Management within the Hydro-Geographical Boundaries or according to the Hydrological Principle

V.A. Dukhovny, V.I. Sokolov, H. Manthrithilake, N. Mirzaev

As known, water does not recognize the administrative division. Following the laws of physics, almost all the water on the earth has passed through the hydrologic cycle countless times - it evaporates from the earth's surface, condenses in clouds, falls back to the earth as precipitation (rain or snow), and eventually either runs into rivers, from which it can be withdrawn for use, and into the seas or re-evaporates into the atmosphere. An Earth area, where surface stream (river) is formed, is called a catchment area (hydro-geographical or river basin). Within the river basin, water is in permanent motion and naturally crosses the administrative boundaries delineated by human beings on the basis of geopolitical considerations. Thus, it is understandable that to manage all factors affecting the hydrological cycle, it is necessary to keep control over the entire river basin by a body or consortium of closely interacting organizations. An organizational set-up within the administrative boundaries, which does not usually coincide with hydrographic boundaries, results in loss of record-keeping and control of some components of the hydrologic cycle, affecting the sustainability and equality of water supply i.e. the key tasks of water management.

Most water professionals feel that river basin boundaries should be adopted following the catchment area pattern, in compliance with the regulations of Article 2 of the Helsinki's Rules (1966). However, in the so-called runoff dispersal zone, the effects of water management often transcend the boundaries of catchment areas and spread, especially, under pumping irrigation, over the command areas of irrigation canals. For example, the command area of Amu-Bukhara Canal (water abstraction from the Amu Darya River) covers practically the whole territory of another river basin (the Zerafshan River). The same takes place in the command areas of Karshi and Kara-Kum canals, which cover the basins of several rivers, and in many other water management systems in the region. A more complicated situation is observed in the Fergana Valley where the modern dense network of main irrigation canals with water diversion from the Syr Darya River, which have been designed and constructed during the second half of 20th century, has overlapped the ancient system of oasis irrigation with water abstraction from small rivers, local streams and aquifers, forming a complex combination of water ways with double and, sometimes, triple feeding.

Figure 1.1
A Leaf of Tree as a Single Organism with the System of Feeding Capillaries

Thus, reviewing the boundaries of water management following the hydrological principle in each specific case, it is necessary to define clearly the limits of real and appreciable impacts of water sources, and territories, which are significant for IWRM. Infrastructure for regulating river flows, especially large dams for irrigation and hydropower, as well as ramified irrigation systems form the intricate anthropogenic morphology of water management systems within the basin as a whole or in part. These are very complicated systems for all kinds of water supply and for drainage as well. As a rule, they have the form of a complex "tree" of water system hierarchy with subordinated branches (main, inter-farm, on-farm irrigation and drainage canals).

Interconnection of these systems creates the intricate complex of objects related to integrated management, use, protection, and development of water resources, which should be covered by the specific governance system. Apart from water resources themselves and water infrastructure, this complex includes related land and other natural resources not only on the catchment area but also in the zone of so-called intensive water-economic influence. It absolutely does not require, and it is often impossible, to manage the territory of a

whole hydro-geographical complex by using one water management organization. A good example of a possible approach is the French basin management organizations, which rely on the public participation in the framework of the so-called basin agencies that interrelate respectively with the subordinated public organizations at the sub-basin level.

Governance based on the hydrological principle, thus, can have a united organizational structure at national level; however, more often, it should coordinate a complicated hierarchical configuration vertically, and that will be described below. A major instrument of water resources governance within the hydro-geographical boundaries is the build-up of organizational structures according to the hierarchy of watercourses, first of all, natural streams and then man-made ones.

So, what does water governance in compliance with the hydrological principle mean? An illustrative example of the hydro-geographical principle under organizing water governance can be a leaf of a tree on which the configuration of arteries and their integration into a single organism are visible (Figure 1.1). Any water management system where the whole area of water use is linked to the hydrography of a major watercourse – a river or main canal with many off-takes into its laterals, through which water is delivered to the end user , is arranged in the same manner. Nature itself created the hydrological cycle, which is related to the specific territory, and this approach should be applied without disturbing the natural harmony of vital functions.

