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Effect of Medium Irrigation Project on Recharge of Ground Water in its Vicinity : A Case Study of Anjani Irrigation Project in Erandol Tehsil of Jalgaon District (MS)

Arvind A. Badgujar

Associate Professor, YCSP Mandal's DDSP College, Erandol, Dist. Jalgaon (MS)

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***Corresponding Author**
Email: aabddsp[at]gmail.com

ABSTRACT

The cost efficiency of Minor irrigation project is important aspect as it evaluates viability of the project. Groundwater recharge and change in cropping pattern (from subsistence to commercial) are two important aspects. The present study will evaluate the rationality of Anjani Minor Irrigation project by using one aspect, i.e. groundwater recharge. The data is collected from primary and secondary sources. The level of groundwater is measured in selected wells. The spatio-temporal change for the considered period 2005 to 2018 (i.e. before and after the construction of the irrigation project) is calculated which suggests increase in level of groundwater due to recharged by Anjani irrigation project. The percentage increase in ground water level is more than 100 percent in the villages located nearer to the reservoir. Increase in ground water level has changed the pattern of agricultural landuse in the vicinity of the project.

1. Introduction

Rapid industrial development, urbanization and increase in agricultural production have led to freshwater shortages in many parts of the world. To proper supply of water for various purposes like agricultural, domestic and industrial, a greater emphasis is being laid for a planned and optimal utilization of water resources. The water requirement for agriculture, municipal and industries is larger than the annual recharge. This may lead to depletion of ground water. On other hand, continuous withdrawals from groundwater reservoir in excess of replenish able recharge may result in lowering of water table. (Pande and Moharir , 2013)

Though the advancement in agricultural technology has been impressive, in many regions poor irrigation management has resulted in considerable depletion of the groundwater table, damaged soils and deterioration in the water quality, making the availability of water in the future highly uncertain. Keeping in mind the scarcity of available water resources in the near future and it impending threats, it has become imperative on the part of water scientists as well as planners to quantify the available water resources for its judicial use (Sreekanth et al. 2009).

In addition to human effects, groundwater fluctuates naturally in response to a sequence of climatic events and to constraints imposed by hydrogeologic and topographic characteristics. Groundwater recharge is largest during late fall, winter, and spring months, when plants are dormant and evaporation rates are small. In the summer when evapo-transpiration rates exceed available moisture from precipitation, recharge to the water table in negligible and groundwater levels decline (Korkmaz 1998).

2. Methodology

The data for the present work is collected from a number of sources, which includes both published and unpublished data and an intensive fieldwork is also undertaken. An attempt has been made to analyze and interpret data thus collected scientifically and objectively by applying suitable statistical and cartographic techniques.

For understanding the physiography and drainage system of study region, Arial Photographs, Landsat Imageries and SOI toposheets are used. The slope and various aspects of Anjani river is explained. The hinterland of the project is divided into various sectors according the distance from the site of Project. The well and tube-well will be visited in each sector to measure the level of groundwater. GPS technology is used for locating the wells and tube-wells. The previous level of ground water is based on past observations of the farmers.

Maps, tables and graphs are used to explain the facts more systematically and scientifically. References are mentioned at the end of each chapter while a consolidated bibliography including books, journals, reports, website link etc. is give in the end of the work.

3. Study Region

The study region lies in Erandol tehsil of Jalgaon district in Maharashtra state. Erandol tehsil is located in the central part of Jalgaon district and is mainly flank by rivers Girna and Anjani. Girna river flows along the eastern border of the tehsil.

