International Journal of Geography, Geology and Environment

P-ISSN: 2706-7483
E-ISSN: 2706-7491
NAAS Rating (2025): 4.5
IJGGE 2025; 7(8): 120-125
www.geojournal.net
Received: 15-06-2025
Accepted: 19-07-2025

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A geographical study of minor irrigation projects in Ahmednagar district (Maharashtra state)

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DOI: https://www.doi.org/10.22271/27067483.2025.v7.i8b.401

Abstract
This research paper focus on the spatial distribution, types, and impact of these projects on the region's water resources and agriculture. Ahmednagar district situated in a rain shadow area, relies heavily on irrigation due to its erratic rainfall and drought conditions. The study would analyze the role of minor irrigation projects in supplementing surface and groundwater resources, assess their effectiveness in drought mitigation, and examine their impact on agricultural practices and livelihoods.

Keywords: Irrigation, projects, drought, agriculture, surface water, ground water

Introduction

Minor irrigation projects will play a key role in addressing the need of domestic, irrigation and industrial. The water source for a minor irrigation project could be either surface or ground water. In this research paper water management through Minor projects is discussed. Water management is important since it helps determine future domestic, irrigation and industrial expectations. Water management is the management of water resources under set policies and regulations. Water, once an abundant natural resource, is becoming a more valuable commodity due to droughts and overuse [1].

Geographical study of minor irrigation projects in Ahmednagar district is important. Ahmednagar district is a large and important district of Maharashtra, and minor irrigation projects are important to improve irrigation facilities here. This geographical study includes the locations of these projects, their capacity, and the area irrigated by them [2].

In Maharashtra, minor irrigation projects are defined as those with a culturable command area (CCA) of 2,000 hectares or less. These projects typically utilize water tanks, small canals, and groundwater systems as their primary water sources [3].

Some major Minor irrigation projects in Ahmednagar district

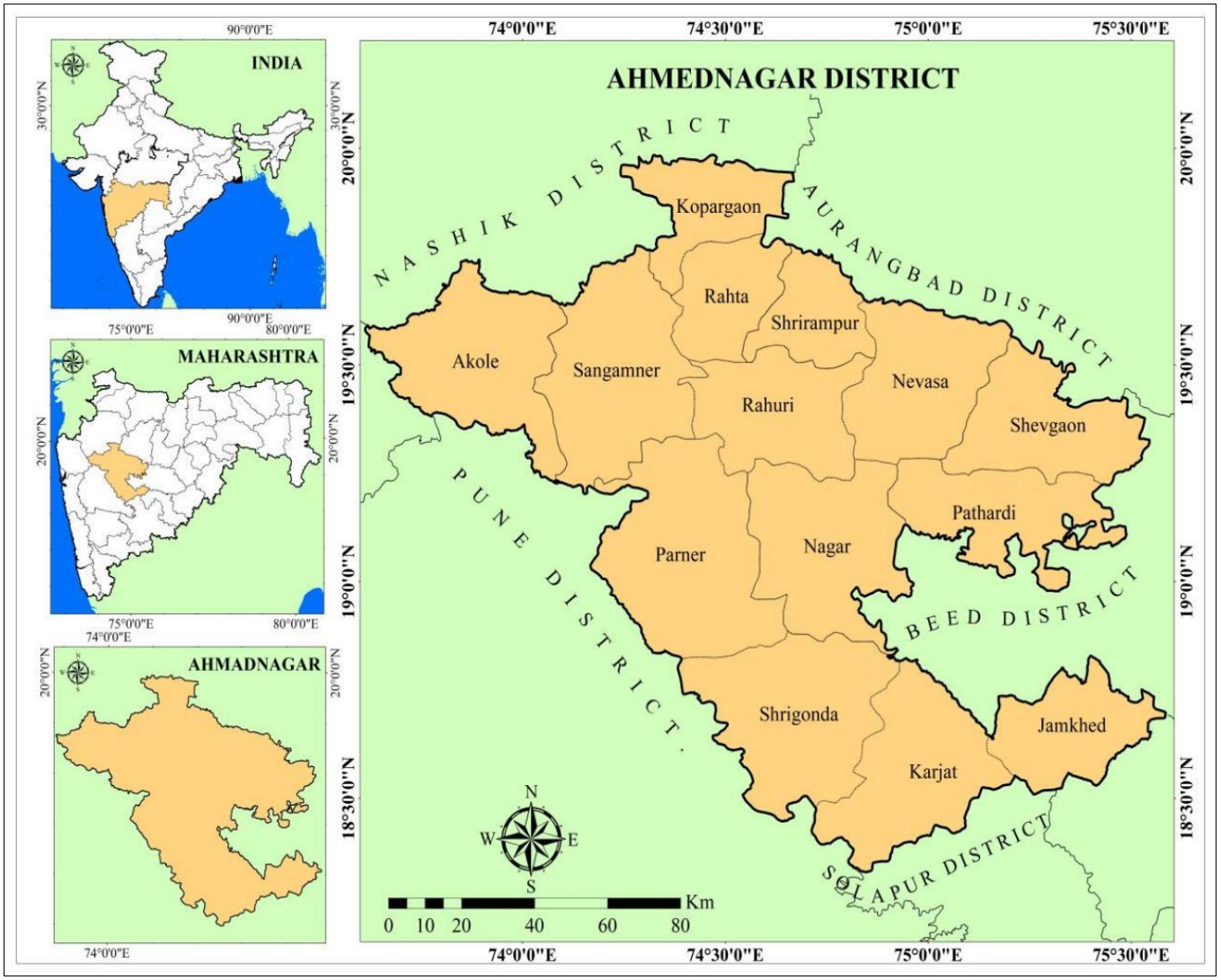
- **Mula Irrigation Project:** This is a large irrigation project, but there are also small ponds and dams under it which are useful for irrigation.
- **Kukdi Irrigation Project:** This is also a large project, and there are also small projects associated with it.
- **Tajnapur Lift Irrigation Scheme:** This scheme has been entrusted to Nandur Madhameshwar Irrigation Department, Vaijapur [4].

