International Transaction Journal of Engineering, Management, & Applied Sciences & Technologies

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PAPER ID: 10A09A

DETERMINING THE ENVIRONMENTAL WATER REQUIREMENT VIA HYDRAULIC AND HYDROLOGICAL METHODS

Ladan Abrari [a*], Majed Parvan [a]

[a] *Department of Irrigation and Drainage, Mahab Ghodss Consulting Engineering Company, Tehran, IRAN*

ARTICLEINFO

Article history:
Received 06 April 2019
Received in revised form 19 June 2019
Accepted 28 June 2019
Available online 10 July 2019

Keywords:
Environmental Flow Assessment; Water resource management; Environmental flow; Ecological management condition; Ecosystem water.

ABSTRACT

This study has used a general-purpose multi-objective programming model to determine the minimum human-ecological water balance and ecosystems to determine at least jericanological or minimal blue-water levels. As the two target functions are, respectively, the blue index for humans and the ecosystem index. A case study on the Sufi Chai River. To determine the environmental water requirement of the Sufi River tea, it has been wetted with a hydrostatic method and hydrologic methods of flow transmission curve continuity and tonnage have been used. In the hydraulic method, the soaked environment was used to determine the breaking point from 4 practices: curve slope, maximum curvature, ideal point with scale factor 1 and ideal point with scale factor 2. The results indicate that the Tenant method has shortcomings in estimating the environmental water requirement. Based on the results, the values obtained from the flow transmission curve method are preferable to ecological management conditions than other methods.

1. INTRODUCTION

Water and soil are one of the most important factors in the formation of life, whose proper use and conservation of these resources, along with other natural resources, is a common task. Expansion of water resources development projects is inevitable given the increasing population growth. But, on the other hand, storing, adjusting and extraction of river water resources has led to a disruption of the natural regime of water flow in a large part of river basins that altered the structure of processes necessary to maintain river ecosystems, Creating barriers for the transfer of sediment and other materials in the water, changing the longitudinal and transverse flow along the river and reducing communications between ecosystems, changing the dominant rivers, changing water quality, etc. In this regard, knowledge of the environmental flow was created to reduce the environmental damage

*Corresponding author (Ladan Abrari). E-mail: ladan.abrari3359830@yahoo.com

caused by the water harvesting of rivers. The purpose of this knowledge is to answer the question of how far the natural conditions of a river and water resources can be changed in order to exploit water resources or develop water resources in such a way that the river ecosystem is not damaged or damaged in Is the limit of the river's ecological environment (Tarma and King, 1998; King et al., 1999). In this way, a new scientific field called the Environmental Flow Assessment (EFA) was developed to protect aquatic ecosystems and estimate their environmental water requirements (Binaam, 2011). However, due to its novel nature in natural resource management and water resource management, especially in developing countries, there is little knowledge about the concepts and application of its methods (Slam, 2010). Determining and allocating environmental flow is the most effective attitude to prevent the effects of river flow regulation. Hence, it is necessary to recognize environmental components as policies of management, policies, and principles as well as legal water users and to be included in management decisions such as management of watersheds (Nimen et al. 2002). There are several ways to determine the environmental need. These methods cannot be used directly, and each of them should be tested and tested to comply with Iran's conditions. The big problem that has occurred in Iran over the past years is the lack of a clear environmental policy in relation to determining the minimum environmental flow for rivers and proper utilization of rivers (Shokouhi and Hang, 2010).In this research, according to available data and time scale, the hydraulic and hydrological methods that are the basis of other methods are used. By determining the amount of environmental flow, ecological characteristics and the health of the river habitat can be maintained. Investigating the methods for determining the environmental requirements of rivers, it seems necessary to consider the various methods for estimating the river's environmental flow. Certainly, it would be very useful to consider these methods in choosing the appropriate method for the Wardhouse conditions and also with the available data. According to the above mentioned, the objectives of this research are 1) Determination of the environmental water requirement during the study period using hydrological and hydrologic methods. 2) Comparison of the results of maximum curvature and curve slope methods with flow transmission curve method during the studied interval.

