waterworks facilities (headworks of BKMK, Parkent canal, Left-bank Karasu, Zakh, Khanym),
- Chirchik-Akhangaran Basin Administration for Irrigation Systems - on structure and characteristics of the objects controlled by this administration (irrigation systems, waterworks facilities, reservoirs in Uzbekistan),
- Aralconsult – on structure and characteristics of the objects in Keless massif (Kazakhstan)

This work was done according to the concept for modeling and database development referred to in the DoW of the RIVERTWIN project.

Chirchik, Akhangaran, and Keles rivere basins were included in the modeling scheme and have the local flow formation sub-basins and the interlinked flow distribution systems, including flow transfers from one basin to another one, with general outlet to the Syrdarya river basin.

2. Summary

A hydrological basis for modeling was created, including:

- Set of hydrological objects for the models and respective information objects in the database,
- Links between the objects and information flows.

A common network of waterways (rivers, canals, spillways, collectors, supply conduits) with regulating and distribution structures (waterworks facilities, reservoirs), objects of water use (power stations), water consumption (planning zones, point water supply objects), and water control (gauging stations) was shaped.

Given system is linked with the surface water sources (represented by river flow in gauging stations tailing catchment areas) and the groundwater sources (group of groundwater intakes).

Given system was tested (GAMS) by checking logical links between the selected objects.

3. Analysis of hydrological conditions

3.1. Characteristics of the flow formation zone

The hydrographic network of the Chirchik-Akhangaran-Keles basin can be conditionally divided into two zones:

- flow formation zone with minimum anthropogenic impact,
- and, flow distribution and use (dispersion) zone, where human factor is important.

Configuration of the hydrographic network and river regimes in the flow formation zone are mainly formed by mountainous relief and climate.

The boundaries of the flow formation zones are: Kuramin and Chatkal ranges in the south and east; Talass Alatou and its western branches in the north; and in the west - flow distribution zone along the Chirchik, Akhangaran and Keles, which is closed by the Syrdarya river valley receiving remained water from those rivers.

Three main basins represent the flow formation zone, such as Chirchik, Akhangaran, and Keles. Besides, there are small rivers (sai) between the Chirchik river and the Akhangaran river (Parket rayon) that do not flow directly to the latter now and can be considered as individual sub-basin.

Pskem range is a basin divide between the main Chirchik tributaries, such as Pskem river and Chatkal river, while Ugam range divides Ugam river (right tributary of Chirchik) and Pskem river. Karjantou range is a basin divide between the Ugam river and the Keles river. Kazykurt range separated the Keles basin from the Syrdarya basin. Rivers flowing from Chatkal and Kuramin mountain ranges are the sources of the Akhangaran river.

Ranges forming catchment basins of the rivers Chirchik, Akhangaran, and Keles are not higher than 4000 m (less than 1% of area is covered by mountains higher than 4000 m), and catchments of the rivers Pskem and Chatkal have few higher peaks (Manas mountain, 4488 m).

Glaciers are located only in the catchments of the rivers Pskem and Chatkal.

The Chirchik river formed from junction of Pskem (right) and Chatkal (left) has only two relatively large tributaries, such as Ugam river (right) and Aksagata river (left). Other inflows to the river are sais, i.e. temporary small stream.

Since construction of Charvak waterworks facility and accumulation of water in reservoir, the rivers Pskem and Chatkal have flown into Charvak reservoir; moreover, part of former tributaries of those rivers (Koksu, etc.) has also formed inflow to the reservoir.

Given the above mentioned, surface flow throughout the Chirchik river basin can be estimated:

- on the basis of inflow to Charvak reservoir – through gauging stations in such rivers as Pskem (Mullala g/s), Chatkal (upstream of Khudaidosai river), Nouvalyysai (Sidjak), Koksu (Burchmulla), Yangikurgan (Yangikurgan), Chimgansai (Chimgan);
- on the basis of lateral inflow to Chirchik downstream of Charvak reservoir - through gauging stations in such rivers as Ugam (Khodjickent g/s), Karankulsai (Karankul), Galvasai (Galvasai), Aktashsai (Aktash), Aksakatasai (Karamazar);
- by balance calculation method – by considering Chirchik river flow downstream of Charvak reservoir (g/s: dam of Charvak HEPS, Gazalkent), flow regulation and flow losses in the reservoir.

Surface flow in the Akhangaran river basin is formed by a number of rivers and sais that can be divided into two group:

- those flowing into Akhangaran reservoir – the Akhangaran river (gauging station in Irtash river estuary), Taganbashisai river (g/s Turk),
- those flowing into the Akhangaran river downstream of Akhangaran reservoir – Dukantsai (g/s Dukant), Karabu (Samarchuk), Gushsai (Kochbulak), Nizbash (Nizbash), etc.

The Keles river takes its origin from junction of the rivers Djuzumduk and Djegirgen. Natural river flow can be estimated in Ramadan (Stepnoye) gauging station.