Importance of the Study

- **Water Management:** By studying Minor irrigation projects, it is possible to estimate the availability of water and plan irrigation accordingly
- **Drought Relief:** Based on this study, it becomes easier to provide water to drought-affected areas.
- **Agricultural Development:** With the improvement of irrigation facilities, it is possible to get good production in agriculture and thus agricultural development can be achieved.
- **Environmental Protection:** With proper water management, the ground water level improves and the environment is protected [5].

Study Area: Ahmednagar district is lying between 18^0 2' to 19^0 9' north latitudes and 73^0 -9' to 75^0 -5' East longitudes. It is situated partly in the upper Godavari basin and partly in the Bhima basin, the inter-fluve in between forming the extensive Ahmednagar plateau. The district is very irregular but compact in shape and somewhat resembling a slanting crosses with a length of 200 km and breadth of 210 km. It is bounded on the north by Igatpuri, Sinnar and Yeola tahsils of Nashik district; on the North-East by Vaijapur, Gangapur and Paithan tahsils of Aurangabad district on the East by Georai, Bhir and Ashti tahsils of Bhir district; Bhum and Paranda tahsils of Osmanabad district; on the south by the Karmala tahsil of Solapur district; and on the South-West by Murbad and Shahapur tahsils of Thane district [6]. It has the total area 17035 sq.km. Ahmednagar is the largest district of the state in area. It occupies somewhat central position in Maharashtra.The total area of Ahmednagar district is 17,048 square kilometers. The district has 14 talukas and a population of 4,543,159. Some parts of the district are hilly, while some parts are flat [7].

Map 1.1 Location Map of Ahmednagar District



Objectives of the Study

- To study the impact of physical factors on distribution of minor projects in Ahmednagar District,
- To study the distribution of minor projects in Ahmednagar District,
- To study the changes in number of minor irrigation projects in Ahmednagar District,
- Identifying the various types of minor irrigation projects prevalent in the district and understanding their respective roles in water management.

