TRANSBOUNDARY FLOODS IN THE TERRITORIES OF FERGANA VALLEY OF UZBEKISTAN

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ABSTRACT

For the last 15 years flooding has occurred in a number of cities and villages, in the Uzbekistan and Kyrgyzstan transboundary territories of Fergana valley (figure 1.) As a result, basements of dwellings periodically have been flooded with groundwater and irrigated lands have become salinated. Groundwater in Uzbekistan has become salinated by the infilitration of groundwater from the territories of Kyrgyzstan. Rishtan(Uzbekistan) wellfields started pumping salty water. The salination of irrigation zones is a result of dissolution of gypsum in the aeration zone of the Burgundin region(Kyrgyzstan) , transport of the dissolved gypsum with groundwater and the evaporation of groundwater from irrigation zones. Thus, the soil productivity in this region has been reduced and farmers are not able to gather enough crops. Groundwater is formed as a result of infiltration of surface water in the upper parts(Burgundin) of the talus train (in gravel zone) . The surface water is used for irrigation of rice fields , but this irrigation water goes though the ground , because the field is placed in gravel zone . And water exits to the surface on lower parts(Rishtan) of the flow out (in clay zones). Up to recent years, natural drains provided stable conditions that did not allow the development of flooding. But, nowadays, Kyrgyzstan irrigates the upper parts of the flow out. This has resulted in an increase in the amount of water in lower parts of the flow out. And, at lower parts of the flow out, farmers from Uzbekistan flattened the territory and removed the natural drain. Thus, all the water collected here now floods the territory. The basements of all dwellings are totally flooded. A field study of the problem has been conducted that consisted of the observation of flooded sites, the regime of wells and measurement of river discharge.

INTRODUCTION

Irrigated lands in the Burgundin region of Kyrgyzstan are the cause of flooded territories of Rishtan city of Uzbekistan. The expansion of flooded areas in Uzbekistan has been observed year after year. Maintaining groundwater levels to greater than 3 meters below land surface has not been successful despite the use of drainage system. A study was conducted to determine the reasons for the flooding and swamping.

The study had two parts:

- Analysis of all information about the geology of the territory, monitoring of the ground- and surface water, irrigational and engineering - land reclamation actions;
- Development of recommendations about the reduction of the cause and consequences of groundwater level rise.

Physic – Geographical Conditions

The observation area covers plain and north mountainous part of Fergana trough within the Republic of Uzbekistan. It is bordered with Chatkal-Kuramin mountain range on north, Alay and Fergana mountain range on southeast. Western part of the valley is open to Mirzachul plains.

The territory surface is occupied from north to south and south-west. Absolute marks are change from 600-700 m till 350-400 m. Major part of the territory is characterized by the climate of desert.

The largest water flow in this region is Sirdarya river, formed by merging of the rivers Narin and Karadarya**.** Minimal flow is expected in September. Average long-year consumption area is 394 m3/s. While passing at lower parts of the trough, Sirdarya drains huge territories, collecting ground and dump waters.

Fergana mountain trough from hydrogeological view presents itself as a large mountainous artesian basin. Quaternary deposits compose near-mountain zone – behind hill, trough between hills, hill itself and central plain, where formed flow out cone of northern influxes of Sirdarya river and valleys of the rivers Narin, Karadarya and Sirdarya. The most powerful part of quaternary adjournments are on the centre of the trough - 600-700 m, on boards it reduces up to 100-50 m.

Ground waters of quaternary deposits are dated to the layer of large and small particles of rock, overlaid with small sized - mixed rocks. They are separated by less-permeable sandy-clay and conglomerate adjournments. As a whole, ground waters are found in close hydraulic condition and the whole thick masses of quaternary deposits are to be the one hydrodynamic system. There allocated two aquifer complexes: alluvial-proluvial and alluvial. Hydrogeological conditions are defined by litological construction, presence of water permeable layers in zones of aeration, by absence or small powered overlaying adjournments in the areas of ground water charge, by thick system of surface water flows and by close hydraulic relation of surface and ground flows.