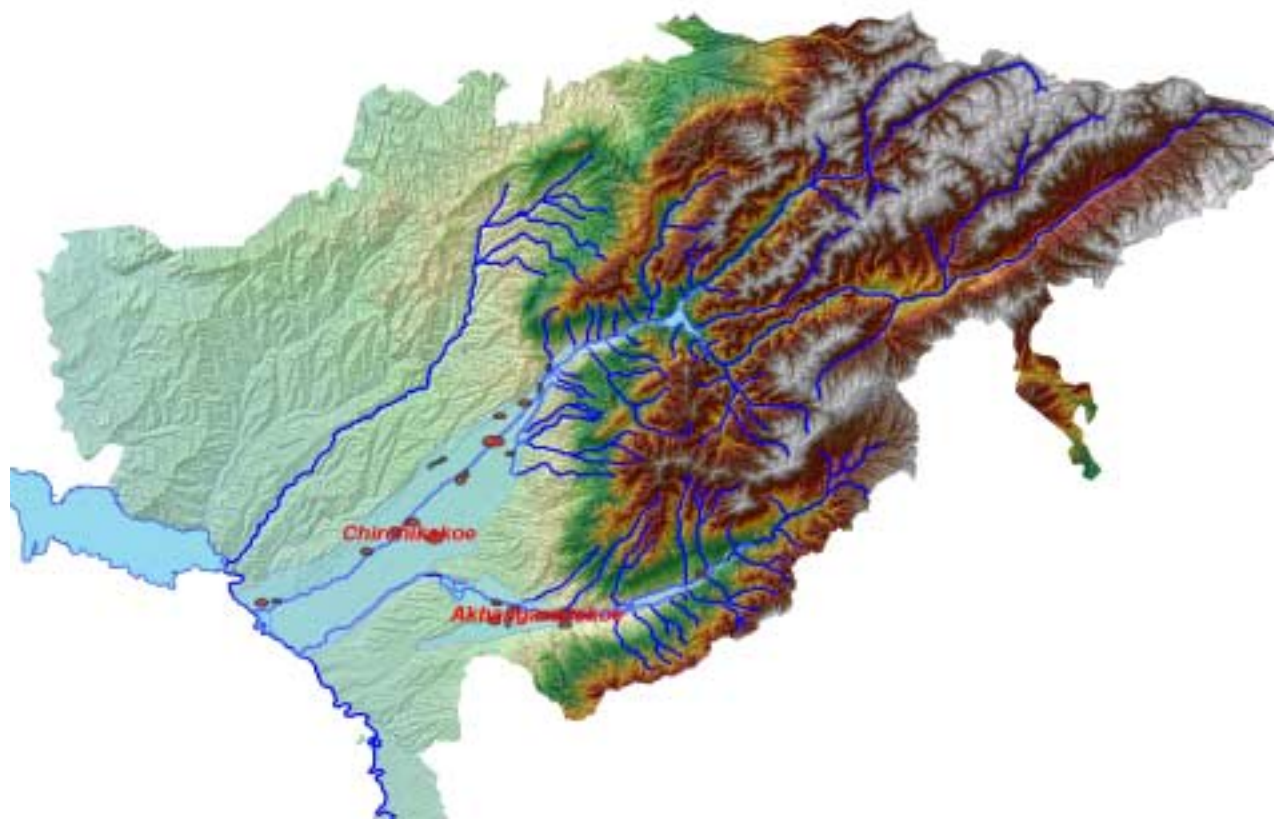
3.2. Characteristics of flow distribution and use zone

While three individual river basins such as Chirchik, Akhangaran, and Keles can be clearly pointed out in the flow formation zone, boundaries between them can be considered only as symbolical in downstream area since the irrigation network becomes entangled and river flows mix. Therefore, from water-management view, these three basins are considered as one Chirchik-Akhangaran-Keles basin.

The main hydrological function of the flow distribution zone in the Chirchik-Akhangaran-Keles basin is evaporation of great water masses and dispersion of flow from the flow formation zone among vegetation, atmosphere, and aquifers. Due to small slopes and excess of evaporation over precipitation, given area does not contribute to natural flow formation.

A network of canals and wasteway channels is advisable to consider, for their simulation, as components of river network, as general network of waterways (Fig. 3.1.).