Methodology

A comprehensive geographical study would employ a combination of primary and secondary data sources. This would include:

The secondary data was collected during the period of 1995. The data regarding minor projects as well as its capacity of water storage, utilization of water and its management was used for the study. The secondary data was collected from the sources, like- socio-economic review, District Statistics Department, District Census Handbook, Dept. of Irrigation., Water and Land Management Institute, Aurangabad, Hand books, periodicals and reports published by different agricultural and irrigation departments. The collected data was analyzed by using statistical methods like measures of central tendency, measures of deviation, correlation, and co-efficient techniques. The cartographic techniques like choropleth maps, Bar graphs, divided circle, Line graphs, figures and pictures was used to depict the statistical data for the effective presentation of research work.

Method of Analysis

The data related to the study feed into a computer and verified in order to eliminate errors. One way and two-way tabular analysis with appropriate statistics like percentage, average, and co-relation used in the analysis of data.

Data Analysis

The study is limited to only working capital management covering various ratios related to working capital. The tool for appraisal of working capital management is ratio analysis. The data has analyzed with the help of financial and statistical tools *viz*. ratio analysis, percentage and average, Standard Deviation, Coefficient of Variation and Compound annual growth rate (CAGR). Graphs and Diagrams have presented to illuminate the facts and figures.

Arithmetic Mean

Arithmetic mean gives a single value to describe the whole data. Simple arithmetic mean of each series of different ratios has been obtained by adding the values of observations and dividing it by the number of observations.

Standard Deviation: The standard deviation is the most extensively used for calculating significant evaluation of deviation. The standard deviation, also well-known as root mean square deviation, is generally expressed by the Greek letter σ this can be calculated by following formula:-

$$\sigma = \sqrt{\frac{\sum(x-\bar{x})^2}{N-1}}$$

Where, **Σ** = Summation, **X** = Individual value, $\bar{X}$ = Mean of all values, **N** = Sample size (Number of values) [8]

Data Analysis and Interpretation: Investigating the primary water sources for these projects (e.g., groundwater, surface runoff) and assessing their recharge potential, especially in relation to rainfall patterns and geological formations [9].

By integrating these approaches, the geographical study of minor irrigation projects in Ahmednagar district can provide valuable insights into the role of these projects in sustainable water management and agricultural development in a drought-prone region [10].

Table 1.1: Tehsil-wise Number of Minor Irrigation Projects in Ahmednagar District