Technogene factors

- Artificial water flows in this region are Northern-Fergana, Big Namangan and Chust channels

- Northern-Fergana channel irrigates about 70 thousand hectares. Major flow makes form 40-75 m3/s in April-August. The channel bottom and coasts are not cemented. Big Namangan channel passes in parallel to Northern-Fergana channel and feeds with water from the river Narin on the distance of 3-5 km, runs along Northern Fergana hills and irrigates declivities. The extent is 162 km, permeability up to 60 m3/s. For about 45 thousand hectares are watered by this channel. The channel bottom and coasts are partly cemented. The channel Chust, feeding with the waters of Kasansay river, runs on the north of behind hill troughs. Total extent of the channel is 48 km, permeability 4 m3/s, irrigates about 8 thousand hectares.

- In Namangan region is widely spread the land irrigation. Main plant is to be the cotton, but in some places gardening, grape planting is developed too. As a result, there developed different geological processes: subsidence, erosion, and landslides.

- But the most dangerous is to be the flooding. In the last years, an intensive flooding is observed in Namangan, Narin, Navbahor, Talbulak, Turakurgan regions**.** There, besides hill mastering, an important role plays non-operation of drainage systems and the change of water permeability from adjacent territories.

- The growth of land reclamation constructions in Namangan region, in the contrast to 1970, forms: boreholes of vertical drainage - from 162 to 268, horizontal drainage - from 8.8 to 36.2 m/he. The increase of irrigated lands equals to 50 thousand hectares. For agricultural purposes, there selected 2523.8 thousand m3/day of ground water.

The use of surface and ground water for irrigational purposes increased 2 times, which resulted in the rise of ground water level from 0.5 up to 6m and in the increase of general mineralization from 1 to 5 g/l and the hardness from 9 up to 40 mg-equ/l. As a result of irrigation, there formed over-flooded areas in Shayan-Baymak, Almas-Varzyk behind hill troughs, Namangan before hill plain and at peripheral part.

