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Effect of Tank Desiltation on Ground Water Status – Case Study of Anakal Tank In Chikkaballapura District, Karnataka

Manjula, N.[1] and Radhakrishna, A. R.[2]

[1]Subject matter specialist (Agric.Extn.), KVK, Chintamani, Chickballapur district, Karnataka, India
[2] Assistant Professor, Department of Agricultural Engineering, GKVK, UAS Bangalore, Karnataka, India
Corresponding author email: nmanjulauasb@gmail.com. Phone 09900895829

Abstract :- Tanks have been the main source of irrigation in many parts of India for centuries. India experiences extreme climate within its 329 million hectares of geographical area. The hydrological characteristic of the Indian monsoon necessitated creating storage facilities to hold the monsoon rainwater and utilize it later. With extraordinary engineering, managerial, and social skills, an extensive system of rainwater harvesting structures comprising tanks and ponds had been built and maintained by the people for centuries. Many of these multiple use structures were the nerve centers for sustenance and livelihood of the rural communities. In Karnataka, there are 36,500 tanks of varying sizes with an irrigation potential of about 0.65 m.ha. Presently, the water storage and longevity of water storage has been reduced. With a view to increase the ground water potential in command area, in the present situation, desilting of tanks is the only way to increase the storage volume and longevity of the storage of water. Impact of tank rehabilitation on ground water levels in wells/borewells was assessed by analyzing the water discharge from the borewells. The fluctuation in the ground water table was assessed by installing the piezometers in the borewells. The results indicated that, fluctuations in ground water, at the time of establishment of piezo meter the water table was 15.50 meters (from the ground level). There was slight increase in the water table (0.75 meters) in the first year of establishment (2005-06). During the second and third years, there was decline in the water table by 5.20 meters and 4.38 meters respectively. The results can be attributed to low rainfall received viz., 297mm in second and 547 mm third year against the normal rainfall of 768mm.

Keywords: *Tank, desiltation, ground water table, piezometer, water discharge, command area.*

I. INTRODUCTION

In Karnataka, 75 per cent of the area is drought-prone, and the State has about 36,500 tanks of varying sizes with an irrigation potential of about 0.65 m.ha. These tanks are age old and poorly maintained resulting in decrease in water storage, with reduced longevity of water storage. The volume and longevity of the storage of water in the tank are the two major factors which influence the ground water level in and around command area as observed in several studies. It is estimated that 20 percent of water wasted due to improper conveyance system and 10 to 15 percent water wasted in sluice and control structures. The tanks are slowly getting silted up due to improper management, which cause reduction in storage capacity. The general belief is that the tanks are in a vicious cycle of 'poor maintenance–decline in condition–rehabilitation–poor maintenance'. On the other hand, proponents argue that tank rehabilitation is a must around which livelihood options of the rural poor are to be built in view of the multiple use of tank water (Sakthivadivel, 2005). In order to increase the ground water potential in command area, the storage capacity of the tanks and the longevity of the storage are to be increased.

At the present situation, desilting of tanks is the only way to increase the storage volume and longevity of the storage of water (Reddy, 2013). The stored water in the tank is presumed to increase ground water level as experienced by farmers in the vicinity of the tanks. To what extent the ground water level rises and provides more water for crop cultivation needs assessment. With this background, as part of community based tank management project, funded by World bank, University of Agricultural Sciences, Bangalore had conducted a pilot study in the Anakal tank of Chintamani taluk, Chikkaballapura district, Karnataka during 2007.

II. MATERIAL AND METHODS

The effect of tank rehabilitation on groundwater recharge was assessed using/ installing piezometers and by analysing the water discharge from wells/ borewells. The details are given below.

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A. Installation of Piezometers

To install piezometers, two borewells were drilled in private farmers land in the tank command area. The points of these piezometer borewells were selected by the geologists from the mines and geology department using sophisticated instruments. The depth of borewells drilled were 157m and 164.6m. The details of Borewells drilled in the tank is given in the Table-1.

After drilling of Bore-wells (Piezometers), Digital water Level Recorder with sensor and data logger with lithium battery connected to communication cable was placed in the drilled bore-wells. The water level logger had been quality tested and approved to provide accurate and reliable water level measurements. This logger with submersible pressure transducer for remote monitory and recording of water level. This highly reliable and accurate water level records 24,400 readings and is programmable from one reading per second to one reading per day. Depending upon the depth of water in the bore-well, the balance length of cable had been folded and kept in the box fixed on the top of the bore-wells. In the present study, the data logger had been programmed for one reading per day.

