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ECOSYSTEM APPROACH TO MANAGEMENT OF DRINKING WATER SUPPLY HEAD WORKS

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Abstract

Human health and sanitation is mostly dependent on water availability and water quality. The Majority of the population in Tamil Nadu depend on groundwater for human consumption.

This paper deals with the problem of availability of groundwater for drinking from alluvial river beds. In all the rivers with alluvium, the present water supply headwork consist of infiltration wells and galleries. Whenever there is flow in the rivers, the alluvium get saturated and this water is drawn through infiltration wells. This water is then pumped to supply mains with or without an overhead tank.

The above conventional water supply head works are facing many problems now. Due to over exploitation of groundwater for irrigation on both banks of the rivers, the aquifer level had been lowering year by year. Now the aquifer level is well below the level of the infiltration galleries. Due to this no water is received through the galleries and only the water in the infiltration well is pumped for supply. This has resulted in a short supply to many Towns. This results in the installation of a higher number of bore wells within the town limits, resulting in over exploitation.

In this paper an attempt is made to suggest an ecologically sound method of rejuvenating the defunct infiltration galleries. The method involves the formation of a subsurface dyke which will be of clay across the river just downstream of the infiltration wells and galleries.

The method of construction, will be detailed in the full text. This method will go a long way to improving the water availability for the people and thereby improving the health and sanitation of the people.

I. INTRODUCTION

In Tamil Nadu many drinking water supply head works are situated in river beds. This is more so in the case of rivers with deep sandy alluvium. Many hundreds of such water supply headworks are seen in Palar, South Pennayar and Vaigai river basins.

The drawal of drinking water from the rivers by constructing a headwork is a conventional method and very old. But this method is cheaper than other methods like the drawal of surface water for drinking. As of now, the drinking water supply head work consists of infiltration wells with a set of infiltration galleries and a pump house.

The sandy alluvium acts as a shallow aquifer and the infiltration galleries collect the water from the alluvium and convey it by gravity to the infiltration wells. The infiltration wells also draw the groundwater up from comparatively higher depths of the alluvium than the galleries. The collection from the wells and galleries is pumped through the pumping mains to the overhead tanks. From the overhead tanks water is distributed after chlorination. In this case no treatment plant is required as in the case of drawal of surface water for drinking. So this method is the most reliable, economical method, when compared to other methods.

II. DISCUSSION

a. The problem : The drinking water supply from infiltration wells and galleries is facing a crisis, more specifically in the past decade. Due to over exploitation of groundwater in some of the river basins, for agriculture and industries, the aquifer level had been continuously lowering day by day. Now the aquifer level is well below the infiltration gallery level and so the galleries do not collect water at all. Only the infiltration wells collect some water which is pumped for supply. Due to this, the availability of drinking water to the municipalities had gone down considerably. This situation had resulted in

1. Installation of more number of bore wells in the affected areas. Almost every house has a borewell.

2. Lowering of groundwater table in the affected areas due to over exploitation of groundwater.

3. Water quality changes in groundwater and consequent health hazards.

4. Conveyance of drinking water by Government agencies through lorries from long distances resulting in huge expenditure affecting the economy.