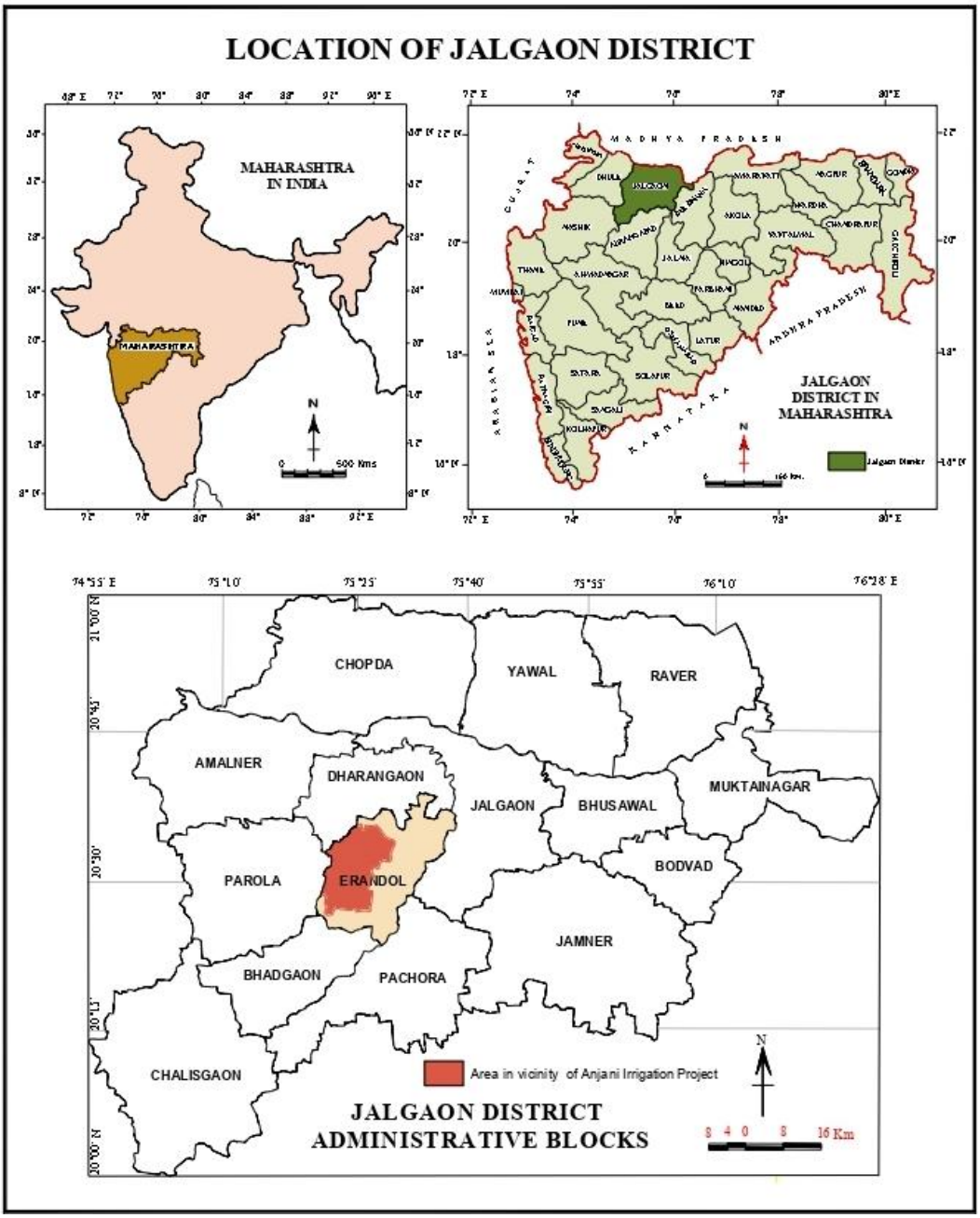

Fig. No. 1

Erandol is situated in the Tapi valley of the Deccan Plateau, between the Satpura hills and Ajanta hills. It has an average elevation of 227 m (744 feet). The Anjani River passes through the town, and the Anjani Dam lies nearby. National Highway 6, which connects Mumbai and Nagpur, links Erandol with Dhule to the west and Jalgaon to the east.