2. MATHEMATICAL MODEL

The study area, which is part of the Sufi Chai river basin, is located in the southern part of Golestan province and in the eastern part of Aliabad Katoul city. Figure 1 shows the location of the area in the country and in the Golestan province. In the province of Golestan, due to atmospheric rainfall, most of the currents are permanent and flood. The Sufi River tea is also one of the permanent rivers, which has a good water supply and high flood. The Sophie Chai River catchment area is 390 square kilometers and its main branch length is about 30 kilometers. The river originated from Sorkhan, Milan and Mount Clouds with a maximum height of 2905 m. It started with the general direction of south-east-northwest, along the route of the village, Shirinabad, and flowing downstream of the village. It receives the valo of Allochan, and from this point onwards it renames the fairy river. In this research, the study area of the Sufi Chay River extends from the vicinity of the bridge to the Shirin Abad village to the Mashhad-Gorgan bridge. In this range, the river was divided into 20 intervals such that the geometric and hydraulic characteristics of each interval are almost constant and uniform. HEC-RAS software was used to determine the water level profile during each interval and at the beginning and end of each interval (each section). Manning coefficient in this river was

determined using available reports and field observations for sections. Within this range, the coefficient varies from 0.039 to 0.05. According to the statistics of 36 years old (1973-1974 (Iran year 1352-1353)), an average river of Dubai is 2 073/2 cubic meters per second. According to the surveys, the status of the rivers and the studied area is based on a series of conditions, characteristics and hydraulic and hydrological information as follows:

1- River has a constant flow.
2- Removal of river water by pumping, or diversion of canal water, irrigation network and ... for agricultural use.
3- The dam is located at the bottom of the river in order to divert water towards agricultural land. Fish in the river can be economically important for residents around the river.
4- Appropriate transverse sections and enough of the range of the study can be prepared with proper accuracy.
5- The longitudinal slope of the river can be determined within the scope of the study.
6- The values of the manning coefficient of the river can be determined by a suitable method.
7- The average annual flow of the studied river is extractable according to available statistics.

Table 1: Characteristics of the flow of the Sufi Chai River at the Sufi Tea Station during the statistical period (1983-1393) in m 3 / s.

Coefficient of variation	Average discharge	Maximum Dubai	Minimum Dubai
0.74	2.073	4.246	0.945