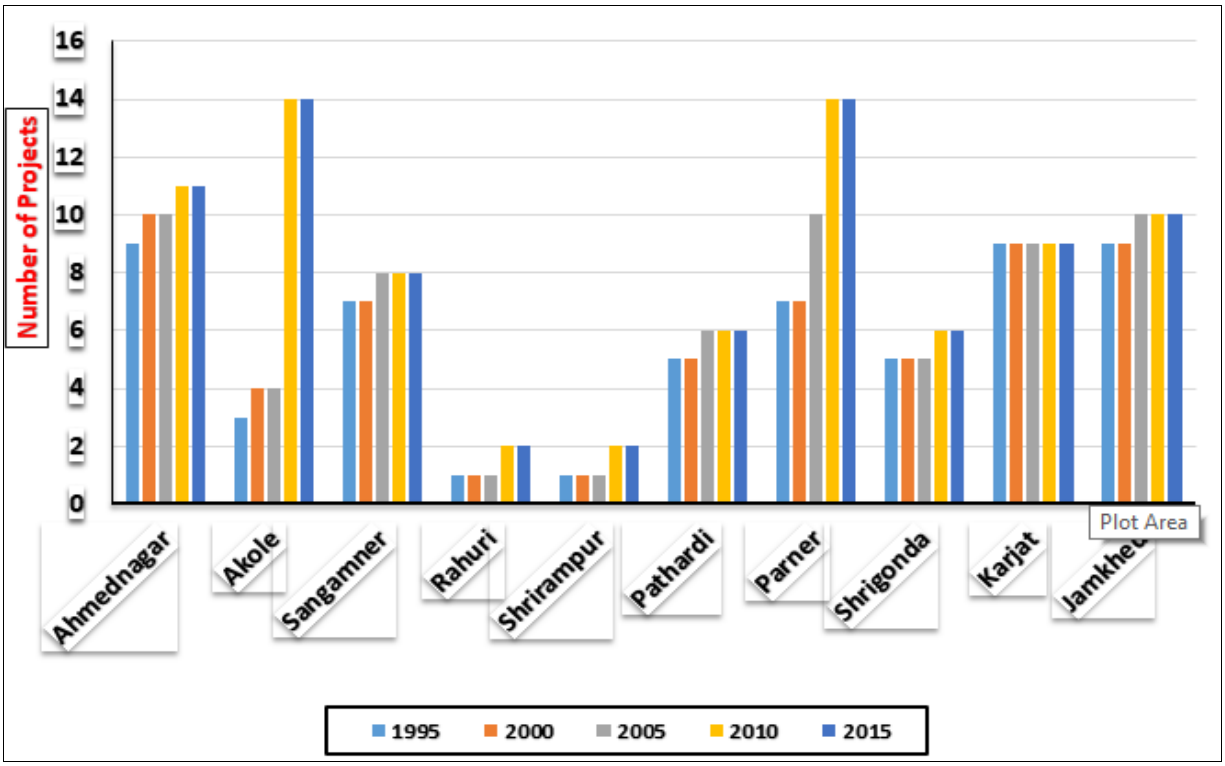
Year	Nagar	Akole	Sangamner	Rahuri	Shrirampur	Pathardi	Parner
1995	9	3	7	1	1	5	7
1996	9	3	7	1	1	5	7
1997	9	3	7	1	1	5	7
1998	9	3	7	1	1	5	7
1999	9	4	7	1	1	5	7
2000	10	4	7	1	1	5	7
2001	10	4	7	1	1	5	9
2002	10	4	8	1	1	5	9
2003	10	4	8	1	1	6	10
2004	10	4	8	1	1	6	10
2005	10	4	8	1	1	6	10
2006	10	5	8	1	1	6	10
2007	10	6	8	1	1	6	10
2008	10	6	8	2	1	6	10
2009	10	14	8	2	2	6	10
2010	11	14	8	2	2	6	14
2011	11	14	8	2	2	6	14
2012	11	14	8	2	2	6	14
2013	11	14	8	2	2	6	14
2014	11	14	8	2	2	6	14
2015	11	14	8	2	2	6	14
Total	11	14	8	2	2	6	14
Average	10.05	7.38	7.67	1.38	1.33	5.62	10.19
SD	0.74	4.86	0.48	0.50	0.48	0.50	2.75

Conti…

Year	Shrigonda	Karjat	Jamkhed	Total	Average	SD
1995	5	9	9	56	5.60	3.13
1996	5	9	9	56	5.60	3.13
1997	5	9	9	56	5.60	3.13
1998	5	9	9	56	5.60	3.13
1999	5	9	9	57	5.70	3.06
2000	5	9	9	58	5.80	3.19
2001	5	9	9	60	6.00	3.33
2002	5	9	9	61	6.10	3.38
2003	5	9	9	63	6.30	3.47
2004	5	9	9	63	6.30	3.47
2005	5	9	10	64	6.40	3.57
2006	5	9	10	65	6.50	3.50

2007	5	9	10	66	6.60	3.47
2008	5	9	10	67	6.70	3.30
2009	6	9	10	77	7.70	3.77
2010	6	9	10	82	8.20	4.29
2011	6	9	10	82	8.20	4.29
2012	6	9	10	82	8.20	4.29
2013	6	9	10	82	8.20	4.29
2014	6	9	10	82	8.20	4.29
2015	6	9	10	82	8.20	4.29
Total	6	9	10	82		
Average	5.33	9.00	9.52			
SD	0.48	0.00	0.51			

Source: Computed by Researcher from Minor Irrigation Department no.2, Sangamner. [10]