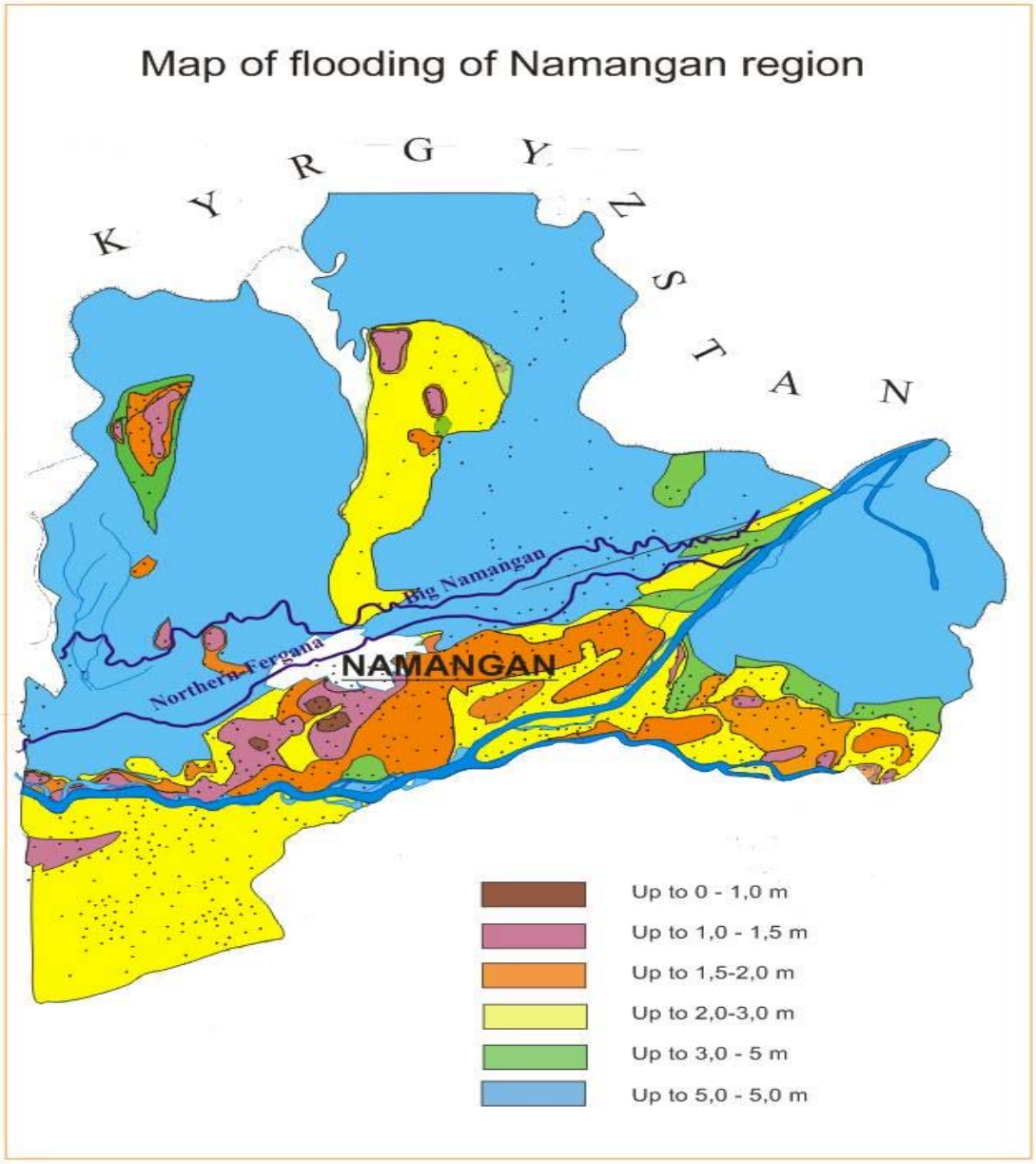

Figure 1. Map of flooding of Namangan region

Long- term observations of Fergana regime station defined the tendency of water level rise from 0.6 up to 13m in Iskovat-Pishkaran behind hill and Kukumbay between hill troughs. Also, there observed water level rise in peripheral part of flow-out cone of Isfara river.

TRANSBOUNDARY FLOODED TERRITORY

Since 1980 the irrigated area of the Burgundin region of Kyrgyzstan has grown rapidly. This region consists of sand-clay soil with a thickness of 0.5m with layers of gypsum clay-sand, and a thick gravel aeration zone of 70m. Here, the groundwater level is at the depth of 60-70m below land surface. After construction of Burgundin irrigation channel these territories have grown rice and vegetables. Watering norms consist of 25-35 thousand tons/he. The major part of the irrigation water volume infiltrates into the ground and dissolves the gypsum. Groundwater flows directly to the territories of Uzbekistan, particularly to Rishtan city. In 1980, the groundwaters of this region had mineralization up to 1 g/l and hardness up to 10mg equ/l. Today, the mineralization reaches 3 g/l and hardness up to 30 mg equ/l. In 1980 the depth of groundwater level was 3-7m below land surface. Since then, it has increased up to 1m of land surface. Until 1990, the people of Rishtan used local groundwater for drinking purposes. Now, groundwater is salinated by infiltrational flow from the territories of Kyrgyzstan. Rishtan

wellfields began to pump salty water so their operation was stopped. A new wellfield has been constructed at the distance of 25 km, near river Soh.