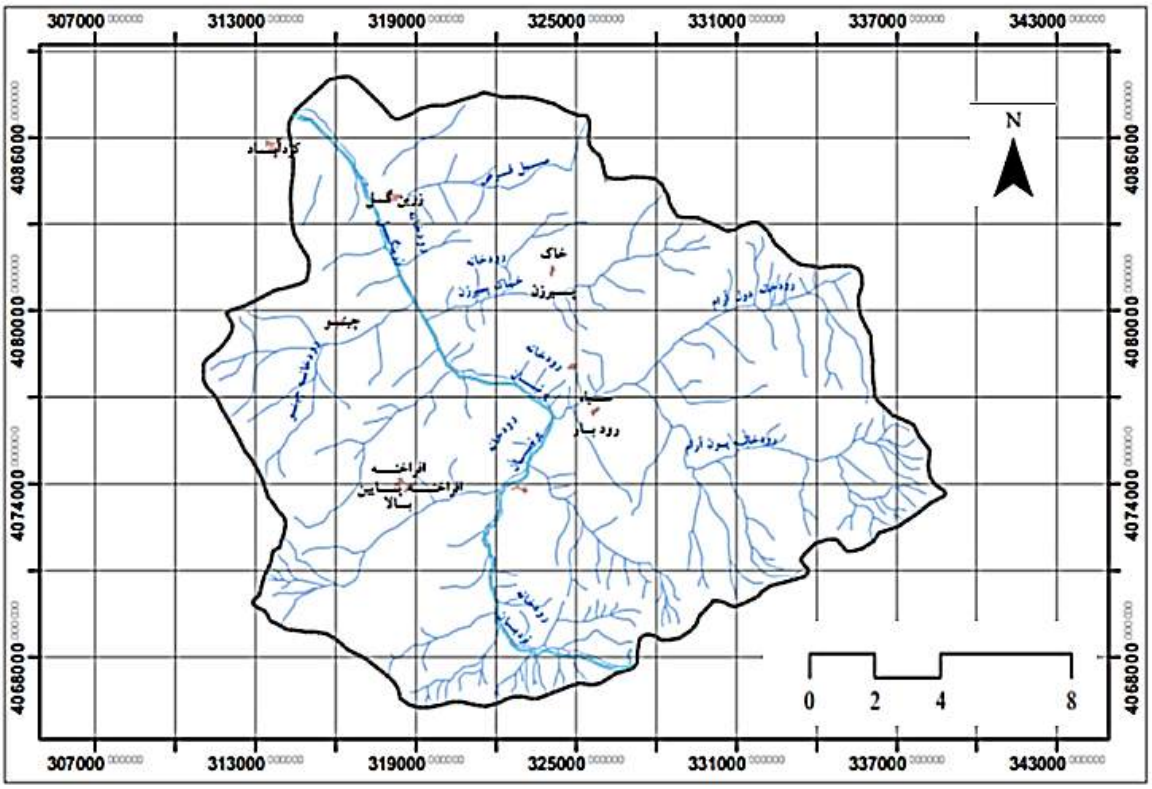

Figure 1: Location of the Sophian Basin and the rivers entering it

3. DISCUSSION

The results of applying the three methods mentioned in Fig. 3 and Table 1 are presented. As shown in Figure 2 and Table 1, the slope method always has more environmental flow than the

*Corresponding author (Ladan Abrari). E-mail: ladan.abrari3359830@yahoo.com Volume 10 No.9 ISSN 2228-9860 eISSN 1906-9642 CODEN: ITJEA8 Paper ID:10A09A http://TUENGR.COM/V10A/10A09A.pdf DOI: 10.14456/ITJEMAST.2019.108

curvature method. This result is consistent with the results of Shan research (2008), Shokouhi and Hoang (2010), Liu et al. (2006), and Poursalahan et al. (2013), but is inconsistent with the results of Gyipel and Standson (1998). The results of the slope method between numbers are 27.6% to 80.55% of the average annual flow. The results of the curvature method are between 96.9% and 47.79% of the average annual flow, and the results of the ideal number point method range from 1.44% to 25.08% of the average annual flow. With the average of the results of each of the three methods, it is determined that the flow curve slope is equal to 13.13% of the annual average flow of the river, the maximum curvature method is equivalent to 45.47% and the ideal point of the Dubai method is equivalent to 55.5% they give. Tenant (2003) found that 10% of the average annual flow is about 50% of the maximum soaked environment. He also considered an annual flow of 10-30 percent of the annual flow of the river to maintain acceptable river conditions. These results are consistent with the results of Liu et al. (2006), Shang (2008) and Poursalahan et al. (2013) Shokouhi and Hang (2010) do not accept this value. In their research, Dubai has at least suggested a tenant approach from Dubai to drought with a return period of 100 years. This seems to be the case when it was used only in a single section in Shawhuhi's and Hang's (2010) research. Therefore, it seems that using a section and citing its results is not very reliable. As shown in Fig. 3, the percentages of the curve slope and maximum curvature are within the range of the Tentan method.

