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Drainage Water Management-Sub Surface Dams to Mitigate Water Scarcity

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Abstract:

Water is a finite resource that is fundamental to human well-being and only renewable if well managed. Smart water management is a pre-condition of sustainable development. Managed efficiently, water plays a vital role in strengthening the resilience of social, economic and environmental systems in the face of rapid and unpredictable changes. The overall agriculture production and output is relying on water supply to crops. One critical problem confronting by India today is how to manage the intensifying competition for water between expanding urban centers, traditional agricultural activities and in-stream water uses dictated by environmental concerns.

Introduction:

The flow of water through well-defined channels is known as drainage 'The network of such channels is called a drainage system'.The drainage pattern of an area is the outcome of the geological time period, nature and structureof rocks, topography, slope, amount of water flowing and the periodicity of the flow. The Drainage System refers to the origin and development of the streams through time while drainage pattern means spatial arrangements and form of drainage system in terms of geometrical shapes in the areas of different rock types. Geomorphologically, the Aurangabad district comprises of varied topographic features and landscapes consisting of high hills and plains and low lying hills. Most of the hill ranges are located in the northern part of the district. The Satmala hills and Ajanta hills extend from east to west. The Satmala range encompasses several hills overlooking the Tapivalley. From west to east they are Antur (826 m amsl), Satonda (552 m amsl), Abasgand (671 m amsl) and Ajantha (578 m amsl). The Satmala hill (493 m amsl) from which name of the range is derived is situated north to Kannad town. The district is a part of the Deccan Plateau. In general, the slopes in the district are towards south and southeast. Major part of the district falls in Godavari basin with a small area in north eastern parts falling Tapi Basin. The major river in the district is the Godavari with its tributaries namely; Purna, Dudhna and Shivna rivers. The other important tributaries are Sukna, Khelna, Kham, Gulathi, Shivbhadra and Girija rivers. The soils are quite fertile and particularly suitable for cultivation of wheat, jowar, cotton, tobacco, chilies and dry land fruits. Poor rainwater management (RWM) and a resultant problems of land degradation, low agricultural productivity, food insecurity and poverty.

Methodology:

The construction of a subsurface dam generally requires cutting off where a subsurface valley is covered by an aquifer. Subsurface valleys are usually formed where the ground is undulating. Similar to surface dams, effective sites for subsurface dam development (suitable slopes) can be easily found by tracing subsurface valleys. Applied Statistical analyses for secondary data, the other data that collected include the rainfall, river discharge, and groundwater level. The collection of available data preferably goes back to the past 5 years at least. The targets of analysis are groundwater level fluctuations (seasonal and yearly) and water quality deterioration.

Study Area:

Aurangabad District

Aurangabad district is situated in the north central part of Maharashtra between North Latitude 19° 15' and 20° 40, and East Longitude 74° 37' and 75° 52'. It covers an area of 10,107 sq. km falling in parts of Survey of India Topo-sheet No. 46 L & P and 47I & M. The district is bounded by Jalgaon district in north by Nashik district in west, Ahmadnagar and Beed districts in south and Parbhani and Buldhana districts in east. The world famous Ajanta and Ellora caves are situated in Aurangabad district. There are also a few caves near Aurangabad City. Other monuments of national fame are Bibi-ka-Maqbara and Daulatabad fort.

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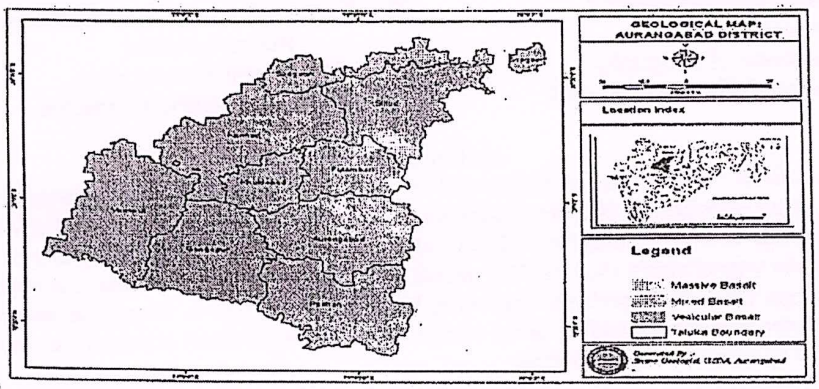
Topography of Aurangabad District:

The location of Aurangabad is on 74 to 76 Degree East longitude and 19 to 20 Degree North latitude forms the part of the vast Deccan plateau all of India and is divisional head of Marathwada region of Maharashtra State. The total area of Aurangabad region is of 10107 Sq. km. and is 3.28 % of total state. The district is surrounded by the East: Jalna district, West: Nasik &Ahmednagar, North: Jalgaon District and South Beed district.