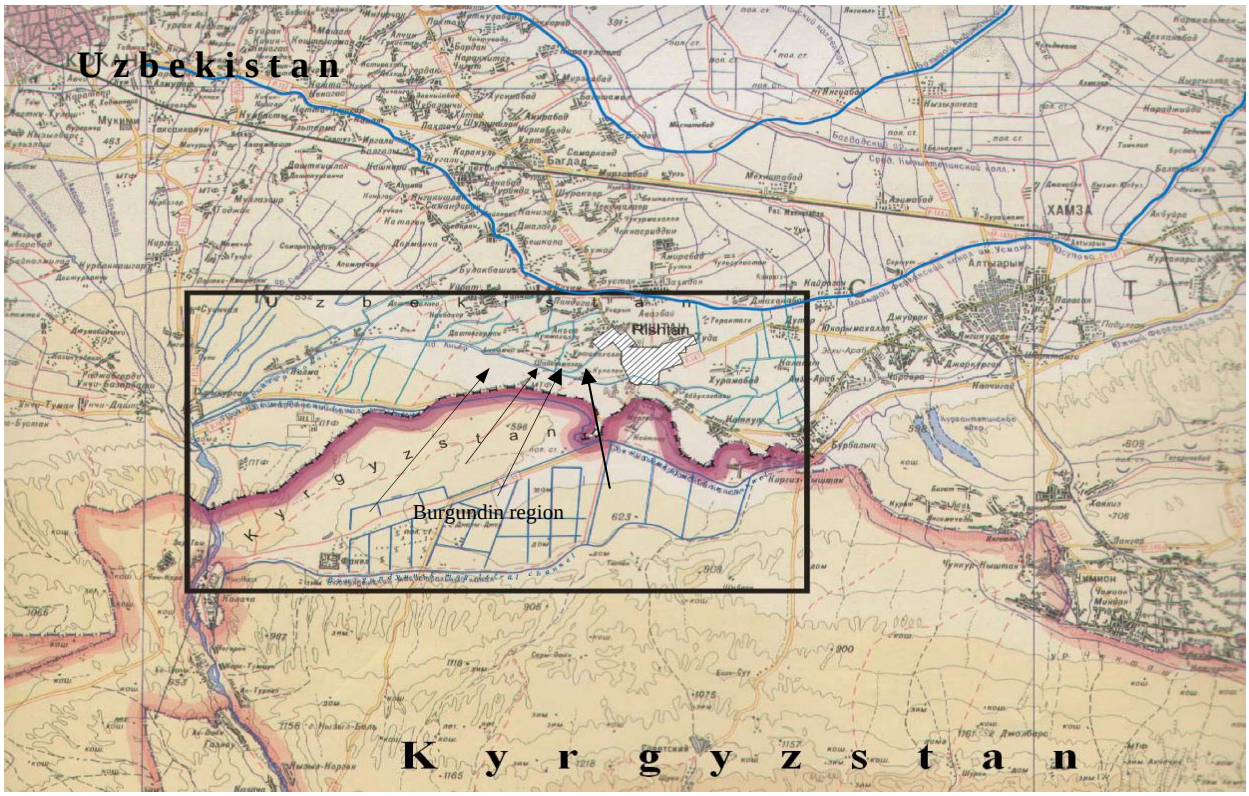

Figure 2. Relief and hydrography of Rishtan in Fergana region, including the direction of groundwater flow.

Today, Rishtan is experiencing rising groundwater levels. There can be seen water in the basements of dwellings. Rishtan was known throughout Central Asia for its apricot gardens. And now, because of soil is so salinated, apricot gardens are not possible. Cotton and wheat production has been reduced by twice.

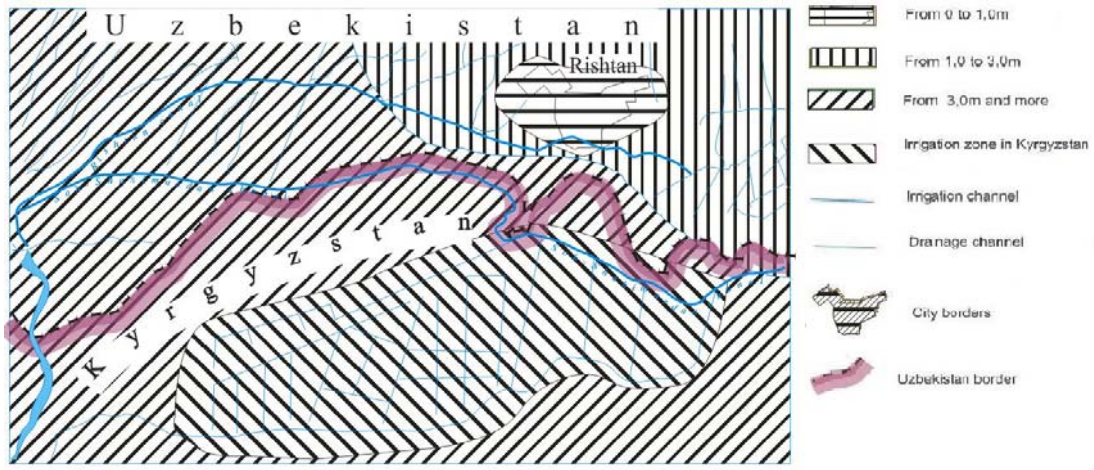

Figure 3. Map of the current groundwater levels in adjoining areas in Uzbekistan and Kyrgyzstan.

The local administration and farmers are constructing and exploiting the systems of vertical and horizontal drainage in order to lower groundwater levels. This is very expensive method and has not been very successful. Thus, the only solution for this is the stoppage of irrigation on

the territories of Burgundin region in Kyrgyzstan. Without attention of NATO and international organizations, these problems will continue and the population of Fergana valley would suffer from it.

