CASE STUDY ON PRODUCTIVITY OF WATER SUPPLY POTENTIALS

ETUDE DE CAS SUR LA PRODUCTIVITE DU POTENTIEL DE LA FOURNITURE D'EAU

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ABSTRACT[3]

Lack of available water resources and rapidly increasing population have been much talked about issues among water experts and scientists in the last decades harping upon the utmost attention needed to increase productivity of the available water.

Case study on Ghanbarkandi-1 pumping station and conveyance conduit revealed considerable non-uniformity in water distribution and consumption. During an irrigation season, only one or two months have maximum water consumption and pumping station is designed for these months. So, pumping and saving the surplus water in other months can have a considerable potential, if there is enough water resources to pump.

Ghanbarkandi-1 pumping station supplies the water needs of Aras-1 irrigation and drainage network (IDN). In the proposed project, the surplus water, after meeting the water demand of the Aras-1 IDN, is diverted to a reservoir dam and using the water for the proposed new network. The existing pumping station with 2 m3/s discharge is able to supply water requirements of the Ghanbarkandi-1 network of 2000 ha and the new network of 1450 ha area.

This pumping station can save about 42.5 MCM water in 8 months of the year and Ghanbarkandi-1 network consumption is about 22.5 MCM per year. So the surplus water is about 20 MCM that can be used to develop a new network. This project has the following advantages:

- *Use of maximum potential of available water*
- *Productivity of existing plants without construction of a new pumping station and conveyance systems*

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- *Increase in irrigation and drainage network*
- *Create new engagements*
- *Create lateral industries and regional economy improvement*

Key Words: *Pumping station, Surplus water, Non-uniform water Distribution, New Network, West Azerbaijan.*

RESUME ET CONCLUSIONS

Cette station de pompage située à l'ouest de réservoir d'eau à l'amont de barrage d'ARAS; dans région province d'Azarbayjan Iranien est installée dans le but d'utiliser une partie de la part Iranienne de débit de cette rivière pour irriguer 2000 hectare des terres irrigables de cette région.

Étant donné que la puissance de cette station de pompage est calculé pour un débit de 2 m3/s et les pompes sont choisis pour cette puissance, ce débit est égale au besoin max d'ensemble de réseau d'irrigation en été. Mais les besoins en eau dans les mois d'autres saisons diminuent, donc les volumes d'eaux pompés avec le débit max dépassent les besoins en eau saisonnier. La différence de volume peut être réserver dans une réservoir en amont d'une digue en terre pour pouvoir augmenter la superficie de réseau d'irrigation en choisir un programme pour les utiliser suivant les besoins en eau de cette parie de réseau .

Puisque le volume totale de potentielle de la station de pompage en 8 mois est égale à 42.5 mcm et les besoins en eau de 2000 hectare est 22.5 mcm, dons nous avons environ 22 mcm d'eau de plus pour augmenter le réseau d'irrigation.

Cette programmation peut avoir les profits suivants:

- *utiliser le max de cette partie de la part de coté iranien de la rivière ARAS*
- *utilisation de la potentielle max de la station de pompage, sans avoir besoin d'augmenter les nouvelles installations comme pompages et les nouvelles lignes de transport d'eau, etc.*
- *augmenter la superficie de réseau d'irrigation*
- *créer des nouveaux métiers et diminuer le chômage dans la région*
- *augmenter la possibilité de développer l'industrie agricole dans la région*

Mots clés: *Station de pompage, eau excédentaire, distribution non-uniforme de l'eau, nouveau réseau, l'ouest d'Azerbaïdjan.*

(Traduction française telle que fournie par les auteurs)

1. INTRODUCTION

Optimal operation of available resources to keep balance between resources and consumptions is a way of sustainable resource use. This has assumed great importance in view of the rapidly increasing population and limitation of water and soil resources. As a result, revision of some of the commissioned projects may be required to achieve the maximum productivity of available water resources and also to compensate for the lack of water and soil resources in the present and future.

2. PROJECT DESCRIPTION

Pumping station, conveyance lines and irrigation and drainage network of Ghanbarkandi-1 are located in West Azerbaijan province in the southern border of Aras River, upstream of the Aras reservoir dam. The maximum discharge capacity of pumping station of $2m^3/s$ is able to meet water requirements of Ghanbarkandi-1 network with 2000 ha area. Water requirement of irrigation and drainage network exists from March through October. Maximum water consumption is in July and pumping station is able to supply water demand in this month. Hence, maximum pump power is not utilized in other consumption months. In other words, there is a considerable potential to save water and pump the surplus water in other months. Portion of surplus water is diverted from conveyance line by Ghanbarkandi-1 pumping station with the capacity of $2m^3/s$ which can cater to the water need of a new irrigation and drainage network without constructing any new pumping station.