Fig 3.2 Groundwater deposits

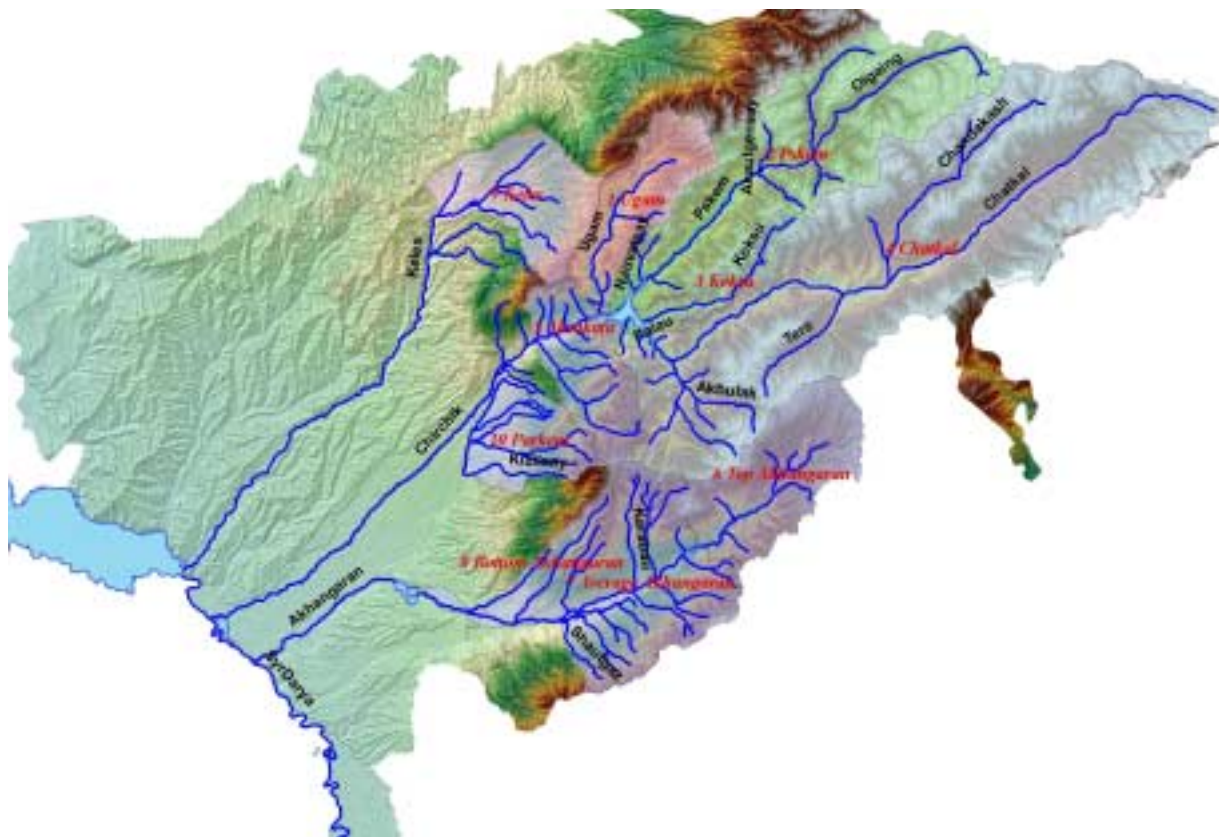


4. Development of hydrological basis for modeling

4.1. Selection of hydrological objects

10 sub-basins were selected in the flow formation zone (Fig. 4.1., Tab.1, Annex 1.). The sub-basins are catchment areas of surface flow originated in mountains. In most sub-basins, catchments can be pointed out for individual tributaries and sairs, as well as gauging stations to monitor flow in points of concentration (Tab. 7, 8, Annex 1.).