Table No. 1 : Details of Anjani Project

Sr. No.	Criteria	Actual	Projected (As per increased height)
I	**Location**		
1.	River name	Anjani	--
2.	Village	Palasdal Tal. Erandol	--
3.	Latitude	20^0 54' 00''	--
4.	Longitude	75^0 19' 00''	--
II	**Year of work commencement**	**1992**	
III	**Important Levels (Base Levels)**		
1.	River's bed level	216.10m	216.10m
2.	Drainage top level	217.92m	220.00m
3.	Minimum water level	222.435m	222.435m
4.	Full reservoir level (FRL)	225.920m	228.00m
5.	Maximum water level (MWL)	227.310m	229.22m
6.	Top Bank Level (TBL)	229.870m	231.70m

IV	**Water Discharge**		
1.	Total Catchment Area	234.34 km^2	234.34 km^2
2.	75 % Water discharge	24.54 Mm^3	67.45 Mm^3
3.	Storage capacity of Project	19.392 Mm3	36.78 Mm3
4.	Live Storage	24.54 Mm^3	24.54 Mm^3
5.	Dead Storage	24.54 Mm^3	24.54 Mm^3
V	**Reservoir and Dam**		
1.	Type of Dam	Composite Dam	
2.	Height of Dam	13.77 m	15.60 m
3.	Length of Dam		
	Soil Dam	3971 m	4516 m
	Stone Dam	46 m	46 m
4.	Crest level of Spillway	46 m	46 m
5.	Position of Spillway	Centrally Location	
6.	Type of Spillway	Ogee Shapped	
7.	No. and Size of gates	No. 03, 12 x 8 m	
8.	Water spread area	678 hectare	980 hectare
9.	Villages submerged	Dharagir, Vaddhanori	Hanmankhede Bk, Hanmantkhede Majre, Sonbardi
10.	Forested area submerged	Nil	Nil
VI	**Ayacut**		
1.	Tehsil	Erandol	Erandol
2.	Gross Command Area	3840 Ha	10144 Ha
3.	Cropped Command Area	3567 Ha	9393 Ha
4.	Irrigated Command Area	2831 Ha	4624 Ha
5.	Irrigation Potential	3000 Ha	7902 Ha
6.	Right Canal		
	Length	8.755 km	11.28 km
	Discharge	0.92 Cumecs	6.82 Cumecs
	Irrigated Area	843 Ha	5125 Ha
7.	Left Canal		
	Length	9.96 km	14.0 km
	Discharge	1.33 Cumecs	2.814 Cumecs
	Irrigated Area	1988 Ha	2330 Ha