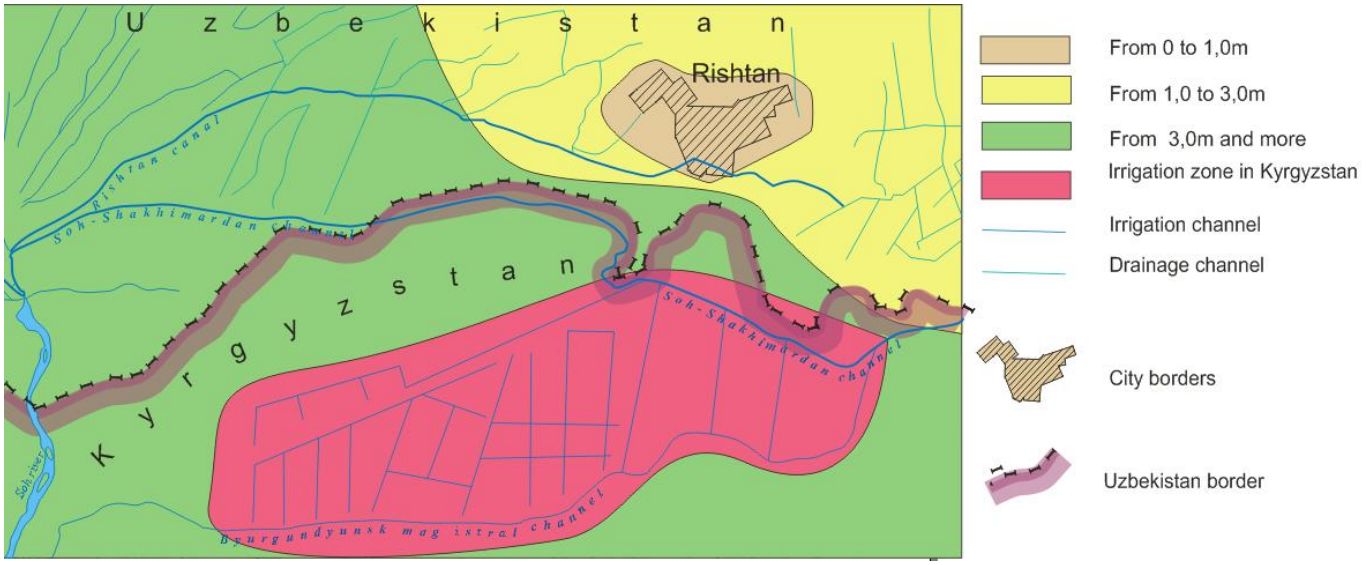

Figure 4. Map of flooded areas in Rishtan district

DETERIORATION FACTORS OF LAND RECLAMATION

- Irrigation of near-mountainous zones promoted the water level rise on plain areas, which is caused by hydrostatic pressures. This conclusion about hydrostatic pressure in ground waters directed from hills to plain territories is to be the basis for engineering-meliorative works.

The Reason of increased flooding, particularly on southern areas of Namangan, is the distribution of lands for civil construction - irrigated areas and accompanying liquidation collectors. If the construction on these territories is to be developed, then it is necessary to provide the construction of horizontal drain for the flow out of ground waters.

- The exploitation of existing collector-drainage system does not correspond to the planned terms. It is in bad technical condition. Its power is not as planned. The reconstruction and optimization of these systems are urgent problems.
- The reduction of negative consequence of flooding can be reached by the regulation of irrigation and use of water preserving technologies.
- The flow out system of dump waters is not provided. Because of high rates of water distribution, some of its part must be directed to r.Sirdarya by system of collectors. But, existed collectors can not deal with this problem. As a result, there occurs flooding and swamping of the territories.
- Antifiltrational actions on the channels are not sufficient. The major parts of channels are not cemented. As a result, there occurs an intensive infiltration of waters under the soil.

CONCLUSIONS AND RECOMMENDATIONS

In the project of improvement of land reclamation conditions in Namangan region, it is necessary to provide:

- implementation of drop irrigation and sprinkling methods on near-mountainous zones;
- change of crop rotation structure on flat territories in accordance with the requirements of water preserving technologies;
- revision of drainage system on salinated and flooded territories;
- rejection of vertical drainage and provision of horizontal closed drainage on new technology; only at some places is necessary the multifunctional drainage;

- stoppage of territory distribution for civil constructions on irrigational purposes;
- improvement of technical conditions of existing drainage system and collectors as required on initial project plans;
- reduction of water provision norms for irrigation up to minimum taking into consideration of ground water depth.
- In the project of improvement of land reclamation conditions in Rishtan district, it is necessary to provide:
- reduction of water provision norms for irrigation in short terms and in the long terms completely stop it.
- Compensate the losses of farmers on Kyrgyzstan territory.