3. WATER RESOURCES PLANNING AND MANAGEMENT

The water available from Aras reservoir dam is about 42.5 MCM. The annual water consumption of irrigation and drainage network according to monthly water consumption of crop pattern is about 22.5 MCM (Table 1). Thus 20 MCM of the available water remains unutilized. This water can be utilized through the existing Ghanbarkani-1 pumping station and pipe network to develop a new irrigated area.

Table 1. Monthly water consumptions in Ghanbarkani-1 IDN

Unit	Sept.	Oct.	Nov. - Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Annual
m^3/ha	853.4	628.3		930.7	1295.1	1690.1	2050.3	2312.7	1314.1	11074.7
MCM	1.7	1.3		1.9	2.6	3.5	4.1	4.7	2.7	22.5
%	7.5	6		8.5	11.5	15.5	18	21	12	100

4. GHANBARKANDI-1 IDN FEATURES

Ghanbarkandi-1 IDN with the area of 2000 ha includes 2 pumping stations named A, B in which the station A conveys water from Aras reservoir dam towards suction of station B. Water requirement of the network is provided by installing 2 electro pump series and 2 steel pipes with the diameter of 900mm. Water volume of 18.5 MCM and 24 MCM is discharged

respectively by pipeline BC and BD in which 9.8 MCM of BC and 12.8 MCM of BD are consumed by Ghanbarkandi-1 IDN and 8.7 MCM of BC and 11.2 MCM of BD are considered as surplus water.

5. OPERATION OF SURPLUS WATER FROM PUMPING STATION

Studies about surplus water from Ghanbarkandi-1 led to construction of an off-river dam called Aras-2. This portion of surplus consumption water is saved and regulated for new-developed irrigation and drainage Network called Araz-3. Considering the elevation of dam location, how to convey surplus water through BC and BD pipelines to reservoir was assessed economically and technically. From the technical point of view, since point C elevation is lower than the elevation of Aras-2 dam, it is not likely to convey the surplus water from point C towards reservoir dam by gravity. Moreover, as far as economy is concerned, use of another pumping station and increase of the height and storage capacity in order to convey and save surplus water of BC line to reservoir dam is not justifiable.

6. CONVEYANCE OF WATER FROM BD TO ARAS-2 RESERVOIR DAM

Water is conveyed from BD line towards Aras-2 reservoir dam by concrete canal with trapezoidal section. The matter of importance is how to divert the surplus water from BD line in operation time of Ghanbarkandi-1 IDN. Therefore, two scenarios were considered. Those of which took out the water either at the end of pipeline of BD or through the pipeline (point E in Figure1). Because of the topographical conditions and high cost of conveying the water at the end of BD line towards reservoir dam, point E has been considered as turn out. In addition, point E has lower elevation than point D. Therefore, when there is no need to pump into point D, total pumping height decreases in point E. Consequently, according to the hydraulic performance curve, lower elevation of pumping results into more discharged water. It should be noted that two points are the main causes of using point E as turn out. First one refers to the no need of pumping to point D for irrigation when sufficient rainfall occurs before irrigating. The second one refers to the decrease of the length of growing period as a result of crop pattern changes and reduction of irrigation season. To regulate the diverted water from BD line in various months, a series of flow control valves has been considered. These devices are able to adjust the amount of surplus water in different months.

7. PROJECT DETAILS

Aras-2 reservoir dam and related IDN (Araz-3) was developed using surplus water derived from Ghanbarkandi-1 pumping station and IDN. Regardless of pumping station plant and conveyance line, new components of the project include flow control valve room, conveyance canal, Aras2- reservoir dam and Araz 3-pressurized irrigation network. Control valves room is responsible for controlling and diverting surplus water from BD line through conveyance canal. Aras-2 reservoir dam with the storage capacity of 4.7 MCM is able to control the water requirement of Araz-3 network with 1450 ha area irrigated by pressurized irrigation methods. Some implemented project details have been shown in Figures 2, 3 and 4.