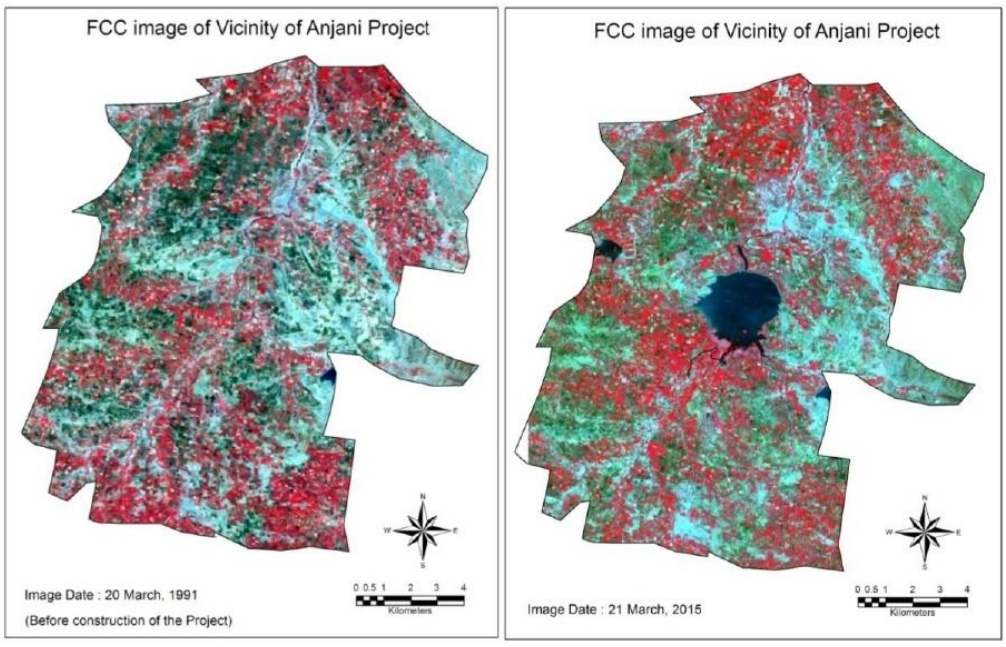

Fig. No. 2

4. Discussion

To understand the effect of Anjani irrigation project on the level of ground water in the vicinity, it was required to verify the water table levels of wells in the surrounding region. For this purpose, as per the table given below, total 57 wells were selected for the field study. The selected wells were visited twice, one before the onset of monsoon (in May) and second after the monsoon (in December). The water levels of the wells were measured manually with the help of measuring tapes. It was practically impossible to measure the levels of water levels of wells in the past for the year 2005 (i.e. before the construction of Anjani irrigation project). Therefore, the farmers were asked about the average water level in the year 2005. The farmers suggested with imperial evidences.

The levels of water in the visited wells were measured and these are displayed in table No. 2. The ground water level

is expressed in meter below ground level. The table shows pre-monsoon and post-monsoon levels of ground water in 2005 and in the year 2018. It is evident from the table that the ground water level decreases as the distance from the reservoirs increases. The Fig. No. 4 also suggests the decrease of ground water level as the distance from the reservoir increases. It is naturally found that ground water level before onset of monsoon is lower than that after the monsoon season. The same results are also found in the study region.

Table No. 2 Vicinity of Anjani Project : Number of Wells Selected for Field Study

Sr. No.	Villages	No. of Wells	Sr. No.	Villages	No. of Wells
1	Erandol	07	13	Farkande	02
2	Vikharan	03	14	Nandkhurde Bk.	02
3	Umarde	02	15	Nandkhurde Kh.	02
4	Ganeshnagar	02	16	Sonbardi	01
5	Khadke Sim	02	17	Hanmantkhade Majre	02
6	Khadke Kh.	02	18	Hanmantkhede Bk.	02
7	Vankothe	02	19	Jalu	03
8	Bambhori Kh.	02	20	Dharagir	01
9	Javkhede Sim	03	21	Patarkhede	02
10	Anturli Kh.	03	22	Palasdal	02
11	Kasoda	04	23	Bhalgaon Bk.	02
12	Janfal	02	24	Nandgaon Bk.	02