Fig. 4.1 Sub-basins of flow formation

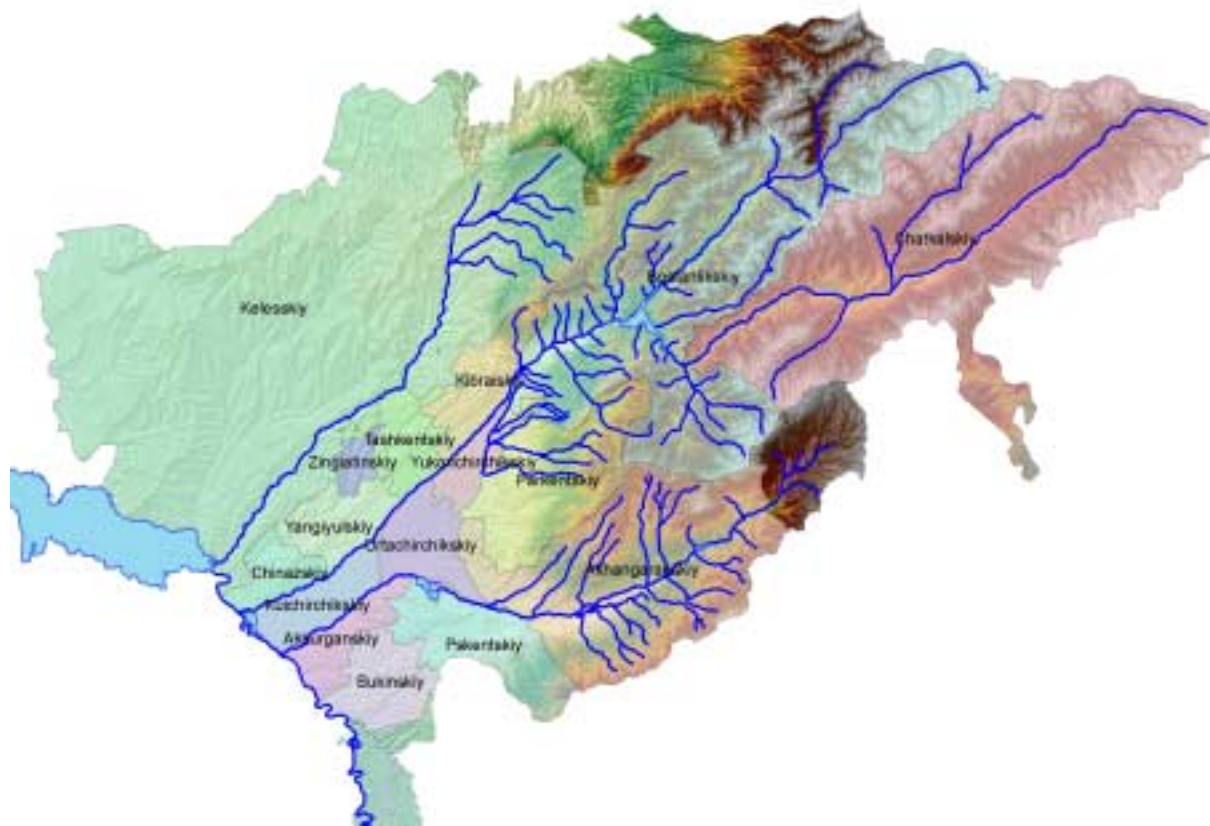


Network of **canals and wasteway channels** (Tab. 4, 5, Annex 1.) in the Chirchik-Akhangaran-Keles basin is divided into five **surface waterway systems**:

- **Bozsu** – located on the right bank of the Chirchik river and fed from the river; small offtake from the Keles river; a share of the Chirchik basin flow is transported through this system to Keles massif; return flow is discharged into the rivers Chirchik and Syrdarya.
- **Parkent-Karasu** - located on the left bank of the Chirchik river and fed mainly from Chirchik and less from Akhangaran; return flow is discharged into the rivers Chirchik, Akhangaran, and Syrdarya.
- **Akhangaran** – located in the Akhangaran river basin, fed mainly from Akhangaran and less from Chirchik; a share of the Akhangaran basin flow is transported through this system to the Chirchik basin; return flow is discharged into the rivers Akhangaran and Syrdarya.
- **Keles massif** – located in the Keles river basin, fed from Keles and Chirchik (through Bozsu system); return flow is discharged into the rivers Keles and Syrdarya.
- **Chatkal** – located in the Chatkal river basin (tributary of Chirchik) and fed from Chatkal and its tributaries.

16 **planning zones** (Fig. 4.2.) representing water consumption and return flow formation patterns were pointed out (Tab. 6, Annex 1.). The planning zones are linked with each other through the system of waterways and are considered as the smallest water consumption, mainly in irrigated agriculture, units.

Fig. 4.2. Planning zones



18 units of **water-supply system** “Vodokanal” were selected (Tab. 10, Annex 1.). These units, in turn, have the same amount of symbolical water consumers (cities, rayon centers) linked with water sources (surface and underground).

“Vodokanal” system supplies water to both urban and rural population.

Keles zone (Kazakhstan), which is provided with its own local water sources, was included in the water supply modeling scheme.

All water consumers (urban and rural) refer to the planning zones and are linked with them (as with contours) and with separate settlements (as with points).

12 major groups of **groundwater intake** were selected as well (Tab. 9, Annex 1.).

Given water intakes provide major part of the “Vodokanal” system and industrial centers with water. Other small sources of groundwater used by rural residents are dispersed among the planning zones and considered as symbolical aggregate water intakes in the modeling scheme.

Share of water for water-supply system comes from surface water sources, major of which are intakes of Bozsou canal for Tashkent and Chirchik.

Reservoirs and waterworks facilities are used as the main surface flow distribution objects in the modeling scheme (Tables 2, 3, Annex 1.).

Annex 2 shows detailed linear schemes of flow distribution zone.

4.2. Linking the objects

The following links were established between the objects in the Chirchik-Akhangaran-Keles basin:

- Sub-basins (catchments) in flow formation zone → gauging stations in points of concentration, where water resources are viewed as surface water sources for the flow distribution and use zone,
- Surface water sources (gauging stations) → sections of the network of waterways in the flow distribution and use zone (i.e. sections of river channels, canals, wasteway channels and collectors, as well as waterworks facilities, reservoirs, and power stations),

- Sections of the network of waterways—> sections of the network of waterways in the flow distribution and use zone (probable places of junction and branching of a few sections),
- Sections of the network of waterways—> planning zones,
- Planning zones —> sections of the network of waterways,
- Sections of the network of waterways—> units of water-supply system (Vodokanal),
- Groundwater intakes —> units of water-supply system (Vodokanal),
- Units of water-supply system (Vodokanal) —> Sections of the network of waterways.