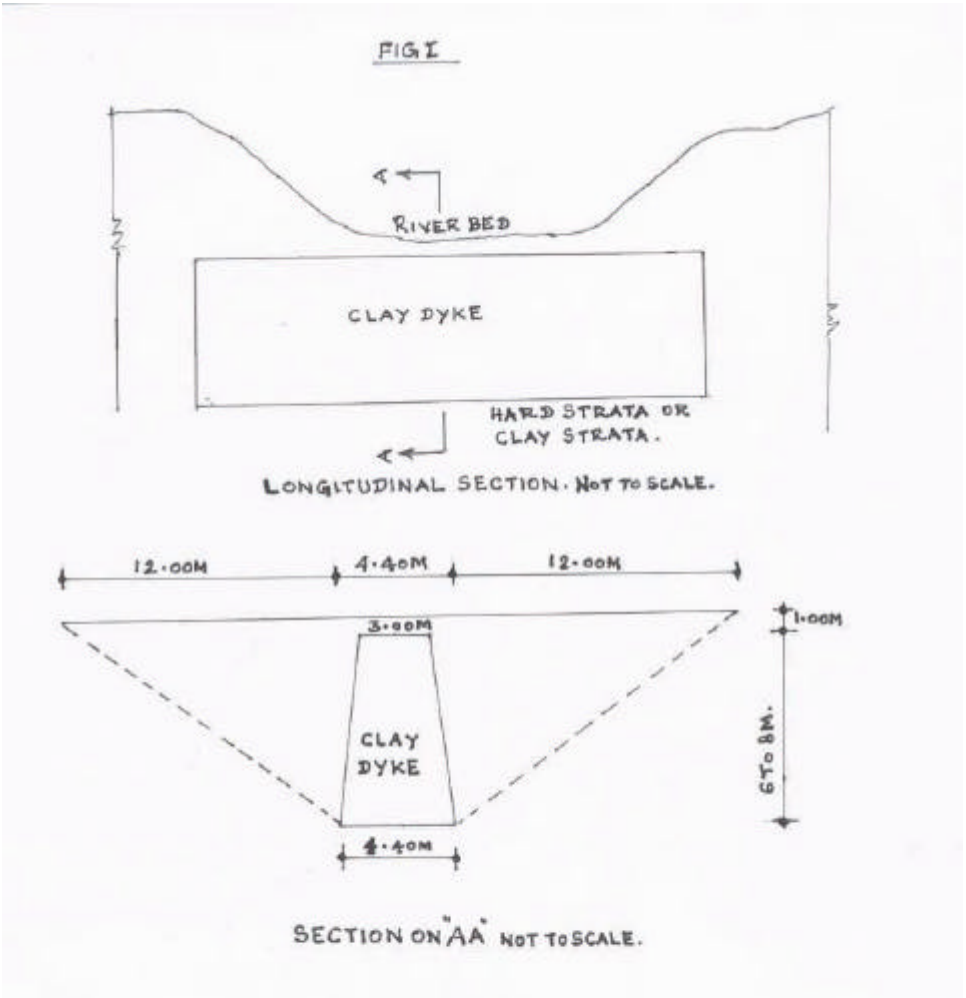
5. Purchase of drinking water by affected people from water market affecting their economy.

6. Consumption of more electrical energy for pumping in the affected areas from bore wells etc.

The above problems are evident in many municipal areas like, Alandur, Pallavaram, Thambaram, Kancheepuram, Vellore etc. As the availability of drinking water has a direct bearing on the health and sanitation of the locality, many water borne diseases are reported from water short areas specifically during summer. But availability of data on these aspects at Municipal offices is sparse. In total if the already established drinking water supply is affected, the above problems are experienced in the affected area, affecting the ecosystem of the area. Therefore, it is imperative to sustain the drinking water supply from the already established water supply head works. This will go a long way in maintaining the ecosystem of the areas.

b. Solution : In any river, the natural subsurface flow is from upstream to downstream. Therefore, to ensure availability of water in the headworks in the infiltration gallery zone, arresting the subsurface flow just downstream of the headworks is essential. This could be done by the formation of a subsurface dyke downstream of the headworks across the river. The depth of the dyke should be up to a reasonably hard strata through which percolation of water would be remote. A dyke is nothing but a barrier which will arrest the subsurface flow and raise it to a desired level as shown in figure 1. But as the dyke is expected to be impervious, any engineer would like to provide this with concrete. Concrete is purely alien as far as a river bed is concerned. More over it is a costly structure. Therefore in fig.1 a clay dyke is shown, which is nothing but an earthern structure embedded in earth.

As sand is available on both sides of the clay dyke, there may not be any pressure on the dyke. No complicated design is involved in this construction. But it requires some caution on the part of the engineer in selecting the earth with maximum clay content for the dyke. The recommended percentage may be 35% to 40% clay. Likewise care must also be taken to construct the dyke in stages by ensuring 100% consolidation of the dyke by rollers.



If the dyke is proposed with concrete, it is too costly even with minimum standards as shown in Fig.II. The time required for execution will also be more. Besides this the structure may require repairs in due course. As the flow of water beyond the concrete dyke is completely arrested, the river on the downstream may become completely dry, thereby decreasing the density of the sand. This may cause difference in earth pressure. If this is also taken into account while designing the concrete dyke, the structure may become huge resulting in increased cost.