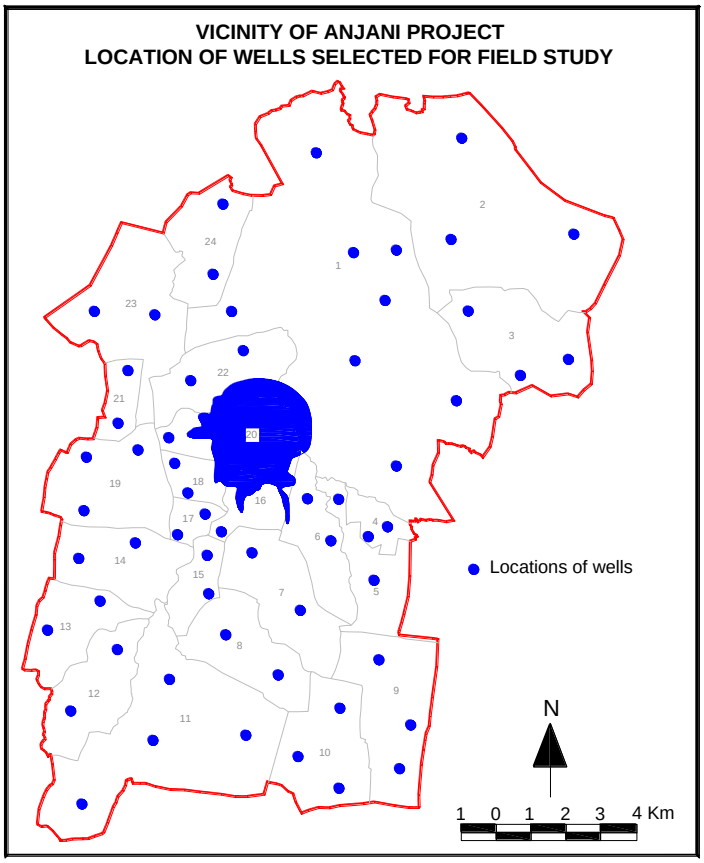

Fig. No. 3

Table No. 3 Vicinity of Anjani Project : Ground Water Level, (2005-2018)

Sr. No.	Villages	Ground water level in 2005 *(in mbgl)*		Ground water level in 2018 *(in mbgl)*	
		Pre-Monsoon	*Post-Monsoon*	*Pre-Monsoon*	*Post-Monsoon*
1	Erandol	7.5	6.5	5.4	4.6
2	Vikharan	7.1	6.3	5.9	5.7
3	Umarde	8.2	7.0	6.4	5.8
4	Ganeshnagar	7.5	6.9	4.8	4.3
5	Khadke Sim	7.6	6.3	6.7	5.2
6	Khadke Kh.	8.6	7.5	6.4	4.2
7	Vankothe	8.1	7.2	6.4	4.8
8	Bambhori Kh.	8.2	7.5	6.9	5.9

9	Javkhede Sim	8.4	7.9	7.4	6.1
10	Anturli Kh.	10.2	9.4	8.3	6.3
11	Kasoda	11.5	9.5	8.3	6.4
12	Janfal	11.0	10.2	8.4	6.2
13	Farkande	10.7	10.2	8.6	6.1
14	Nandkhurde Bk.	9.7	8.3	7.9	5.8
15	Nandkhurde Kh.	10.2	8.1	7.4	5.3
16	Sonbardi	12.8	10.5	8.1	3.7
17	Hanmantkhade Majre	9.2	7.6	5.6	4.4
18	Hanmantkhede Bk.	9.4	7.8	5.1	3.8
19	Jalu	10.2	8.9	6.1	4.9
20	Dharagir	9.5	7.6	5.1	3.4
21	Patarkhede	11.5	8.2	6.2	4.6
22	Palasdal	9.5	7.6	5.4	3.4
23	Bhalgaon Bk.	10.5	8.4	6.8	5.4
24	Nandgaon Bk.	11.8	9.7	7.6	5.3

Source : Records from tehsil office, Erandol; and Field observation.
mbgl – meter below ground level

