

# Assessment of Groundwater Level Fluctuation After Construction of Farm Ponds – A Case Study of Chotila Taluka, Gujarat

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**Abstract**— Groundwater scarcity has emerged as a major concern in semi-arid regions due to irregular rainfall, over-extraction of groundwater, and increasing agricultural demand. Farm ponds are small-scale rainwater harvesting structures constructed primarily to support agriculture; however, they also play an important role in groundwater recharge through seepage and percolation. This study assesses the impact of farm ponds on groundwater level fluctuation in Chotila Taluka of Gujarat. Groundwater level data from observation wells located near farm ponds were analyzed for pre-monsoon and post-monsoon periods over multiple years. Rainfall data were also examined to understand recharge behavior. The results indicate a noticeable improvement in groundwater levels after construction of farm ponds, particularly during post-monsoon periods. The study highlights the effectiveness of farm ponds as decentralized and sustainable groundwater recharge structures in drought-prone regions.

**Index Terms**— Farm Pond, Groundwater Recharge, Water Level Fluctuation, Rainwater Harvesting, Chotila Taluka, Gujarat

## I. INTRODUCTION

Groundwater is the primary source of water for irrigation and domestic use in many parts of Gujarat. Semi-arid regions such as Chotila Taluka experience highly variable rainfall and limited surface water availability, resulting in heavy dependence on groundwater resources. Over-extraction of groundwater has led to declining water tables, increased pumping costs, and reduced water security.

Artificial recharge techniques are increasingly adopted to mitigate groundwater depletion. Farm ponds are small rainwater harvesting structures constructed on agricultural land to store surface runoff during the monsoon season. In addition to providing protective irrigation during dry spells, farm ponds contribute to groundwater recharge through infiltration and seepage. Their decentralized nature makes them suitable for widespread implementation in rural and agricultural landscapes.

The present study focuses on evaluating the impact of farm ponds on groundwater level fluctuation in Chotila Taluka, Gujarat, where farm ponds have been constructed under government-supported agricultural and watershed development schemes.

## II. STUDY AREA

Chotila Taluka is located in Surendranagar district of Gujarat, India, approximately between 22°24' North latitude and 71°12' East longitude. The region experiences a semi-arid climate with an average annual rainfall of about 490 mm, characterized by high inter-annual variability. Most of the rainfall occurs during the southwest monsoon season.

Geologically, the area consists mainly of weathered and fractured rock formations with moderate groundwater potential. Agriculture is the dominant land use, and groundwater is the primary source of irrigation and domestic water supply. Frequent droughts and declining groundwater levels have prompted the adoption of rainwater harvesting and artificial recharge measures such as farm ponds.

## III. DETAILS OF FARM PONDS

The Farm ponds in the study area are generally excavated earthen structures constructed on individual agricultural fields or along natural drainage paths. These ponds are designed to collect surface runoff generated during rainfall events and store water for supplementary irrigation.

Several farm ponds constructed between 2002 and 2010 were considered for this study. Observation wells located within the effective influence zone of these ponds were identified. The recharge efficiency of farm ponds depends on factors such as soil permeability, pond size and depth, rainfall intensity, and maintenance practices such as desilting.

## IV. METHODOLOGY

The methodology adopted for this study includes the following steps:

1. Selection of Observation Wells: Observation wells located near farm ponds and within their influence zone were selected for groundwater level monitoring.

2. Data Collection: Groundwater level data were collected for pre-monsoon and post-monsoon periods over multiple years. Rainfall data for the corresponding period were obtained from nearby rain gauge stations.

3. Data Analysis: Seasonal and long-term groundwater level fluctuations were analyzed. Comparative analysis was carried out to assess groundwater levels before and after construction of farm ponds using tables and graphs.

4. Impact Assessment: The impact of farm ponds on groundwater recharge was evaluated based on changes in groundwater levels over time.

## V. DATA ANALYSIS AND RESULTS

Groundwater level data collected from observation wells indicate a gradual improvement in groundwater levels after the construction of farm ponds in Chotila Taluka. Post-monsoon groundwater levels are consistently higher than pre-monsoon levels, indicating effective recharge due to stored surface runoff.

Long-term analysis shows a reduction in groundwater depletion rates and improved stability of water tables. Areas with a higher density of farm ponds exhibit better groundwater conditions compared to areas without such structures.

1. The average rainfall in the area obtained with the help of Meteorological data of Chotila as shown in Figure 1 for the period of 9 years span (2001 to 2009)

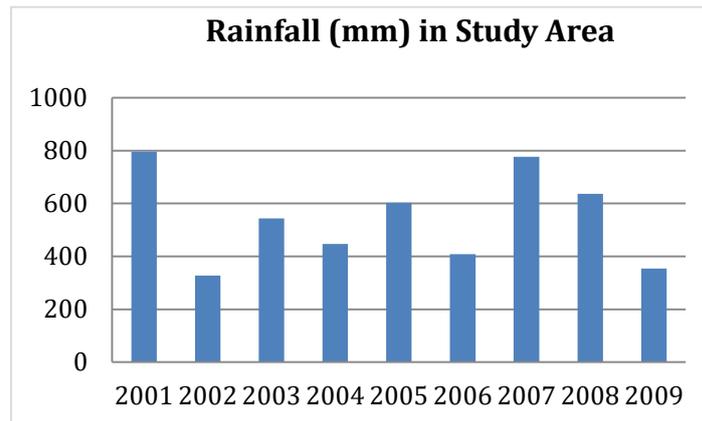


Figure 1. Yearly Average Rainfall

TABLE 1. STATEMENT SHOWING THE PRE-MONSOON AND POST-MONSOON WATER DEPTH IN METER BELOW GROUND LEVEL OF OBSERVATION WELLS

Name of Village	Code of Well in Nearby Vicinity	Date Of Completion of Pond	Year 2000		Year 2003		Year 2006		Year 2009	
			Pre	Post	Pre	Post	Pre	Post	Pre	Post
Mordhla	BAS6	06-07-04	4.40	3.52	9.40	8.80	3.40	1.65	2.70	2.10
Morthda	BAS7	14.05.09	21.65	18.75	23.0	15.5	19.7	8.45	15.8	13.1
Morthda	SST8	15-06-04	13.15	10.32	12.4	11.8	4.00	3.70	6.25	4.70
Chotila	SST9	22.08.05	16.00	15.52	16.3	15.5	15.6	14.7	13.2	9.10
Chotila	BAS8	01-07-01	17.35	11.40	12.5	10.5	12.6	4.85	12.5	6.85

## VI. DISCUSSION

The improvement in groundwater levels can be attributed to enhanced infiltration from farm ponds. Farm ponds act as decentralized recharge systems, distributing recharge across agricultural landscapes. This reduces runoff losses and increases storage

The effectiveness of farm ponds is influenced by local hydro-geological conditions, soil characteristics, rainfall distribution, and maintenance practices. Regular desilting and proper design are essential to maximize recharge potential.

## VII. CONCLUSION

The study concludes that farm ponds have a positive impact on groundwater level fluctuation in Chotila Taluka, Gujarat. Improved post-monsoon groundwater levels and enhanced long-term groundwater stability were observed after the construction of farm ponds.

Farm ponds are cost-effective, farmer-friendly, and sustainable rainwater harvesting structures. Their widespread adoption can play a significant role in groundwater conservation and sustainable agricultural development in semi-arid regions.

VIII. REFERENCES

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