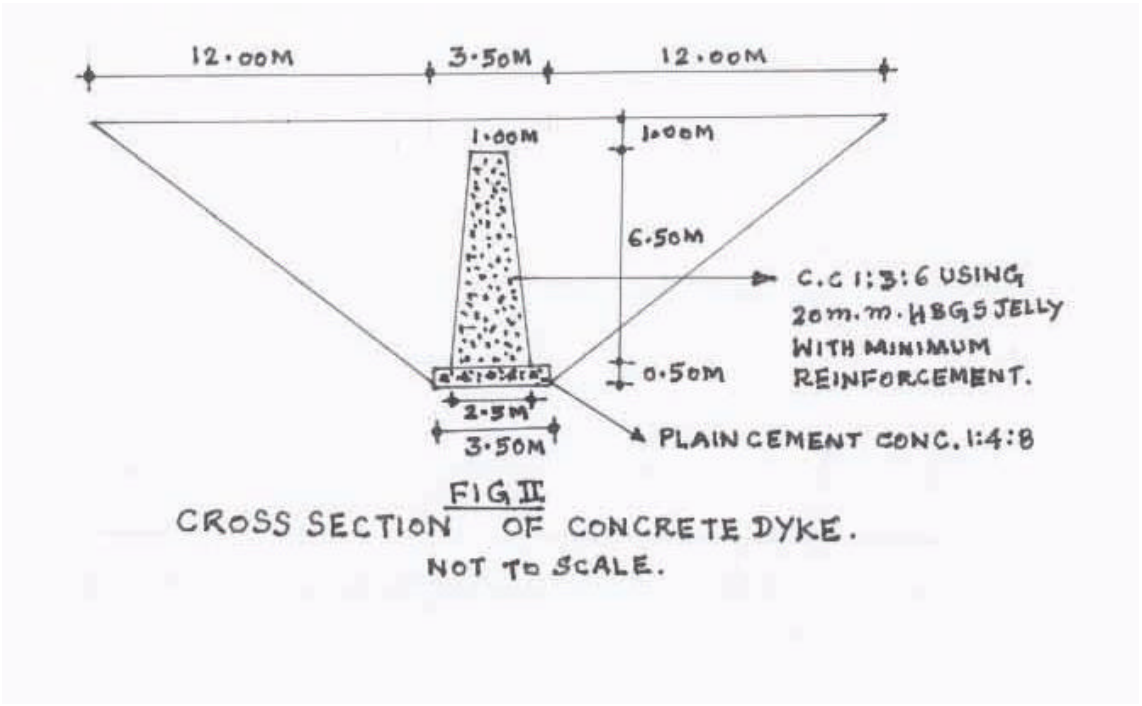


FIG II

CROSS SECTION OF CONCRETE DYKE.

NOT TO SCALE.

Sl.No.	Description	Clay dyke	Concrete dyke
1.	Construction	Easy	Complicated
2.	Time of execution	Less	More
3.	Design	Easy	Complicated
4.	Structure	Not alien to a river bed	Alien to a river bed
5.	Ecological & Environmental aspects	Sound	Unsound

6.	Cost aspects	Cheaper	Costlier
7.	Maintenance	Nil	Needs maintenance
8.	Benefits	Will increase availability of G.W.	Will increase availability of G.W.
9.	Rough cost per metre run	Rs.12,000/-	Rs.36,000/-

III. CONCLUSIONS

1. With the present trend of lowering of aquifer in river beds, action should be taken to restore the aquifer level by artificial means, to sustain availability of drinking water.

2. The artificial methods adopted to restore the aquifer level in river beds should be cost effective and adaptable to the local environment.

3. As the artificial dyke is sure to increase the availability of drinking water by rejuvenating the infiltration galleries, it will reduce groundwater pumping in Municipal areas.

4. Increased availability of water in Municipal areas will improve the health of the people and bring in overall improvement of the environment.

5. Comparatively the clay subsurface dyke has many advantages over concrete/sheet pile dykes. Clay dyke is conducive to our country as well as other developing countries.

6. Forming a clay subsurface dyke downstream of all water supply headworks in rivers of Tamil Nadu is very much essential to rejuvenate the infiltration galleries. Before taking up this venture, a pilot project must be taken up to study the effectiveness in detail.

7. Banning all groundwater pumping activities within a radius of 2 km. from all drinking water supply head works is a must to sustain the availability of groundwater.