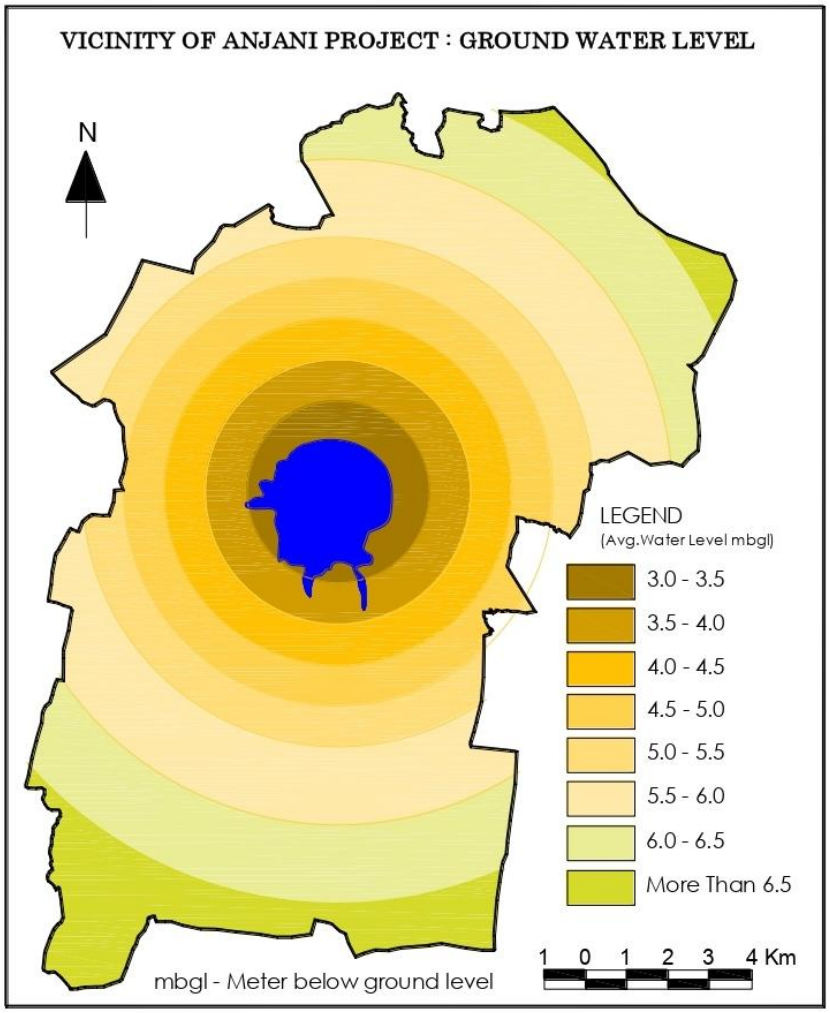

Fig. No. 4

The spatio-temporal changes in level of ground water are calculated with the help of measurement of water level in the wells at the two point of times in a year, i.e. at pre-monsoon and at post-monsoon. For calculating spatio-temporal changes, water levels in 2005 are taken as base and the increase is calculated in percentage and explained as spatio-temporal changes. The Fig. No. 5 shows spatio-temporal changes in level of ground water in the study region for the period of before and after the construction of Anjani irrigation project. The graph shows that the spatio-temporal changes are lower in the areas which are comparatively away from the site of the irrigation project while higher increase in found near to the site of irrigation project.

Table No. 4 Vicinity of Anjani Project : Spatio-temporal Change in Ground Water Level, (2005-2018)

Sr. No.	Villages	Spatio-temporal change *(in %)*	
		Pre-Monsoon	*Post-Monsoon*
1	Erandol	38.89	41.30
2	Vikharan	20.34	10.53
3	Umarde	28.13	20.69
4	Ganeshnagar	56.25	60.47
5	Khadke Sim	13.43	21.15
6	Khadke Kh.	34.38	78.57
7	Vankothe	26.56	50.00
8	Bambhori Kh.	18.84	27.12
9	Javkhede Sim	13.51	29.51
10	Anturli Kh.	22.89	49.21
11	Kasoda	38.55	48.44
12	Janfal	30.95	64.52
13	Farkande	24.42	67.21
14	Nandkhurde Bk.	22.78	43.10
15	Nandkhurde Kh.	37.84	52.83
16	Sonbardi	58.02	183.78
17	Hanmantkhade Majre	64.29	72.73
18	Hanmantkhede Bk.	84.31	105.26
19	Jalu	67.21	81.63
20	Dharagir	86.27	123.53
21	Patarkhede	85.48	78.26
22	Palasdal	75.93	123.53
23	Bhalgaon Bk.	54.41	55.56
24	Nandgaon Bk.	55.26	83.02

Source : Records from tehsil office, Erandol; and Field observation.