4.3. Representation of hydrological objects in the models

Hydrological objects are represented in the models and the database in form of area (polygons), linear and point objects connected with each other in form of oriented graph.

The key hydrological objects included in the HBV-Chirchik model are sub-basins (catchments) of the flow formation zone.

The Chirchik river basin is divided into 5 sub-basins – three sub-basins along inflows to Charvak reservoir (Pskem, Koksus, Chatkal) and two sub-basins downstream of Charvak reservoir, i.e. right tributary and left tributary Aksagata.

The Akhangaran river basin is divided into three sub-basins – the first one along the Akhangaran river and its tributaries upstream of Akhangaran reservoir; the second one below Akhangaran reservoir along tributaries up to Sharkhi waterworks facility (right tributaries, such as Dukan, etc. and left tributaries – Nougargazan and others); and, the last one along tributaries downstream of Sharkhi waterworks facility (Shavazai, etc.).

One sub-basin was selected in the Keles river basin. Besides, seis of Parkent rayon flowing into Left-bank Karasu (Parkentsai, Kyzylsai, etc.) were marked as a separate sub-basin.

Thus, first, 10 sub-basins (catchments) were chosen in the flow formation zone and then divided into elevation zones with 200 m increment, starting from elevation of 600 m to 4400 m. Every elevation zone is characterized by relief, soil, temperature (calculated as a function of height), and precipitation characteristics.

The main hydrological objects in flow distribution zone are: rivers divided into balance sections (with respective coordinates and features, such as morphology, hydrological regime); network of canals, wasteway channels, and collectors having also balance sections; reservoirs; and, groundwater intakes.

Each object is described in the database in special directories that mention: object name, its code, coordinates, key parameters and links to other objects, if available. Separate tables store regime data and morphometry.

Links were established between the hydrological objects and the objects of flow use (HEPS, TEPS) and consumption (planning zone, point objects of water supply).

The database is structured in such a way so that to process source information stored in the database in line with the model structures and to transmit it (through interface) to the models.

For modeling purposes, it is important to select manageable objects. Water management in the basin is implemented at two levels: interstate - BWO “Syrdarya” (Fig 4.3) and national (Chirchik-Akhangaran Basin Administration for Irrigation Systems). Separate control and management objects belong to each level. Connection is established between the levels.

Fig 4.3 Objects controlled by BWO “Syrdarya”



Regulation reservoirs are existing reservoirs (Charvak, Akhangara, and Tashkent) and future one (Pskem). Scheme of Charvak reservoir is shown in Fig. 4.4.

Fig 4.4. Charvak reservoir



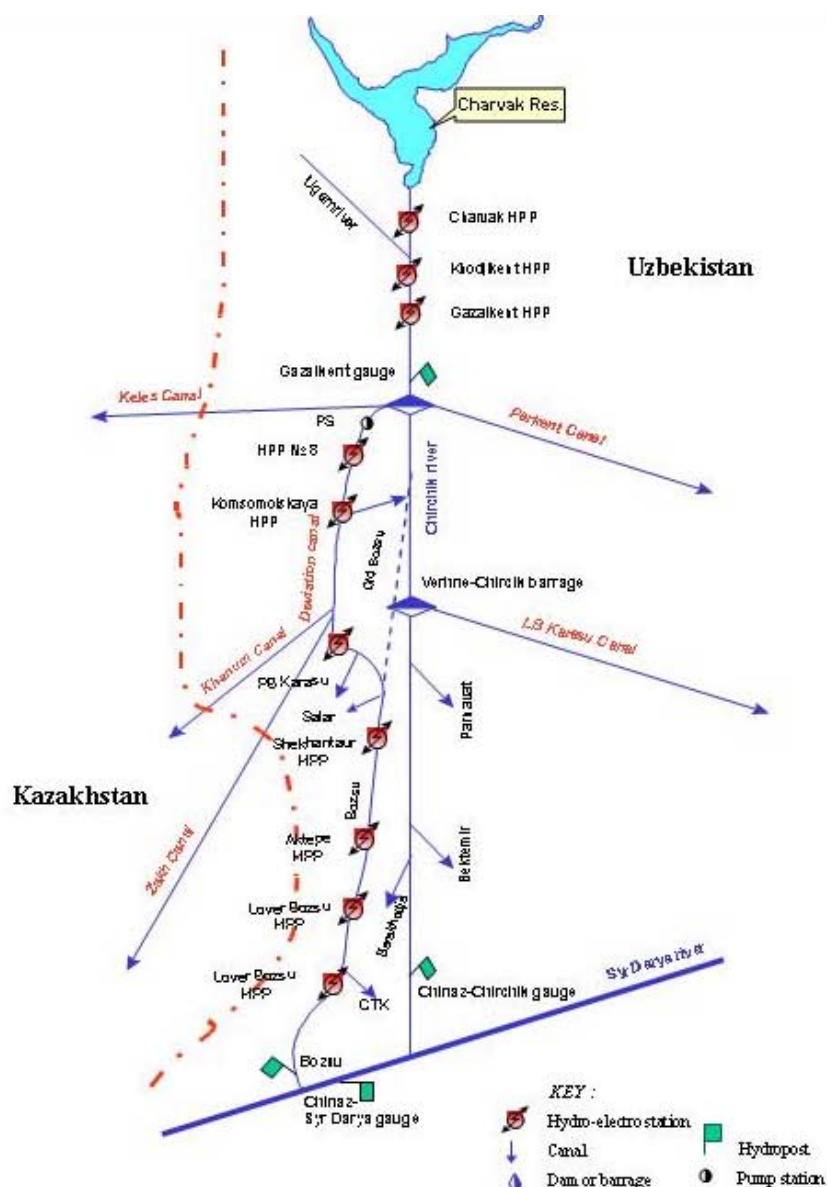
Charvak reservoir (net capacity – 1580 Mm³) located at the point of junction of the rivers Pskem and Chatkal is designed for multi-purpose use and provides seasonal regulations of the Chirchik river flow.