Let's imagine what can happen when an administrative border crosses a leaf as the border between two countries or, in other words, water (nutrition) supply over a leaf will be arranged within these "administrative borders" in the non-coordinated way. For example, the upper part of this leaf draws more water than necessary and intercepts water supply to its lower part. It is clear that such water distribution can result in partial degradation of the leaf or even complete damage. Water does not recognize the administrative borders established by mankind in line with geopolitical or other considerations. Therefore, water governance should be built up for a single hydrographic network rather than according to the administrative borders.

A system of the South Fergana Canal (SFC) in the Fergana Valley can be used as a model of the hydro-geographical unit (Figure 1.2).

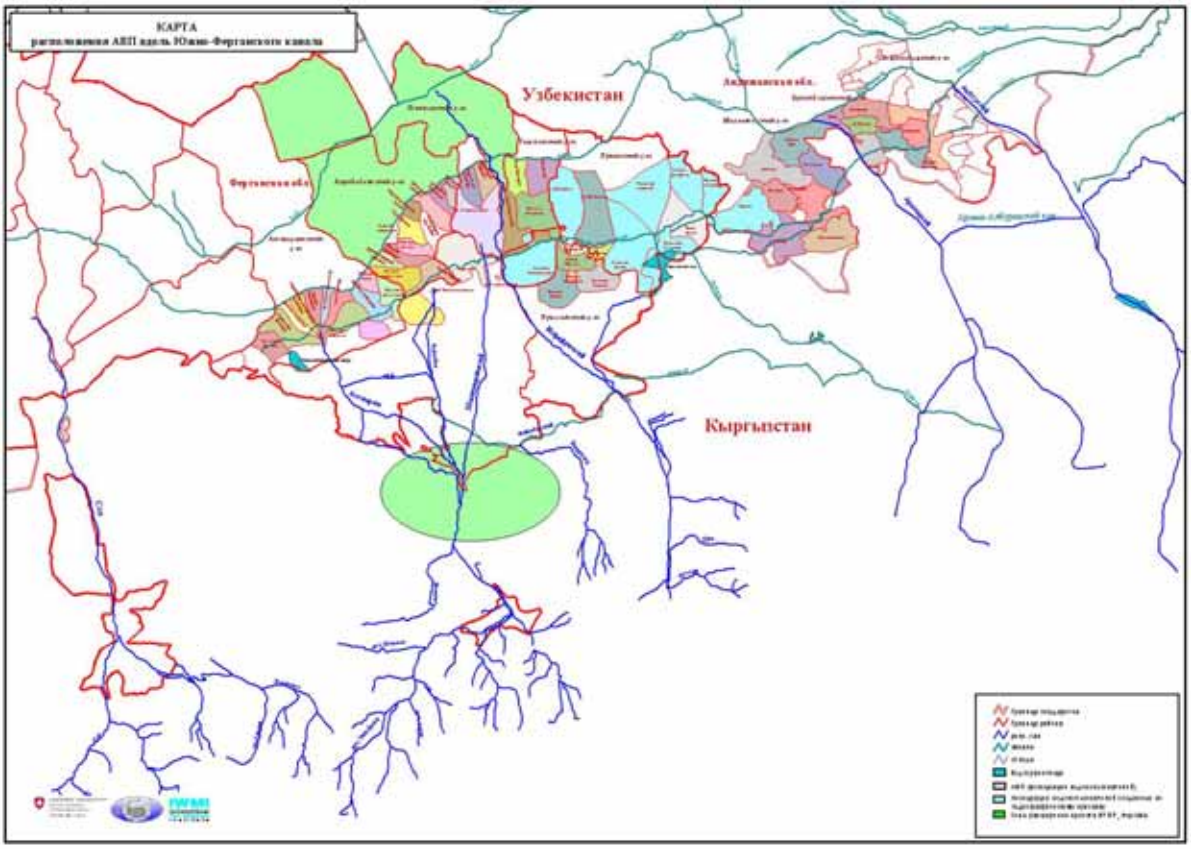

Figure 1.2 Irrigated Lands in the SFC Command Area

The head works of the SFC is located on the Shakhrikhan-Say that is the tailrace canal of the Andijan Dam on the Karadarya River. The total length of the canal amounts to about 120 km. The size of the SFC command area is 83,844 ha, and it covers mainly the territories in the Andijan and Fergana provinces and partly in the Osh Province in the Republic of Kirgizstan (about 2500 ha). In 1962, in order to increase the water availability in the SFC command area, the Kirkidon Reservoir (having a capacity of 218 million m^3), which was partly was filled by water from the Isphara-Say River, was built. to fill the reservoir during periods of excess water resources in the SFC, the supply canal 26 km long with a carrying capacity of 18 m^3/sec that diverts water from the SFC, was built 6 km upstream of Markhamat Settlement. Since 1967, the Kirkidon Reservoir is annually filled up to a total volume of 170 – 180 million m^3. The lined tailrace canal is 2.7 km long and with a carrying capacity of 50 m^3/sec it releases its water back into the SFC during periods of water shortage. Since 2003, this entire system, from