

A Study of Flow and Sedimentation at the Basins of Khoozestan Province Rivers: A Case Study of Boneh Basht Pumping Station

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Abstract—The present paper is a case study about exploitation of Kheir Abad river (Khoozestan, Iran) water resources and the problems caused by river sediments around the pumping stations. The weak points and strong points of Boneh Basht pumping station have been studied by experienced experts, work teams, and consulting engineers and technical and executive solutions have been suggested. Therefore, the suggestions of this article are based on the performed studies and are proposed in order to evaluate the logical solutions.

Rather complicated processes resulting from the interaction of water flows and sediments observed at Boneh Basht pumping station occur at other pumping stations in almost the same way. Therefore, Boneh Basht pumping station can be selected as a sample (pilot) and up-to-date theories and experiences can be applied to this station and the results can be offered to other stations.

Keywords—Boneh Basht , Iran , Pumping Station, Sedimentation

I. INTRODUCTION

THE sentence “water is the source of life and prosperity” has been used as the initial sentence in many books, articles, and writings on water. But do we really understand the meaning of this sentence or has it simply become the verbal habit of many –including experts? Is the twentieth century conflict really about water and possessing its resources? Are we really prepared for facing this crisis which is going to afflict future generations? The vital importance of water in maintaining life and the health of the society explains its decisive role in development. The continuation of population growth with regard to the limited resources of water on this planet will be a pretext for future conflicts about water. Taking into consideration the abovementioned issues, we can fully realize the significance of fundamental and systematic work in all fields related to water. Thus, researches done by the senior experts of water engineering along with other experts of this science will have

a major role in meeting the requirements of future generations. Numerous studies [1]-[5] have been conducted in the field of sediment and open canals and this study entitled: “A Study of Flow and Sedimentation at the Basins of Khoozestan Province Rivers: A Case Study of Boneh Basht Pumping Station” is a further step in this field.

II. MATERIALS AND METHODS

The region being studied, the irrigation network of Boneh Basht, Behbahan, is one of the watering places of Kheir Abad River in Khoozestan province, Iran. Gross and net areas of Boneh Basht pressure irrigation networks are respectively 4248 and 3958 hectares . The water resource for the lands in this plan is the fresh water kheir Abad River which crosses the south-eastern part of Behbahan. The above-mentioned river originates from the mountains which are located to the east of Behbahan.

The area of Kheir Abad river basin is 3030 kilometers and its length is 80 kilometers. The average Debbie of Kheir Abad river flow within the statistical period of 1955-2003 equals 25.14 m³/sec. With regard to irrigation quality, river water is classified in the C3-S1 group. Thus, this water can be used to irrigate the region in all seasons. Due to the great difference between the lands and water level, water is pumped and transferred through transfer channels.

III. CONDUCTING WALLS

Where water is drawn from a straight section of the river course, in order to create artificial curves for deviating sediments to the other side of the river, conducting walls are used. A sunken wall with a height equal to ¼ to 1/3 of the depth of the river is constructed in a convex form in the upper part of the river, in the way of the flow, and facing the basin and diverts the sediment flow towards the river. Therefore, sediments are deposited on the middle part of the river bed or are drawn to the lower part of the river before entering the basin. Walls are usually constructed horizontally in the upper part and their curve radius is large and is approximately 7 to 15 meters Fig .1.

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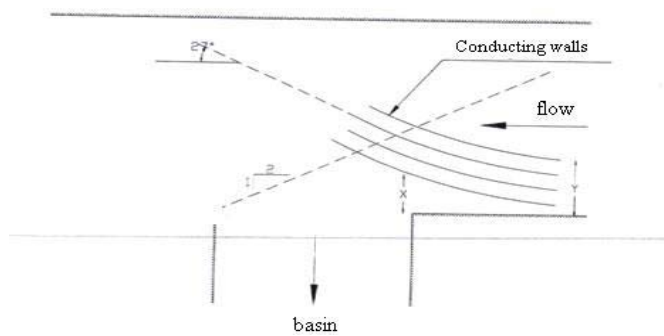


Fig 1. Conducting walls of the King type

IV. SUNKEN SHEETS

Sunken sheets system is a developed form of deep panels. These sheets drive a higher amount of the lower levels of water towards the front side of the basin and help sedimentation occur at that place. When the flow nears a side basin, the flow accelerates laterally and is divided into two parts. The turbid and whirling three dimensional current which enters the basin includes a higher amount of lower water and the centrifugal force caused by this current deviation shifts the base line of the river to the front side of the basin and sedimentation occurs in the mouth and inside the basin. Sunken sheets system was first used by Edgard and Kennedy (1982) in order to prevent the erosion of the outer bank of the curve. Since then these sheets are used for various purposes including protecting banks against erosion, solving the problem of sedimentation in shipping channels, and reducing sediments in the mouth of the basins.