Akhangaran reservoir (net capacity – 170 Mm³) is located north-eastward of Angren city and is a multi-purpose one: increases withdrawals for irrigation; improves water supply to settlements and industries; takes the Akhangaran river away of coal cut and reduces flood discharge in the river.

Tashkent (Tuyabuguz) reservoir (net capacity – 224 Mm³) of seasonal regulation is located in Akhangaran midstream.

Key feature of the basin is a multi-purpose use and consumption of water resources. The example of such use is Chirchik-Bozsu water tract (Fig. 4.5), where coordinated hydroelectric system is operated (in the model it is divided into three groups – Chirchik, Bozsu and Nizhnebozsu) and water is taken to the system “Vodokanal”, for irrigation (Uzbekistan and Kazakhstan shares), industry and supplied for TashGRES. The tract also receives wastewater and an object of ecological monitoring.

Fig. 4.5. Chirchik-Bozsu tract



Annex 1. Tables

Table 1. Sub-basins in the flow formation zone

No	Sub-basins	River catchments	Water divide (ranges)
1	Ugam	Ugam, Karankulsai, Tashsai	Karjantou, Ugam
2	Pskem	Pskem and its tributaries, Nouvalisai	Pskem, Ugam, Talass Alatou
3	Koksu	Koksu	Pskem, Koksu
4	Chatkal	Chatkal and its tributaries, Chimgansai, Yangikurgan	Koksu, Pskem, Chatkal, Talass Alatou
5	Aksagata	Aksagata, Aktash	Karjantou, branches of Chatkal range
6	Angren	Akhangaran (Irtash), Tagan-bashisai	Kuramin, Chatkal
7	Dukent	Dukent, Karabou, Nougazan, Nishbash, Gushsai	Chatkal, Kuramin
8	Sharkhi	Shavazsai, Almalyksai	Chatkal, Kuramin
9	Keles	Keles and its tributaries	Karjantou, Қазықурт
10	Parkent	Parkentsai, Kyzylsai	branches of Chatkal range

Table 2. Reservoirs

№	Name	Waterway
1	Charvak	River Chirchik
2	Khodjикent	River Chirchik
3	Gazalkent	River Chirchik
4	Akhangaran	River Akhangaran (Angren)
5	Tashkent (Tuyabuguz)	River Akhangaran

Table 3. Waterworks facilities

№	Name	Main waterway (river, canal)	Water intake
1	Gazalkent dam	River Chirchik	BKMK (Keless), Parkent, Derivation canals
2	Verkhnechirchik (VChVU)	River Chirchik	Canal Left-bank Karasu
3	Intake to Tashkanal	Left-bank Karasu	Tashkanal, RK-5
4	Khanskiy	Left-bank Karasu	Canal Margunenkovna, RK -8, RK -9
5	Naiman	Left-bank Karasu	RK -7
6	Angren intake waterworks	River Akhangaran	Canal of Angren TEPS
7	Sharkhi	River Akhangaran	Sharkhiya (Tangi-Buka), Hodjabaland
8	Akkurgan	River Akhangaran	RK -10, Samalyak

