

# The Necessity of Optimized Management on Surface Water Sources of Zayanderood Basin

A. Gandomkar, K. Fouladi

**Abstract**—One of the efficient factors in comprehensive development of an area is to provide water sources and on the other hand the appropriate management of them. Population growth and nourishment security for such a population necessitate the achievement of constant development besides the reforming of traditional management in order to increase the profit of sources; In this case, the constant exploitation of sources for the next generations will be considered in this program. The achievement of this development without the consideration and possibility of water development will be too difficult. Zayanderood basin with 41500 areas in square kilometers contains 7 sub-basins and 20 units of hydrologic. In this basin area, from the entire environment descending, just a small part will enter into the river currents and the rest will be out of efficient usage by various ways. The most important surface current of this basin is Zayanderood River with 403 kilometers length which is originated from east slopes of Zagros mount and after draining of this basin area it will enter into Gaavkhooni pond. The existence of various sources and consumptions of water in Zayanderood basin, water transfer of the other basin areas into this basin, of course the contradiction between the upper and lower beneficiaries, the existence of worthwhile natural ecosystems such as Gaavkhooni swamp in this basin area and finally, the drought condition and lack of water in this area all necessitate the existence of comprehensive management of water sources in this central basin area of Iran as this method is a kind of management which considers the development and the management of water sources as an equilibrant way to increase the economical and social benefits. In this study, it is tried to survey the network of surface water sources of basin in upper and lower sections; at the most, according to the difficulties and deficiencies of an efficient management of water sources in this basin area, besides the difficulties of water draining and the destructive phenomenon of flood-water, the appropriate guidelines according to the region conditions are presented in order to prevent the deviation of water in upper sections and development of regions in lower sections of Zayanderood dam.

**Keywords**—Zayanderood Basin, Efficient Management, Hydrology Climate.

## I. INTRODUCTION

ONE of the effective factors in comprehensive development of a region is to provide water and on the other hand the appropriate management of water sources. In the previous years, cause of the managers' approaches to the basin areas some cases such as water crisis, unstable

development, and management crisis have been propounded as the most serious challenges in many parts of the world. Generally speaking, the ultimate purpose of comprehensive management of a basin area is to achieve a constant development in that basin [1]. Unless we protect the nature and natural sources, the constant development as a guideline for the protection of the earth and human being considered as a part of nature could not have an assured future [2]. The location and position of water and land sources, in addition the plant covering and ecology in nature are often related to the basin areas. In this case, the basin area is studied and considered as the basis and case of survey in various aspects of this research; also the effects of natural system operations in hydrological subjects, social and economical, agricultural and plant ecology, agrology and erosion and the similar subjects are related to the basin area studies; In this way, the reciprocal effects arising of various sources and living and non living beings in a basin necessitate the planning of a systematic and unified management model in basin areas with the purpose of efficient profits of water sources and coordination in order to reach a constant development [3].

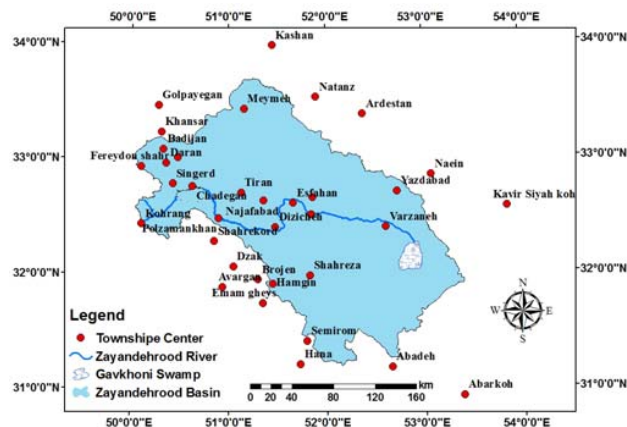


Fig. 1 The Map of geographical condition and the hydrologic network of Zayanderood basin

Iran, from the point of view of water division is separated into 8 regions and 38 basin areas. Zayanderood River basin area is specified as the first basin in the sixth region with the code number (1-6). This basin is located in the middle section of central plateau of Iran in geographical coordinates of 02', 50° to 24', 53° of eastern length and 11', 31° to 42', 33° of the northern latitude and contains a vast domain (Fig.1).