Graph 1.1: Tehsil-wise Number of Minor Irrigation Projects in Ahmednagar District

Table 1.2: Map Index of Minor Irrigation Projects in Ahmednagar District

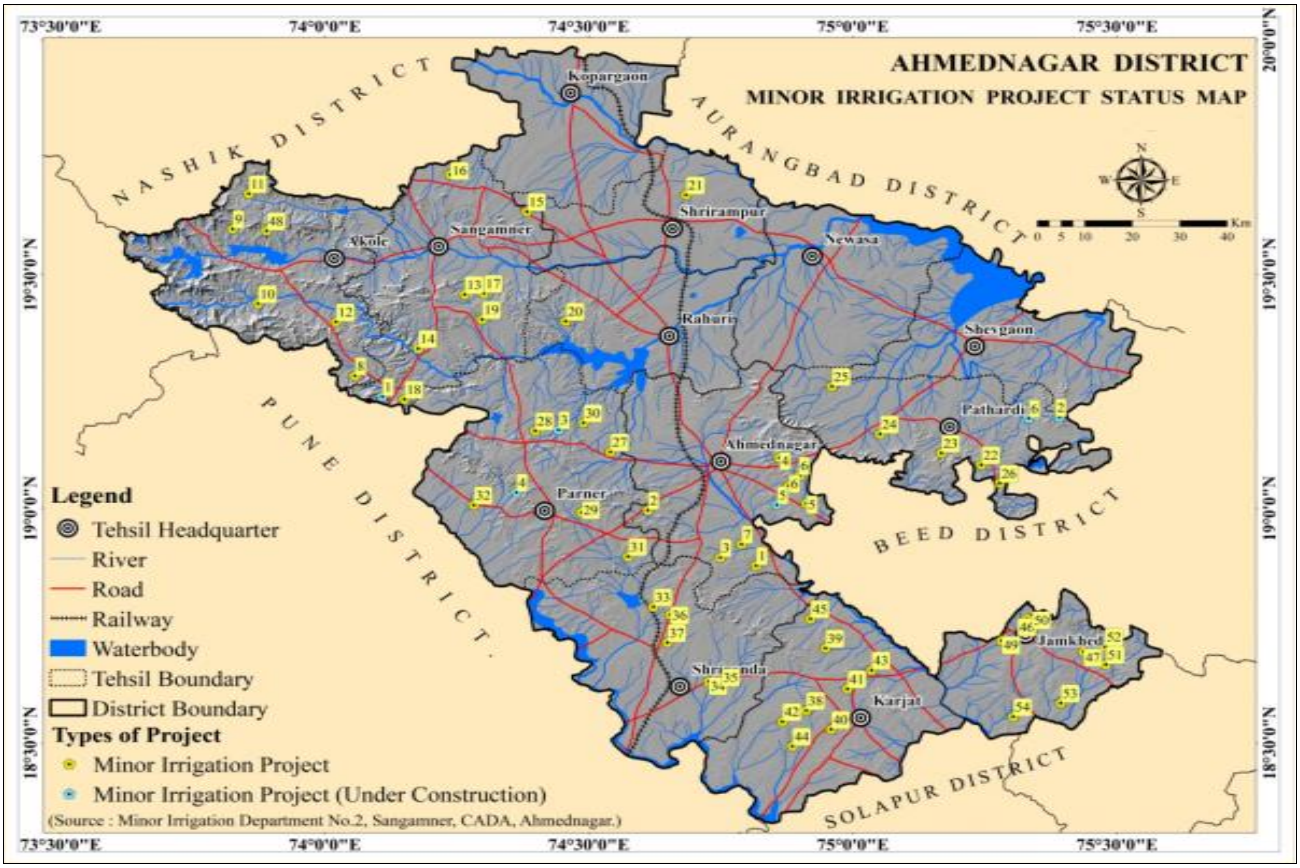
ID	Name of the Project	ID	Name of the Project
Minor Irrigation Project (Completed)		**31**	Rui Chatrapati
1	Gunwadi	32	Loni Mawala
2	Kamargaon	33	Kolgaon
3	Deoulgaon Sidhi	34	Autewadi
4	Bardari	35	Ghodegaon
5	Chinchodi Patil	36	Limjewadi
6	Bhatodi	37	Pargaon Sudrik
7	Wadgaon Tandali	38	Durban
8	Belapur Badagi	39	Gurav Pimpri
9	Waki	40	Therodi
10	Ghotith	41	Bahirobawadi
11	Padoshi	42	Rakshsawadi Bk
12	Bori	43	Takli Khandeshwari
13	Ambhore	44	Yesodi
14	Ambi Khalsa	45	Thergaon
15	Lohare Kasar	46	Bhutwada
16	Chincholi Gurav	47	Naygaon
17	Malunj	48	Pimpalgaon
18	Kelewadi	49	Ratnapur
19	Sakur	50	Jamkhed Dhotre
20	Kolyachi Wadi	51	Mohari
21	Muthewadgaon	52	Telangshi