Table 4. Head intake structures of canals

№	Name	Location, distance from estuary, km	Flow capacity, m ³ /s	Notes
River Chirchik				
1.1	BKMK (Keless)	133	72	From river
1.2	Parkent	133	55	
1.3	Derivation	133	240	
1.4	Left-bank Karasu	108	180	
1.5	Parnavat	93	12	
1.6	Bektemir	78	12	
1.7	Barathoja	75	4	
1.8	Chartak	70	5	
1.9	Alabiya	20	5	
1.10	Rybkhodz	6	5	
Derivation canal (Bozsu – downstream of Akkavak HEPS)				
2.1	Zakh	112	65	From canal
2.2	Khanym	112	15	
2.3	ChEHK	112	10	
2.4	Right-bank Karasu	104	15	
2.5	Salar	96	20	
2.6	Kalkouz-Damashi	89	45	
2.7	Ankhor	86	10	
2.8	STK	67	20	
Left-bank Karasu				
3.1	Khandam	84	20	From canal
3.2	Tashcanal	51	87	
River Akhangaran				
4.1	Sharkhiya		25	From river
4.2	Hodjabaland		15	
4.3	Right-bank canal of Tashkent reservoir	57	55	From reservoir
4.4	Left-bank canal of Tashkent reservoir	57	25	From reservoir

Table 5. Outlet structures

№	Name	Location, distance from estuary, km	Flow capacity, m ³ /s	Notes
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River structures				
1.1	Dam of Charvak waterworks facility (WF) - escape	154	1650	to Chirchik
1.2	Dam of Charvak WF - HEPS	154	500	to Chirchik
1.3	Dam of Gazalkent WF	133	2300	to Chirchik
1.4	Dam of VChVU	108	1500	to Chirchik
1.5	Tail-race of Akhangaran reservoir		460	to Akhangaran
1.6	Dam of Sharkhi WF		480	to Akhangaran
1.7	Spillway of Tashkent reservoir	58	750	to Akhangaran
1.8	Dam of Akkurgan WF		730	to Akhangaran
Canals				
2.1	Vertical lift gate	114	260	to Chirchik
2.2	Yumalak	106	15	to Chirchik
Collectors				
3.2	RK-6	55	6	to Chirchik
3.3	Kalganchirchik	24	15	to Chirchik
3.4	RK -10	9	17	to Chirchik
3.5	Karakamysh	75	5	to Bozsu

Table 6. Intakes to planning zones

Irrigation system	Planning zone	Intakes to planning zones from sources (rivers, canals)
Bozsu	Kibray	River Chirchik, canals Keles, Zakh, Right-bank Karasu, Bozsu, Eski-Khonim
	Tashkent	Rivers Chirchik, Keles, canals Zakh, Kalkouz, Bozsu
	Zangiata	River Chirchik, canals Kalkouz, Bozsu, Ankhon, Salar, Right-bank Karasu
	Yangiyul	River Chirchik, canals Damashi-Ramadan, STK, Salar, Djun
	Chinaz	River Chirchik, canals STK, Bozsu, Salar-Karakulduk, Djun
Parkent-Karasu	Bostanlyk	Rivers Ugam, Aktash, Chimgansai, Aksagata, Chirchik, canals Parkent, Derivation
	Parkent	Sais of Parkent, canals Khandam, Parkent
	Upper-Chirchik	River Chirchik, canals Bektemir, Left-bank Karasu, Parkent
	Mid-Chirchik	Rivers Chirchik, Akhangaran, canals Bektemir, RK-5, RK -6, RK -7, Left-bank Karasu, TBPk
	Lower-Chirchik	Rivers Chirchik, Akhangaran, canals RK -7, RK -8, RK -10
	Akkurgan	River Akhangaran, canals Margunenkovna, TBLK, Tashcanal
Akhangaran	Akhangaran	River Akhangaran, sais, canals Khojabaland, Khandam, Tashcanal
	Pskent	Canals Tangi-Buka, Tashcanal, TBPk
	Buka	Canals Танги-Бука, Tashcanal, TBPk, Margunenkovna
Keless massif	Keles	River Keles, canals Eski-Khonim, Keles, Zakh, VTK, STK
Chatkal	Chatkal	River Chatkal and its tributaries

Table 7. Gauging stations

№	Name	Location, distance from estuary, km	Notes
River Chirchik			
1.1	Dam of Charvak HEPS	154	Uzbekenergo
1.2	Gazalkent	135	Uzgidromet
1.3	Chinaz	3	Uzgidromet
Chirchik tributaries (upstream of Charvak waterworks facility)			
2.1	Pskem – Mullala	21	Uzgidromet
2.2	Koksu – Burchmulla	2.7	Uzgidromet
2.3	Chatkal –upstream of Khudaidosai river estuary	20	Uzgidromet
2.4	Nouvalysai - Sidjak	1.6	Uzgidromet
2.5	Chimgansai - Chimgan	9.9	Uzgidromet
Chirchik tributaries (downstream of Charvak waterworks facility)			
3.1	Ugam – Khojikent	0.9	Uzgidromet
3.2	Aktashsai - Aktash	8.0	Uzgidromet