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Zayanderood basin from the natural division point of view contains 7 sub-basins and 20 hydrologic units. The western section of this basin is primarily mountainous (Daran, FereidoonShahr and Farsan cities), and the eastern section is mostly plain and contains Isfahan, Shahreza and Meymeh provinces. This basin contains a main branch named Zayanderood River and some secondary branches. The main branch originates from the eastern slopes of Bakhtiari mounts (Koohrang) located in middle Zagros. It flows from the west to the east and after travelling a distance about 350 kilometers enters Gaavkhooni pond. The general slope of the region decreases from the west to the east; the more progress to the east, the less height of the earth clears till the eastern border of under consideration region locates near the desert plains. The average height of the earth in this region varies between 3600 meters in the west and about 1440 meters in the east. The basin area is about 41500 square kilometers and milieu of 1183 kilometers. Generally speaking, the purpose of aquiferous studies is the protection of water sources and the other related sources [4]. In this study, for the evaluation of the constant development conditions and efficient management of surface water sources in Zayanderood River basin, a comprehensive survey on hydrographic network and the existed statistics and data of hydrometric stations of the region has been accomplished. At the most, 1- basin conditions from the view point of primary and secondary canals, their geographical conditions, also the divisions of sub-basins; 2-evaluation of the existent surface water conditions in the basin related to the upper and lower sections of the basin and from the view point of entrance water content in the basin, on the other hand the consumer water content are surveyed and studied. Finally, according to the difficulties and deficiencies of an efficient management of water sources in this basin area, besides the difficulties of water draining and the destructive phenomenon of flood-water, the appropriate guidelines according to the region conditions are presented in order to prevent the deviation of water in upper parts and development of regions in lower parts of Zayanderood dam. In this case the managers and hydrologists are responsible to design and manage water sources systems in a way to be able to provide the changeable water demands at the present time and in the future without the destruction and annihilation of the river system. Such development of water sources is called "constant development".

## II. METHODOLOGY

According to the survey and explanation of the satellite photos and pictures and the topographic maps, we can divide Zayanderood basin area from the view point of surface currents into two groups: 1) upper section currents of Zayandehrood dam; and 2) lower section currents of Zayanderood dam (Fig. 2).

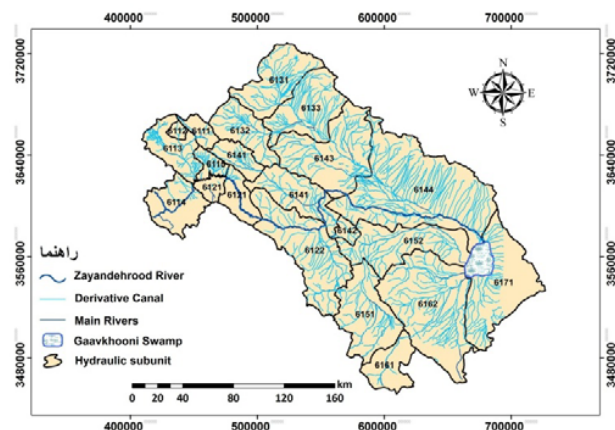


Fig. 2 The hydrographic network of Zayanderood and Gaavkhooni basin

## III. DISCUSSION

The upper section currents of Zayanderood dam: In this section of basin area, two river networks are located including Zayanderood and Pallasjan and on the other hand the isolated rivers containing Samandegan and Razve which are evacuated directly into the dam lake.

**Zayanderood River (the main branch):** This river is one of the most important and water logged rivers of the country which drains Zayanderood basin area and finally enters Gaavkhooni pond and is defined with a single number code. The river network of Zayanderood main branch is primarily constituted the collection of certain small and watery branches named: Aab Zari, Cham Rood, Dareh Na'al Eshgenan, Dareh Khorbeh, Dareh Ghaazi, Dareh Dollat Aabaad, Dareh Soodjan, Dareh Darakeh Aabaad, Dareh Oregon, and Dareh Ghalle Shaahrok.

**Pallasjan River:** This River is constituted from the connection between two primary branches of Daaran and Booein which are originated from the slopes of the North East and the North West of Fereidan. They conjoin each other around Savaraan village and constitute Pallasjan River. The surface currents content of this river in Eskandari Hydrometer station in a 21-year period is averagely announced 144 million cuboids meter annually.

**Samandegan River (Dareh Gol):** This River is originated from the slopes of Daalan Kooch and Analooche and moves from the north to the south. After it irrigates part of Chaadegan plain lands and Samandegan village located in Mondarejan village it will enter the dam lake. The length of this river is 25 kilometers. The current content of this river is averagely announced 14 million cuboids meter annually.

**Razve River:** This River is originated from the northern slopes of Beedak mount located in 25 kilometers of South East of Daaran. It flows across Daaran- Chadegan road from the north to the south. It irrigates Razve village and in Mansoorieh village it enters the dam lake.

The lower section currents of Zayandehrood dam: These currents are divided into two groups, the surface currents

which directly enter Zayanderood River such as: Shoor Ballaagh, Karkavand, Shoor and Dehaghan, Dastkan and Morghaah.

The currents which directly enters Gaavkhooni pond such as: Zarcheshmeh and Izadkhaast.