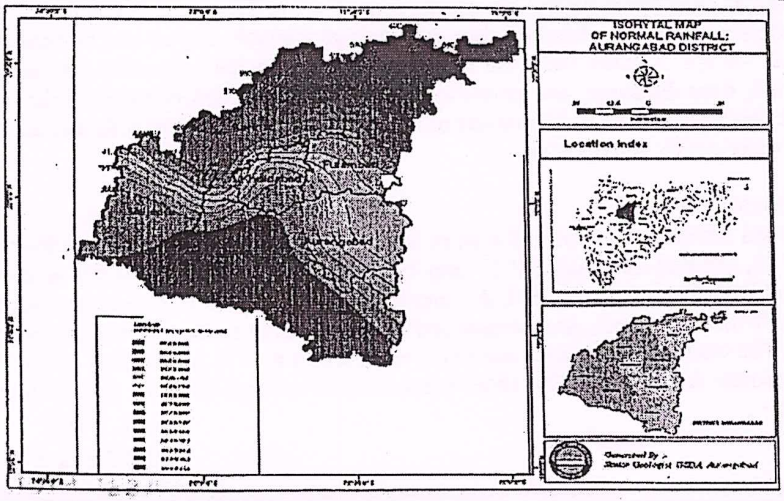


Soil plays a very important role in the agricultural activities and forest growth of the area. The fertility of the soil from agricultural point of view depends upon the texture and structure which controls the retaining and transmitting capacity of moisture and various nutrients such as nitrogen, phosphorous and potassium present in the soil. The major part of the district is covered by black cotton soil or 'Regur' formed by the weathering of Deccan Trap Basalt. It is rich in plant nutrients such as lime, magnesia, iron and alkalies on which cotton and dry crops like Jowar, Bazra and tur etc flourish. The soil varies both in texture and depth. In northern portion of the district the soils are shallow and relatively poor while in south they become deep and fairly rich in nutrients.

Climate and Rainfall

The climate of the district is characterized by a hot summer and a general dryness throughout the year except during the south west monsoon season, which is from June to September while October and November constitute the post-monsoon season. Except during the southwest monsoon season, when the relative humidity is high, the air is generally dry over the district. The summer months are the driest when the relative humidity is generally between 20 and 25% in the afternoon. Winds are generally light to moderate with increase in speed during the latter half of the hot season and in the monsoon season. The winds flow predominantly from directions between west and north during the hot season. They are mostly from directions between south west and northwest during the south west monsoon season. They blow mostly from the directions between northeast and southeast during the rest of the year becoming southwesterly to north westerly in January and February.

Seasonal Rainfall Comparative Statement last 4 years Rainfall Normal, Actual & percentage



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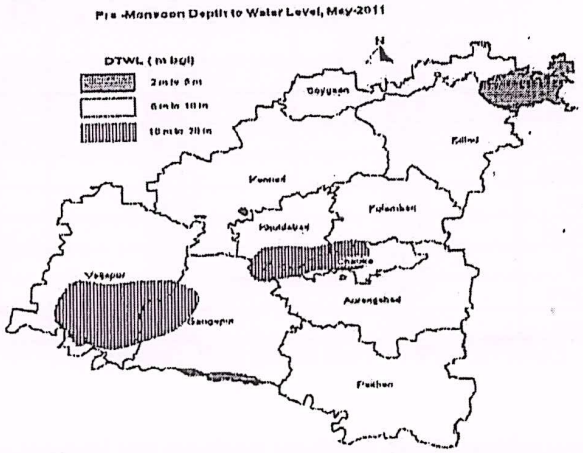
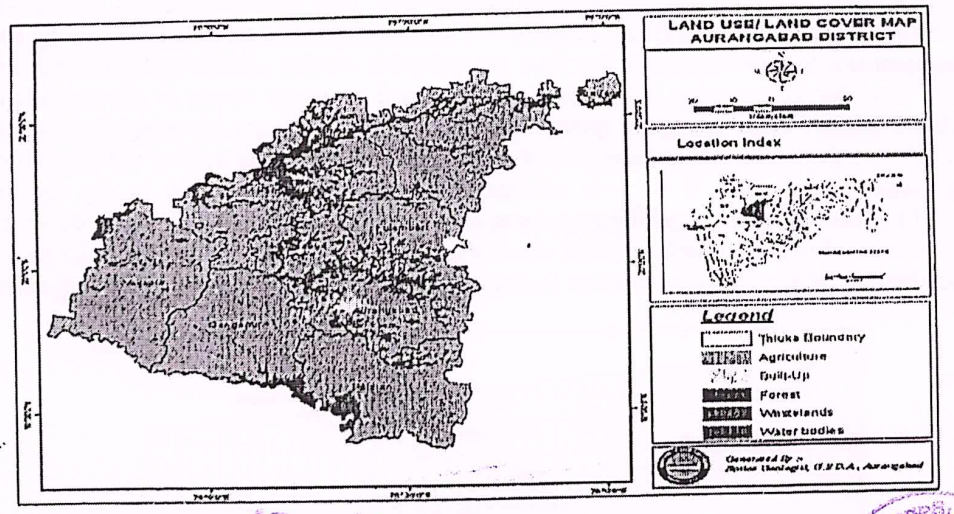
Basic Statistics of Aurangabad District