Table 2: Minimum river flow ecosystem (cubic meter) based on three methods of slope, curvature and ideal point

Section number	Slope	Curvature	Ideal point
1	0.29	0.14	0.12
2	0.37	0.12	0.46
3	0.61	0.16	0.14
4	0.16	0.10	0.03
5	0.40	0.08	0.48
6	0.31	0.12	0.22
7	0.39	0.14	0.49
8	0.43	0.10	0.34
9	0.19	0.04	0.29
10	0.13	0.06	0.06
11	0.35	0.24	0.43
12	0.38	0.04	0.18
13	0.58	0.02	0.42
14	0.33	0.10	0.41
15	1.67	0.97	0.32
16	0.26	0.18	0.32
17	0.26	0.18	0.34
18	0.50	0.10	0.52
19	0.48	0.12	042
20	0.28	0.08	0.35

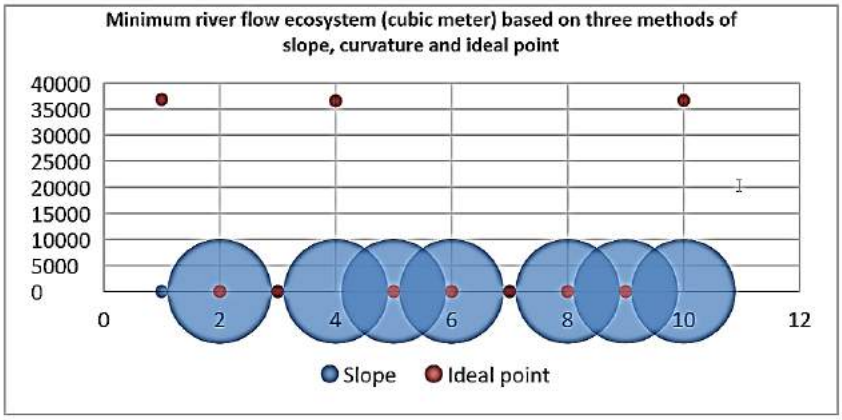

Figure 2: Minimum required environmental flow in terms of the average annual flow of Sufi tea in different river sections

4. CONCLUSION

The assessment of environmental water requirements is one of the most important issues that should be determined for the survival of downstream dams, gangways and the life of the river flow. Considering that comprehensive methods and habitat simulators need to spend more time and cost and in addition to that, hydraulic and hydrological methods are considered as the basis of these methods. Hence, it seems that hydraulic methods have better conditions for using to determine the environmental water requirement. In this research, a dichroic hydraulic method was used and the results of determining the critical point of the soaked environment using the curved slope and ideal point method were proposed in the range of the Tenant method. The flow rate is 0.41 m3 / s, which is 20.13% of the annual average flow rate and the ideal discharge point of 0.23 m3 / sec, which is equivalent to 15.55% of the average annual discharge. According to the results of the present study, the ideal point is chosen because of direct use of the flow chart-soaked environment, no need for sequential derivative operations, reduced computational errors and time saving as the preferred method. Therefore, the discharge 0.23 cubic meters/sec is recommended as the minimum environmental requirement of the Sufi River.

5. AVAILABILITY OF DATA AND MATERIAL

Data can be made available by contacting the corresponding authors

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*Corresponding author (Ladan Abrari). E-mail: ladan.abrari3359830@yahoo.com Volume 10 No.9 ISSN 2228-9860 eISSN 1906-9642 CODEN: ITJEA8 Paper ID:10A09A http://TUENGR.COM/V10A/10A09A.pdf DOI: 10.14456/ITJEMAST.2019.108

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Ladan Abrabi is a Master's degree graduate from Civil Engineering Department, Shiraz University. She is currently working in the irrigation and drainage department of Mahab Ghodss Consulting Engineer Company in Tehran. Her Master's thesis entitled "Investigating the hydraulic performance of piano-shaped spikes using three-dimensional numerical simulation".

Majed Parvan is the Project Manager at Department of Irrigation and Drainage, Mahab Ghodss Consulting Engineering Company, Tehran, Iran. He got his Master's degree in Agricultural Engineering from Ferdowsi University of Mashhad, Iran. His research focuses on Irrigation and Flood Analysis.