3.3	Aksakatasai - Karamazar	12	Uzgidromet
River Akhangaran (Angren)			
4.1	Akhangaran – estuary of Irtash river	167	Uzgidromet
4.2	Below Akhangaran dam	143	Uzgidromet
4.3	Syphon of Tashkent canal	71	Uzgidromet
4.4	Below Tashkent reservoir	57	Uzgidromet
4.5	Akhangaran – Saldatskoye	19	Uzgidromet
Akhangaran tributaries			
5.1	Taganbashisai - Turk	0.5	Uzgidromet
5.2	Nishbash - Nishbash	8.0	Uzgidromet
5.3	Dukantsai - Dukant	10.0	Uzgidromet
5.4	Gushsai - Kochbulak	6.0	Uzgidromet
Sais between the Chirchik river and the Akhangaran river			
6.1	Parkentsai – Kirgiz	27	Uzgidromet
6.2	Kyzylsai - Nevich	31	Uzgidromet
River Keles			
8.1	Yangi-Bazar	206	Kazgidromet
8.2	Ramadan (Stepnoye)	145	Kazgidromet
8.3	Estuary	1.3	Kazgidromet
Canals			
7.1	Right-bank canal of Tashkent reservoir – head	-	Uzgidromet
7.2	Left-bank canal of Tashkent reservoir – head	-	Uzgidromet
7.3	Derivation canal – Tavak HEPS	133	Uzbekenergo
7.4	RK-10 - head of canal from the Akhangaran river	31	Ministry of Agriculture and Water Resources of Uzbekistan
Spillovers			
8.1	Spillover of Left-bank Karasu to the Akhangaran	40	Ministry of Agriculture and Water Resources of Uzbekistan

Table 8. Water quality monitoring points

№	Name	Location
Charvak reservoir		
1.1	Sidjak	Estuary of Sidjaksai river
1.2	Pskem	Backwater discharge site at Pskem river
1.3	Mazar-sai	Reservoir bowl at s. Mazarsai
1.4	Tail water	Tail race of Charvak HEPS
1.5	Kok-su	Estuary of Koksui river
1.6	Chatkal	Backwater discharge site at Chatkal river
1.7	Yusup-khona	Reservoir bowl at point of inflow to Chimgansai river
River Chirchik		
2.1	Gazalkent	Section line of Gazalkent waterworks facility
2.2	VChVU	Section line of Upperchirchik waterworks facility
2.3	ChEHP	Chirchik river downstream of wasteway channels of Elektrokhimprom plant
2.4	Chinaz	Chirchik river near Chinaz town
River Akhangaran		
3.1	Syphon of Tashkent canal	Head-water of Tashkent reservoir
3.2	Saldatskoye	Estuary of Akhangaran
River Keles		
4.1	Estuary	Estuary of Keles

Table 9. Groundwater intakes

№	Group of intakes	Source	Consumer
1	Arachinsk, Central	Chirchik river flood-plain	Chirchik city
2	Intake UzKTJM	Chirchik river flood-plain	Chirchik enterprise Kaprolaktan
3	Kibray rayoniy	Right-bank Karasu flood-plain	Kibray rayon
4	Kibray	Chirchik river flood	Tashkent city
5	Kuilyuk, Bektimir	Chirchik river flood	Tashkent city

6	Karasu, Yuzhniy	Right-bank Karasu flood-plain	Tashkent city
7	Yangiyul, Niyazbash	Chirchik river flood	Yangiyul city
8	Chinaz, Almazar	Chirchik river flood	Chinaz rayon
9	Intake Alisaid	Left-bank Karasu flood-plain	Yangibazar
10	Angren	Akhangaran river flood-plain	Angren city
11	Upper-Akhangaran, Lower-Akhangaran, Sartamgali, Tashsk	Akhangaran river flood	Cities Akhangaran and Almalyk
12	Saganak, Lower- Saganak	Akhangaran river flood	Industries

Table 10. Clients of water-supply system (Vodokanal)

№	Name	Consumers
1	Gazalkent	Bostanlyk rayon, Gazalkent city
2	Chirchik	Chirchik city
3	Tashkent	Tashkent city
4	Keles	Tashkent rayon, Keles city
5	Kibrai	Kibrai rayon
6	Zangiata	Zangiata rayon
7	Yangiyul	Yangiyul rayon, city Yangiyul,
8	Yukochirchik	Upperchirchik and Parkent rayons
9	Toitepa	Midchirchik rayon, cities Toitepa, Tuyabuguz
10	Kuichirchik	Lowerchirchik rayon
11	Pskent	Pskent rayon, city Pskent
12	Chinaz	Chinaz rayon, cities Chinaz, Almazar
13	Almalyk	City Almalyk
14	Angren	City Angren
15	Akkurgan	Akkurgan rayon, cities Akkurgan, Alimkent
16	Akhangaran	Akhangaran rayon, city Akhangaran
17	Bekabad	Bekabad rayon, city Bekabad
18	Buka	Buka rayon, city Buka

Annex 2. Linear schemes