Sr No	Tehsil Name	Number of Villages	Villages with Water Storage Facilities	Villages without Water Storage Facilities
1	Kannad	202	165	37
2	Soygaon	84	58	26
3	Sillod	132	51	81
4	Fulambri	92	77	15
5	Aurangabad	153	123	30
6	Khultabaad	76	56	20
7	Vaijapur	164	105	59
8	Gangapur	224	114	110
9	Paithan	196	88	108
10	Total	1323	837	486





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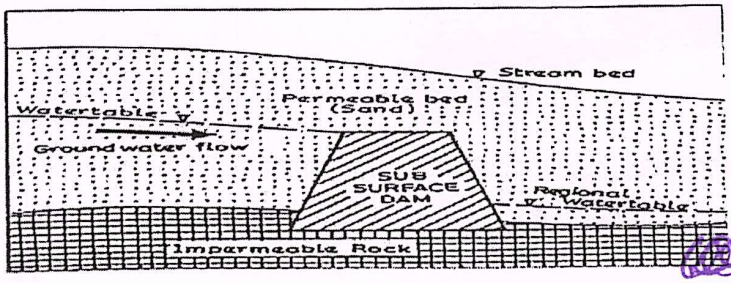
Sr no	Tehsil	Total Geographical area	Forest Cover	Cultivable total area	Net sown area	
					Net Cropped area	Irrigated area
1	Kannad	156417	30312	114450	110348	27500
2	Soygoan	54494	15511	50650	48461	9285
3	Sillod	151723	2827	124850	120673	29605
4	Phulambri	66268	4425	50721	63345	14188
5	Aurangabad	94777	22463	101563	91621	26855
6	Khulaabad	51846	2047	48960	50549	10972
7	Vaijapur	159403	3057	147891	134044	35586
8	Gangapur	124292	2219	108602	143045	40244
9	Paithan	142812	1554	126748	112349	29156
	Total	1002035	81415	874435	874435	223391

Sr No	Taluka	Average of 5 years (of Jan month)	01/01/2015 SWL (m)	Difference
1	Aurangabad	8.08	10.11	-2.03
2	Gangapur	9.78	11.20	-1.42
3	Kannad	8.32	10.16	-1.84
4	Khultabad	10.89	11.80	-0.91
5	Paithan	9.35	10.60	-1.25
6	Phulambri	7.78	8.35	-0.57
7	Sillod	8.13	8.26	-0.13
8	Soyegaon	4.71	3.69	1.02
9	Vaijapur	9.63	10.94	-1.31

Observation Well Data for the SWL (meter)

Subsurface dams

Subsurface dams are groundwater dams, which are structures that intercept or obstruct the natural flow of groundwater and provide storage for water underground. They have been used in several parts of the world, notably India, Africa and Brazil. Irrigation of arid and semi-arid areas is touted as the solution to alleviating food shortage in these areas that have unpredictable weather patterns and persistent drought. The optimum zone for constructing a SSD is generally found on gentle slopes in the transition zone between hills and plains. Water storage in groundwater dams offers as a major advantage that evaporation losses are much less for water stored underground. Since the subsurface dam suffers virtually no loss of stored water from evaporation, it is more advantageous than the surface dam in dry regions.The construction of a subsurface dam generally requires cutting off where a subsurface valley is covered by an aquifer. Subsurface valleys are usually formed where the ground is undulating. Similar to surface dams, effective sites for subsurface dam development (suitable slopes) can be easily found by tracing subsurface valleys.



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Conclusions:

Soil and water conservation is a high priority in the drier areas of the Aurangabad district. The variability in rainfall cause impacts on standing crops; if irrigation is not managed properly it may turn into a big economic loss. The surface temperature and uneven rainfall lead farmers to go for well irrigation and indiscriminate use of underground water table which goes down after some level. Groundwater dams, which storewater under the ground, can store sufficient quantities of water for livestock and minor irrigation as well as for domestic use. The subsurface dams have advantage as evaporation losses are much less than surface dam water evaporation. It will help to increase agricultural productivity where water scarcity is in acute form.

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