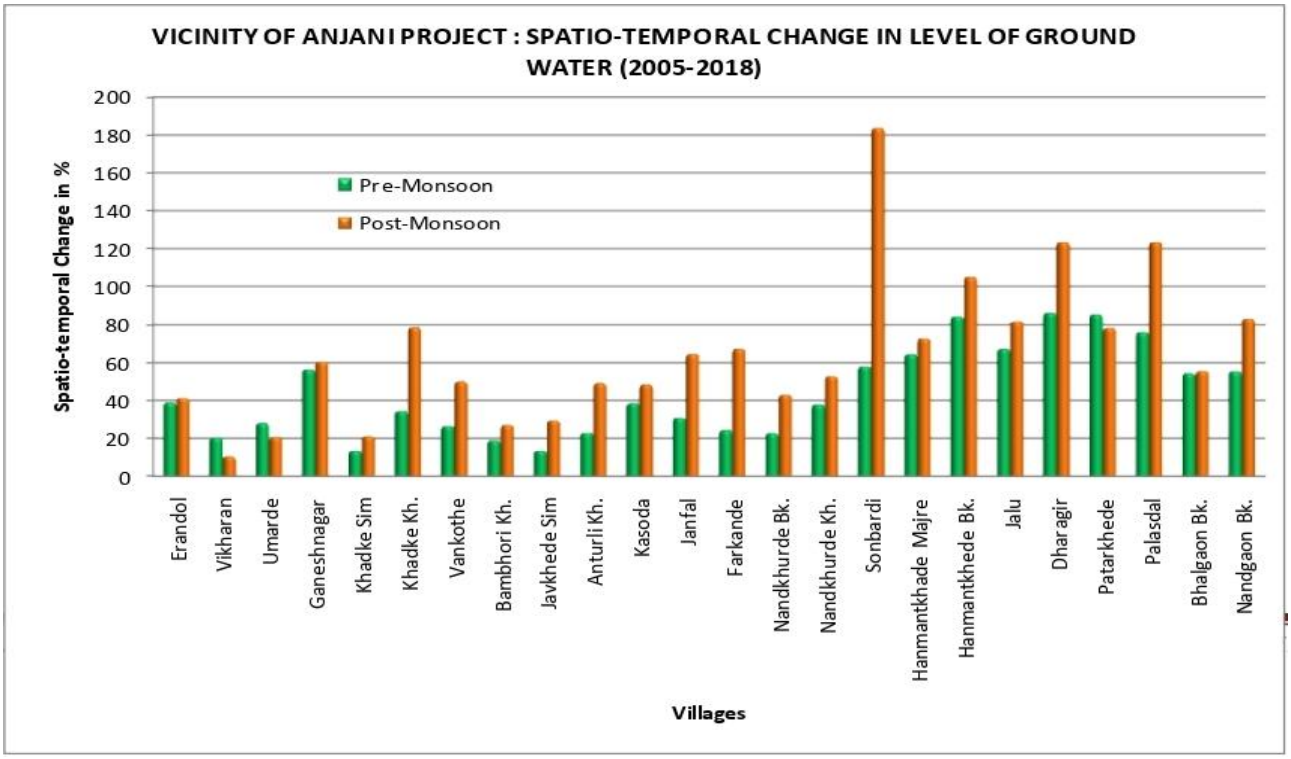

Fig. No. 5

5. Conclusion

The spatio-temporal change is level of ground water is low in Erandol, Vikharan, Umarde, Ganeshnagar, Khadke Sim, Khadke Kh., Vankothe, Bambhori Kh., Anturli Kh., Kasoda, Janfal, Farkande Nandkhurde Bk. and Nandkhurde Kh. while higher increase in the Sonbardi, Hanmantkhede Majre, Hanmantkhede Bk. Jalu, Dharagir, Patarkhede, Palasdal, Bhalgaon Bk. and Nandgaon Bk. villages which are located comparatively near to the site of the irrigation project.

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