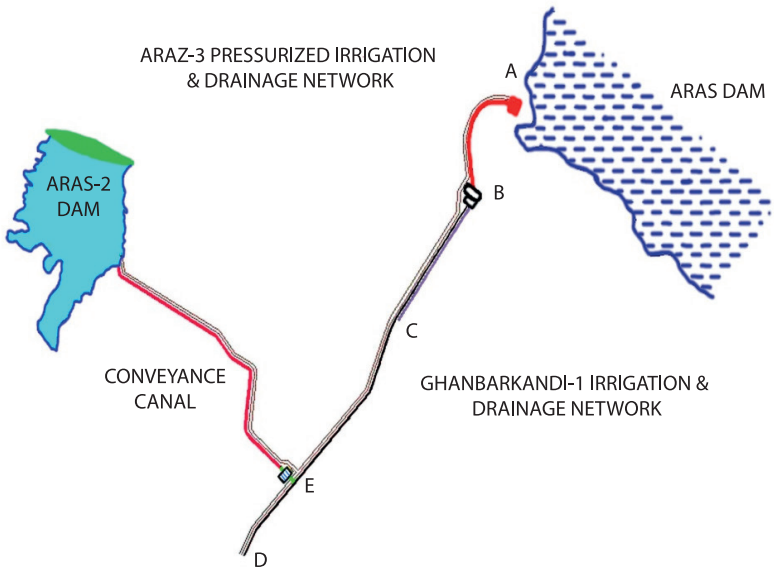

Fig. 1. Plan of Project

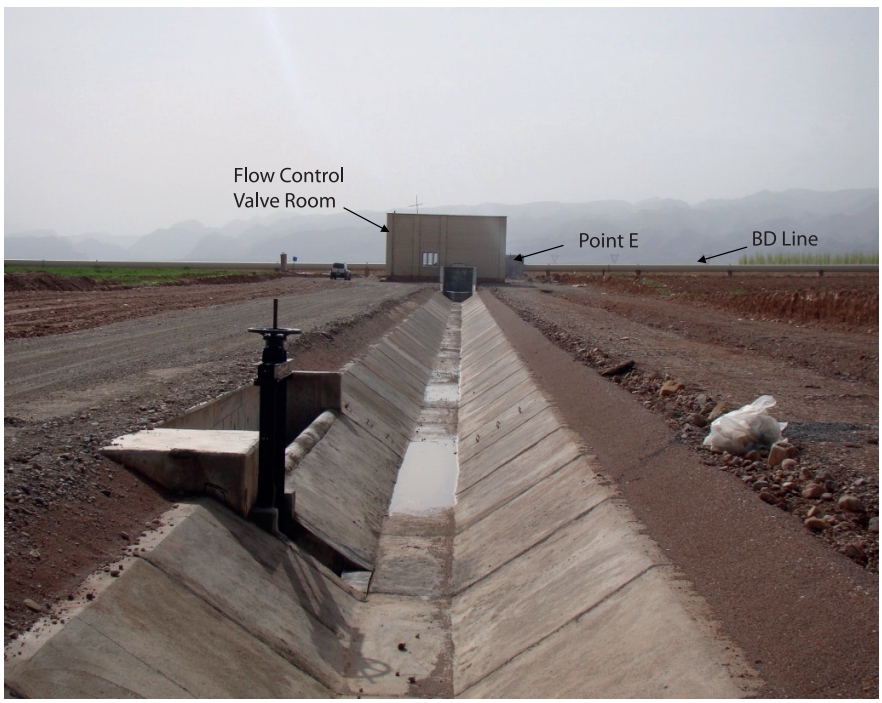

Fig. 2. Flow Control Valve Room, Conveyance Canal and BD Line

Fig. 3. Flow Control Valve Room

Fig. 4. Inverted Siphon used in Conveyance Canal

8. CONCLUSIONS AND DISCUSSION

The amount of water shared to West Azerbaijan Province from Aras reservoir dam is 2m^3/s; however the entire quantity is not used because of the variation of water consumption of the crops in different months. The existence of good cultivable land on the southern border of Aras River and availability of surplus water from Ghanbarkandi-1 pumping station and IDN were the reasons for proposing development of a new IDN Araz 3. As a result, the whole available water becomes utilizable and the existing pumping plant and conveyance line are operated at the highest productivity.

Moreover, development of pressurized irrigation methods is conducive to minimizing the water loss and maximizing the productivity of water.

This project has the following advantages:

- Maximum use of potential available water
- Use of the current structures
- Development of pressurized irrigation methods
- Development of modern irrigation and drainage Networks in the region
- Creating new job
- Development of lateral industry and improvement of regional economy
- Avoiding rural people from immigrating to the big cities

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