the outlet of Andijan Dam to the tail section of this canal in the Altyaryk District of the Fergana Province, was handed over to the SFC Administration for integrated management. However, in the process of introducing IWRM within the SFC system, the need to link this management with operational regimes of a number of small rivers, which cross this canal, has arisen; because their unregulated flows considerably affect the operation mode of the SFC system as a whole.

Thus, the morphology of basin or system is a key factor for transition to management based on hydro-geographical principles, in the framework of which appropriate limits and requirements should be specified in accordance with specific features of this morphology to provide the sustainability of natural complexes. At the same time, the monitoring and drawing up of the water balance for the basin as a whole, separate sub-basins or irrigation systems (their close coordination with using institutional, economic, technological, and managerial instruments and involving stakeholders) should be provided.

An overall co-ordination of all hierarchical levels of water resources management (Figure 1.3) is founded on two fundamental principles:

- Achieving potential water productivity at all hierarchical levels right up to the basin level;
- Reducing specific water consumption within the system (against water diversion) up to the level of water consumption being equal to the evapotranspiration of crops.

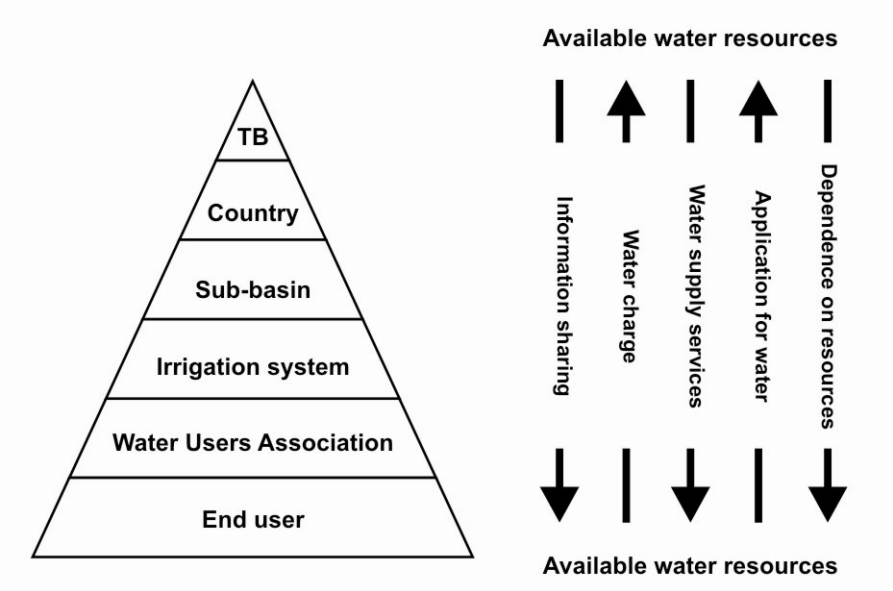

Figure 1.3 Levels of Water Governance Hierarchy and Main Links in the IWRM System

One more feature of water resources management grounded on the hydro-geographical principle is the fact that it is unique for each basin, irrigation system, and WUA because the basin morphology, soil and hydro-geological conditions as well as organizational and economic relations of water suppliers and water users are extremely diverse. We should not look for general patterns or solutions for different systems; it is necessary to develop only the overall principles of implementing IWRM.