Table 1- Piezometer details

Particulars	*Borewell-1*	*Borewell-2*
Farmers name	Mr.Chowdareddy	Mr.Sathyanarayana Reddy
Survey No.	31/33	34/3
Date of drilling	10.06.2005	11.06.2005
Depth (ft/m)	515’ (157m)	540’ (164.6m)
Gaps (ft/m)	140’ (42.7m) 167’ (50.9m)	451’ (137.5m)
Length of casing pipe (ft/m)	80’ (42.4m)	45.5’ (13.90m)
Discharge (inch/I/sec)	2” (083.l/s)	1”(0.14m)
Depth of sensor (ft/m)	500 (152.4m)	500’ (152.4m)

III. RESULTS

The results in respect of discharge of water in the borewells revealed that average discharge was 3.53 liters per second during 2005-06. It gradually declined to 3.44 liters per second during 2006-07and further declined to 2.11 liters/ second during 2007-08. With respect to fluctuations in ground water, at the time of establishment of piezo meter the water table was 15.50 meters (from the ground level). There was slight increase in the water table (0.75 meters) in the first year of establishment (2005-06). During the second year, there was decline in the water table by 5.20 meters (Table-2). The annual rain fall received during the year was 297mm against normal rainfall of 768mm. During third year, the decline in water table was 4.38 meters and the total rainfall was 547 mm (Table-5). The per cent exploitation of borewell water was found to be 144.20 during 2005-06, and it was 188.45 in 2006-07 and 110.40 during 2007-08 (Table-3). The decline in water table and water discharge rates can be attributed to the low rainfall and less water stores in the tank. The results are in conformity with the study of Sakthivadivel and Srinivasan (2004). Therefore, influence of tank rehabilitation could not be attributed in the present study.

Table 2 - Effect of tank rehabilitation on ground water in Anakal tank

Year	*Rainfall (mm)*		*Water stored in tank (cum)*		*Avg. borewell yield (lit./sec.)*	*Fluctuation in ground water (m) (WT-15.50m)*
	Normal	*Actual*	*Min.*	*Max.*		
2005-06	*768*	*318*	*2610*	*11103*	*3.53*	*+0.75*
2006-07	*768*	*297*	*3220*	*8320*	*3.44*	*-5.20*
2007-08	*768*	*547*	*2100*	*9890*	*2.11*	*-4.38*

WT - Water table

Table-3 : Exploitation of ground water in Eastern dry zone Anakal, Chintamani Taluk , Chikkaballapur Dist.

Year	*Rainfall (mm)*		*Water stored in tank (cum)*		*Estimated Recharge (cum)*	*Total water exploitation (cum)*	*Per cent exploitation over recharge*
	Normal	*Actual*	*Min.*	*Max.*			
2005-06	*768*	*318*	*2610*	*11103*	*38285*	*55206*	*144.20*
2006-07	*768*	*297*	*3220*	*8320*	*42441*	*79980*	*188.45*
2007-08	*768*	*547*	*2100*	*9890*	*23240*	*25657*	*110.40*

Table 4- Groundwater Depths in Anakal Tank Command area

s		*Bore well No.*	BW 1	BW 2	
		Depth of BW (m)	157.00	164.60	
		Depth of Sensor (m)	54.38	132.01	
	Water table depth in bore well from ground level (m)				
Month	*2005*		*2006*		*2007*		*2008*	
	BW 1	**BW 2**	**BW 1**	**BW 2**	**BW 1**	**BW 2**	**BW 1**	**BW 2**
Jan	-	-	16.88	86.47	24.73	96.9	28.3	116.5
Feb	-	-	17.55	84.65	25.08	98.4	28.3	118.2
Mar	-	-	18.08	86.32	25.6	99.9	27.8	123.1
Apr	-	-	18.41	88.65	25.37	101.85	28.3	125.69
May	-	-	18.72	90.99	26.9	104.2	28.9	128.1
June	-	-	19.13	93.65	28.44	105.9	29.5	130.3
July	-	-	19.62	35.69	29.02	106.3	29.96	131.45
Aug	-	-	20.22	96.26	26.6	108.1	30.18	132.06
Sept	-	-	21.04	96.31	27.3	109.8	27.5	131.51
Oct	15.5	96.76	23.26	96.35	27.7	111.3	28.3	130.1
Nov	15.77	96.05	24.04	96.4	27.1	112.9	-	-
Dec	17.08	91.62	24.48	96.6	27.6	114.8	-	-

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Table 6- Groundwater Depths in Anakal Tank Command area