22	Kutarwadi	53	Jawalke
23	Mohori	54	Munjewadi
24	Ghatshiras	Minor Irrigation Project (Under Construction)	
25	Shiral	1	Ambi Dumala
26	Pimpalgav Tappa	2	Mindsangavi
27	Bhalawani	3	Dhoki 2
28	Tikhol	4	Jadhavwadi
29	Hunga	5	Dashmi Gavhan
30	Dhoki 1	6	Bhatewadi

Source: Computed by Researcher from Minor Irrigation Department no.2, Sangamner [11].

A map index help us to find specific spot on the map using the grid. A map's legend explains what the symbols on a map used. The code numbers in the map show the names of the minor irrigation projects in the Ahmednagar district as shown in the map index. This map provides information of the irrigation project in the Ahmednagar [12].

Map 1.2 Minor Irrigation Project Status Map of Ahmednagar District



Tehsil-wise and year-wise number of minor irrigation projects in Ahmednagar district has been shown in Table and Graph 1.1. The table revealed that there is no change in the number of minor irrigation projects from 1995 to 2000 due to unconstruction of new projects. During the period of investigation, there are 82 total minor irrigation projects in the district. Out of the total 82 minor irrigation projects in the Ahmednagar District, the highest increase has been seen in the year 2010 to 2015, while other years noted a drastic changes. It can be seen from table and graph no. 1.1 that there is change in the number of projects after gap period of 5 years. The table further revealed that the highest number of minor irrigation projects was found in the tehsils of Akole and Parner whereas remaining tehsils recorded lowest numbers. It is same as 14 for both, as they having favourable sites to develop minor irrigation projects. Overall, the total number of minor irrigation projects has increased from 56 to 82 from 1995 to 2015. It is an under construction/ constructed multi-purpose minor irrigation project on the Pravara river in Ahmednagar district. It shall be the last project to be accorded the minor irrigation project status.

A large standard deviation, which is the square root of the variance, indicates that the data points are far from the mean or average and small standard deviation indicates that they are clustered closely around mean or average. Above table no. 1.1 also shows that, Average and SD of tehsil wise number of Minor Irrigation Project in Ahmednagar District. In that tehsil-wise Ahmednagar has maximum minor irrigation with average 10.05 and SD of 0.74 whereas Shrirampur has mean, SD is 1.33 and 0.48 respectively. On the other hand year-wise, since year 2010 to 2015 has maximum minor irrigation with Mean and SD is 8.20, 4.29 respectively and minimum in the year of 1995 to 1999 with Mean, SD is 5.0 and 3.13 respectively.

Conclusions

Ahmednagar district, especially the parts of Marathwada region, often faces drought-like conditions. Therefore, minor irrigation projects are important to increase water availability and improve irrigation facilities.

While geographical study of Minor irrigation projects, their locations, source of water availability, soil type, and area to be irrigated are considered. This makes it easy to select projects and implement them effectively.

Thus, the geographical study of Minor irrigation projects in Ahmednagar district is very important for the development of the district and improvement of water availability.

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