V. VORTEX SEDIMENT REMOVER

These sediment removing corridors which are also known as vortex sediment removers are constructed across the river. These corridors with their steep design carry the accumulated sediments to the other side of the river and from there, through ducts deviate them to the buttresses and the inner parts of the river.

VI. EPI BLADE WATER BREAKERS

Considering the location of the suction pools of Kheir Abbad River and the condition of river sediments, sunken sheets with blades must be selected to correct the trend of sediment transfer. Epis not only create a suitable sedimentation pattern but also do not have abnormal effects on the natural behavior of the river and, therefore, do not have unsatisfactory effects on the river environment. By creating secondary spin, change the amount and direction of cut tension of the river bed and result in the collapse of the river bed and creation of platforms. The whirling current is created on the two sides of the sheet due to the development of vertical pressure gradient. The function of multiple and multi-layered (as a collection) sheets and with a defined pattern will have a suitable efficiency.



Fig. 2 Boneh Basht pumping station

VII. RESULTS

Choosing technically superior options

A. Conducting walls:

As mentioned before, the highest efficiency of these walls is in the lateral basins. Since the water drawing angle is along the current direction, the sediments rush from the first corridor towards the basin. Conduction of the sediments toward the middle of the river and their accumulation behind the buttresses is yet another problem caused by the construction of these walls. Besides, since the height of these walls is more than the depth of the current, if constructed, these walls can cause problems such as obstruction of the water surface by floating objects which requires constant cleaning and maintenance. Another reason why this option must not be selected is the difficulty of construction of such walls due to their curve which leads to higher costs and longer construction time.

B. Sunken sheets in the river bed:

These sheets have the same function as conducting walls but due to their low height and remaining below water surface, they will not cause the problem of the obstruction of the water surface by floating objects such as tree logs. In practice, by drawing sediments towards the middle of the river, these sheets make the sediments accumulate behind the buttresses and increase the water level more than the predicted level. On the other hand, constructing these sheets disturbs the current lines on the river bed. Besides, since these sheets are inclined, coarse sediments are not conducted properly. And there is the risk of the sheets being destroyed or damaged during a flood. Just like conducting walls, the rush of the sediments from the first corridor due to the reduction of the width towards the basin is another one of the problems caused by the sunken sheets in the river bed.

C. Vortex sediment remover:

Compared with previously discussed cases, this kind of sediment remover causes less problems, for instance, it does not disturb the current lines. Some of its problems are the difficulty of its construction and the possibility of the obstruction of vortex pipes. But this type of sediment remover is preferable because it carries the sediments to the other side of the dam. Since construction of this type of sediment remover elevates the river bed, it leads to the reduction of water level but the change in the water level before reaching the dam is not suitable. Besides, due to the high costs of vortex sediment removers and the difficulty of their construction because of the steepness of the river bed, this option is not acceptable.

D. Blade water breakers or Epis:

As mentioned before, by creating a suitable sedimentation pattern, epis do not cause an abnormal effect on the river bed and since they are located below the water surface, they do not lead to the obstruction of water surface due to floating objects. However, constructing this structure drives the sediments to the other side of the river but, in practice, it will not be a big problem and, besides, by developing a channel they can be transferred to the other side of the dam. Finally the cost of this option is less than other options.

VIII. CONCLUSION

Taking into consideration the above-mentioned reasons, with regard to expenses as well as technical matters and according to the performed studies, the blade sediment remover (Epi) is recommended as the best option for preventing sedimentation at Boneh Basht pumping station. And also the installation of drawer valves at the entrance of suction pools is a suitable and simple option –especially during the flood season of the river. At least, this valve can function as spillover and prevent excessive amounts of coarse and fine sediment from entering the suction pools. And sediment discharge valves for the deviational dams are among options which must be designed and considered for Boneh Basht pumping station so that the bed river load in front of the station mouth and the deviational dam may be removed to the lower part of the river.

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