The rivers which are located in the lower section of the dam and directly enter Zayanderood River:

Dehaaghan and Shoor River: It is originated from the east of Broojen heights and Hamgeen heights. The primary branches of it flow towards the east after they pass Hamgeen and Dezej villages. Then, they conjoin each other in Dehaaghan region. This river moves towards the north and gathers the flood-waters of that area and finally in Esma'eil Tarkhaan one of the environs of Mobarakeh it enters Zayanderood dam. This river does not have a consistent flow and is considered as a seasonal river. In the upper sections, its season water is consumed for the agriculture and the nourishment of subterranean canals and beds.

Morghaah River: one of the other branches of Zayanderood which is originated from Dallan Kooch slopes. It flows across Fereidan-Najafaabaad road and along side of Zayanderood. It irrigates Tiraan, Karvan and Najafaabaad villages. Morghaah spring provides the constant water flows of this river which through the canal is transfer to the back of Khamiran dam. Water of this river just in flood-water situations after passing Nekooabaad dam enters Zayanderood River. The annual content average of this river is 40.5 million cuboids meter; from this amount, 35 million cuboids meter consumed for the agricultural lands of Karvan villages and about 5.5 million cuboids meter consumed for the agricultural lands of Najafaabaad villages.

Dastkan River: Dastkan stream is one of the seasonal branches and dry river beds of Zayanderood River. Water of the southern slopes of Karkas heights are gathered and after the irrigation of Joushghaan Ghaali and Meimeh lands passes Moorchehkhort region and before it reaches RoodShatein's dam installation it enters Zayanderood River. While passing along side, this river supplements various branches which are just dry streams; the most important of them are Joushghaan River, Meymeh River (MahmoodAabaad), Robaat River, Chaarook River, Laghar River, Laadorcheh River, Dehlor River, Hini River, Khoshkrood River, Tabarood River and Zafreh River.

The lower section rivers of Zayanderood dam which directly enters Gaavkhooni pond: these rivers are Zarcheshmeh and Izadkhaast

Zarcheshmeh River: This River is one of the other rivers of Zayanderood basin area. It originates from the southern mounts of Shahreza; at the most, independently and without the confluence with Zayanderood River it will enter Gaavkhooni pond. This river is constituted of some big and small branches. Its two primary branches originated from Soltan Khalil slopes in the south of Shahreza. They flow from the south to the north and pass Tangchaaideh and Esfarjan region. Then, they conjoin each other in Voshareh village in the south of Shahreza and create Zarcheshmeh River which

irrigates the southern plains of this province. Then, it enters Shahreza city and flows towards the North East and enters Jarghooyeh plain. It moves along side of Zayanderood River and finally in Hasan Aabad village lands it enters the western border of Gaavkhooni pond. The average content of this river in Esfarjan hydrometric station is estimated about 16.2 million cuboids meter. The length of Zarcheshmeh River is 200 kilometers which in the main branch and upper section is considered as a constant river while on its route the side villages consume its water and on the other hand it nourishes the subterranean canals and beds, so in the lower sections it faces lack of water flow. Just in the case of rainfall and torrent its extra water enters Gaavkhooni pond. On the primary branches in the south of Amin Aabaad and Esfarjan villages, there are suitable locations to construct dam and to collect and save the torrential water of this river. The main branches of Zarcheshmeh River are Tangchaaideh, Esfarjan and Kohrooyeh.

Izadkhaast River: This River passes Izadkhaast and irrigates Chaah Gholi, Raamshe, Mobarakeh and Mashi Aabaad, then it enters Gaavkhooni pond. In Ghallegoori there is an appropriate location for the construction of dam and store of the torrential water. The watering of this river varies in various sections. The annual content average is about 12 million cuboids meter which about 5 million cuboids meter of it flows towards Raamshe in the winter in order to nourish the subterranean canals. This river contains the constant water and during the fall and winter has a hydrous period. The most important branches of this river are Rahimmi and Kashk khara.

According to the statistics of regional irrigation and hydrology organization, the entrance measurement of water in Zayanderood River flows and after passing through the adjusted dam is estimated about 1720 million cuboids meter which in the distance between the adjusted dam and the hydrologic station of Varzaneh village located in the shoal of the river, 191 million cuboids meter of surface water flows from different hydrological units and 21 million cuboids meter of returned water, in addition, 47 million cuboids meter of Isfahan city sewage located in the east of this city finally will enter into this river water flows and the general entrance amount of this river is estimated about 1972 million cuboids meter. The consumption measure or water removal of this river through the way from the adjusted dam to Gaavkhooni pond contains 195 million cuboids meter for drinking consumption, 91 million cuboids meter for industrial usage and 1363 million cuboids meter for agricultural consumptions. In addition, 119 million cuboids meter of flowing water of this river is used for the nourishment of irrigable areas and the usage of surface wells alongside the river, 2 million cuboids meter is evaporated by draining or dam lake waterfall and the river surface; also, 11 million cuboids meter of the river is used for green space consumption of the east of Isfahan and the alongside parks of the river in this city. Finally, 198 million cuboids meter enters Gaavkhooni pond to protect the ecosystem and living environment. It should be mentioned

that from 1363million cuboids meter, about 55 million cuboids meter in hydrologic unit of Ban and Saman is sent by pumping to Chahar Mahal and Bakhtiari province for consumption and the rest is used in Isfahan province in order to irrigate about 85000 to 90000 hectares of agricultural lands [5].