			Bore well No.		BW 1		BW 2	
			Depth of BW (m)		157.00		164.60	
			Depth of Sensor (m)		54.38		132.01	
	Water table depth in bore well from ground level (m)							
Month	*2005*		*2006*		*2007*		*2008*	
	BW 1	**BW 2**	**BW 1**	**BW 2**	**BW 1**	**BW 2**	**BW 1**	**BW 2**
Jan	-	-	16.88	86.47	24.73	96.9	28.3	116.5
Feb	-	-	17.55	84.65	25.08	98.4	28.3	118.2
Mar	-	-	18.08	86.32	25.6	99.9	27.8	123.1
Apr	-	-	18.41	88.65	25.37	101.85	28.3	125.69
May	-	-	18.72	90.99	26.9	104.2	28.9	128.1
June	-	-	19.13	93.65	28.44	105.9	29.5	130.3
July	-	-	19.62	35.69	29.02	106.3	29.96	131.45
Aug	-	-	20.22	96.26	26.6	108.1	30.18	132.06
Sept	-	-	21.04	96.31	27.3	109.8	27.5	131.51
Oct	15.5	96.76	23.26	96.35	27.7	111.3	28.3	130.1
Nov	15.77	96.05	24.04	96.4	27.1	112.9	-	-
Dec	17.08	91.62	24.48	96.6	27.6	114.8	-	-

IV. CONCLUSION

The real picture about the increase in the level of ground water in the catchment and the neighbouring places could not be obtained due to low rainfall in the area during the study period. But, it is evidenced by the farmers of the locality of the study area that if there is water in the tank, the defunct borewells are activated and recharged.

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Table 5 - Details of Rainfall, Evaporation, Tank water storage, Ground water Exploitation and Borewell discharge of Anakal Tank

	Normal Rainfall	**Rain fall**						*Evaporation (mm)*			*Tank water storage (cum)*			
Month	*(mm)*	*2004*	*2005*	*2006*	*2007*	*2008*	*2005*	*2006*	*2007*	*2008*	*2005*	*2006*	*2007*	*2008*
Jan	2.10	0.00	0.00	0.00	0.00	2.08		159.0	175.6	124.0		80183	-	-
Feb	5.50	0.00	0.00	0.00	0.00	14.00		168.6	164.0	160.2	-	30925	-	-
Mar	12.10	24.2	0.00	9.00	0.00	48.00		184.0	198.3	131.2	-	12102	-	-
Apr	30.30	22.0	64.20	4.00	9.00	-	Install	187.7	209.9	188.8	-	17510	-	-
May	70.40	105.2	76.30	10.50	86.00	58.00	ation in	178.2	176.9	166.8	--	2975	-	-
June	64.80	2.20	79.40	27.40	88.50	13.50	July	139.7	69.8	118.5	-	1123	-	-
July	85.60	272.70	12.70	1.00	54.80	172.30	44.9	142.3	113.1	72.8	126220	565	12102	-
Aug	97.60	14.40	46.00	26.50	28.20	120.20	148.5	176.1	117.5	108.6	214724	-	19896	1354
Sept	175.10	135.20	21.50	24.00	139.2	148.50	120.3	159.7	131.7	-	100316	-	100316	21383
Oct	174.10	93.30	52.50	45.00	98.9	-	126.5	154.3	127.8	-	45358	-	80183	30665
Nov	68.40	24.60	65.50	74.80	16.7	-	87.5	132.9	86.4	-	214724	-	30665	-
Dec	14.80	0.00	17.00	3.20	56.2	-	77.7	115.8	99	-	214724	-	30231	-
Tot	**767.80**	**703.30**	**435.00**	**225.40**	**577.5**	**576.58**	**605.4**	**1898.3**	**1670.0**	**1070.9**	**916066**	**145453**	**273393**	**53402**

Table 4 - Contd.....

	Ground water exploitation (cum)					*Borewell discharge(lt/sec)*				
Month	*2004*	*2005*	*2006*	*2007*	*2008*	*2004*	*2005*	*2006*	*2007*	*2008*
Jan	-		4579.00	6827.70	3888.0	-	1.67	4.13	3.23	2.21
Feb	-		5736.00	5944.76	3456.0	-	1.65	4.00	3.11	1.94
Mar	-		8828.00	4273.72	3330.0	-	1.53	4.13	3.00	1.85
Apr	-	5191.50	8267.80	6935.76	3222.0	-	2.46	3.58	2.90	1.79
May	--	5070.35	6118.00	4155.84	3222.0	-	2.40	4.10	2.77	2.00
June	-	3742.24	1885.00	2006.64	2079.0	-	2.34	4.17	2.89	2.32
July	-	5199.56	11262.00	452.90	3609.0	-	2.73	4.03	2.85	2.10
Aug	5868.0	5808.48	9853.00	5115.12	4860.0	1.63	2.99	3.88	2.75	2.35
Sept	5675.1	5740.11	10518.00	2160.1	2490.0	1.70	2.99	3.72	1.60	2.61
Oct	4165.0	4885.50	7965.00	2535.0	-	1.59	3.68	3.65	1.90	-
Nov	2675.0	1850.30	4255.00	2906.0	-	1.60	3.31	3.45	1.92	-
Dec	3113.0	2554.88	6104.00	2601.0	-	1.63	4.02	3.40	2.11	-
Tot/Av.	**21496.1**	**40042.92**	**85370.8**	**47921.54**	**30156.0**	**1.63**	**2.65**	**3.85**	**2.59**	**2.13**