#### IV. CONCLUSION

According to the mentioned measures and numbers, in addition surveys about Zayanderood basin areas for the achievement of a constant development and an efficient management in the basin some problems have been observed:

1) Considering the key role of Zayanderood River in the development of the lower section of the dam and the planned programs to provide water for desert regions and provinces which lead the lack of water, transferring of these sources to the mountainous and watery regions lead to the waste of national capitals.

2) The elimination of basin areas management in the upper section parts especially Chahar Mahal and Bakhtiari regions leads to the destruction of the obstacles and of course natural sources. It causes the appearance of lands and regional dusts and their entrance into Zayanderood dam store and finally leads the decrease of efficient dam store.

3) The easy access of abundant water in alongside lands of Zayanderood River and the lack of principle and correct programming in water usage.

4) The existence of destructive torrents in basin areas especially beneath Khoshkrood basin.

5) Water pumping to mountainous regions and heights in order to construct gardens without paying attention to the land sources capability and paying a great amount of expenses lead to the destruction of natural sources; in addition it is against the constant development.

The evaluation of the general conditions of the basin and its present management show that the only approach to solve the problems and management of them through the constant development is to execute a systematic management or to survey and consider the entire basin ecosystem from the upper section to the lower one; the same management which aquifer theory and constant development rely on it [6].

The existence of water sources and consumptions in this central basin with dry and semidry continent, the transferring of water between basins in entrance and existing ways, the existence of contradiction between the upper and lower section profits, the worthwhile natural ecosystems such as Gaavkhooni pond in this basin, the quality and quantity exchange between the surface and underground water, the returned water of various consumptions and with different qualities and finally the appearance of water shortage conditions in this basin all necessitate the comprehensive management of water sources in this central basin area of Iran [7].

According to the mentioned facts and by considering the ecological system and natural and humanism characteristics of

Zayanderood basin area, some suggestions are presented here:

1- The common session of political and official responsible men of neighborhood and effective provinces of Zayanderood basin areas (Isfahan and Chahar Mahal and Bakhtiari provinces) in order to confirm the charter of this basin constant health.

2- According to the national profits and the potential dryness of Zayanderood basin area for the production of the provender crops for dry farming and animal husbandry, and tourist attraction, the more waste and deviation of water in Zayanderood should be prevented; in this case, the capitalization in the lower sections of the basin and national productions will not destroy more and will be safe and protected.

3- The execution of the earth dam designs, torrent distribution and artificial nourishment especially beneath Khoshkrood basin and the hydrologic unit of Esfandaran-Dastjerd.

4- Beneath the upper section basins of the dam when torrent happens the extra water which is more than the seasonal or torrential rivers height and finally gets out of access are controlled in various ways such as deviation to the lands surface, torrent distribution systems, storing in certain applicable dams which are responsible to postpone the torrent and to nourish the subterranean canals and beds. In this case, we decrease the torrential damages and improve the nourishment of critical plains and somehow compensate the negative balance of water.

5- The application of logical limitations in civil activities and the necessity of the adoption in having a logical authorization; in addition, the process of subject survey through the natural sources offices, aquiferous offices and province ecosystems considering the charter of constant development of the basin before the destruction or repairing of it.

Drought is a phenomenon involving large areas all over the world each year obviously. The consequences of drought have influenced not only on the production of agricultural products but also simultaneously all the living creatures including various planets and animals. Drought is a natural feature of a climate occurs in all the climate zones but its features differ from one region to the other. drought occurrence is the worst environmental event baring unique climate and hydrologic features in an area.

In this research the drought condition of Fars province was statistical period and drought widespread maps were predated during a 37 years statistical period and drought widespread maps were prepared for each of the statistical period years.

Based on SPI, the years 1974, 1976, 1975, 1982, with the SPI rates (-1.03, 0.93, -1.05 and -1.49) respectively, are the most arid years and the years (1996, 1997, 2000 and 1994) with the SPI rates (2.49, 1.49, 1.46, 1.04) respectively, the study and the rest are in normal conditions of wet year and drought. Studying the widespread maps show that all of the areas in this province have experienced drought but some parts of the province like Lar, Lamerd, Shiraz and Fasa have

been more susceptible to drought. Therefore, it's necessary to pay a special attention to these areas when planning and managing the water of the province.

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