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Hydrological Comparative Survey: Banswara District of the Rajasthan through using of GIS and Remote Sensing Technique

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Abstract – Water resources are sources of water that are useful or potentially usefully to humans. Uses of water include agriculture, industrial, household, recreational and environment activities. Virtually all of these human uses require fresh water. 97 percent of water on the Earth is salt water, and only 3 percent is fresh water of which slightly over two thirds is frozen in glaciers and polar ice caps. Biodiversity-rich freshwater ecosystems are currently declining faster than marine or land ecosystem. In our district there are so many water units Limestone, Nisus, Basalt, Phyllite, and schist there area is esteemed near about 80.62 square Km, 986.49 square Km, 1238.43 square Km and 1983.38 square Km. In the year of 2006 pre-monsoon analysis of underground water the level of Underground (UGW) water had been found 0.65m. This record which is maximum UGW record was found is ghatol panchaya samiti the village where it found was Bundawai the maximum UGW level which was found in this village was 50.00m & it was more big record then panchayat samiti Talwara .

Key Word – Underground water level, Per- Monsoon, Post – Monsoon

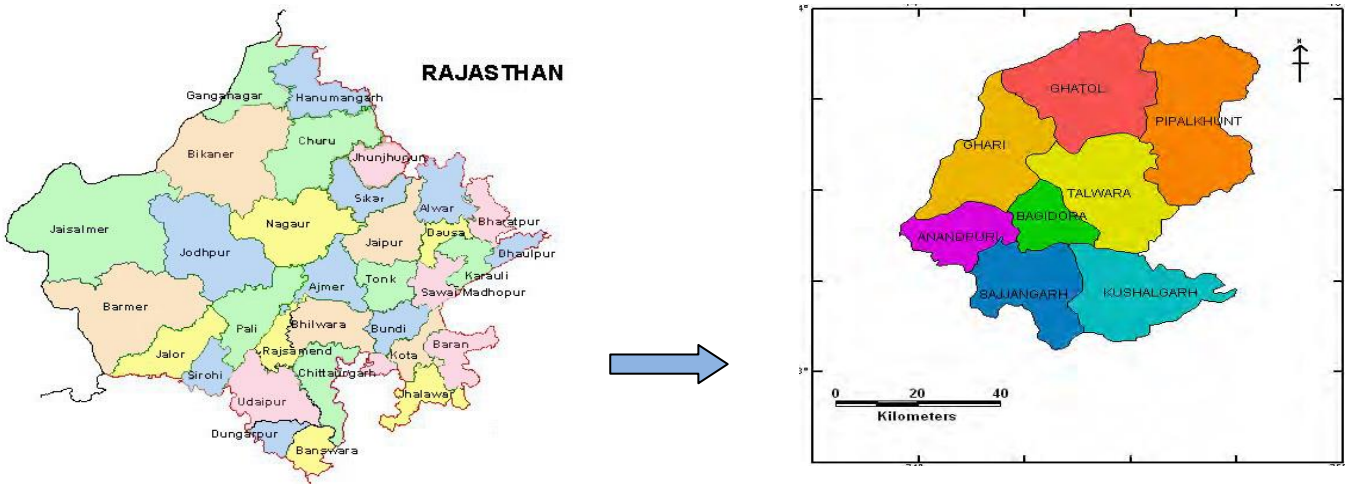
Introdection – Water resources are source of water that is useful or potentially useful to humans. Uses of water include agriculture, industrial, household, recreational and environment activity virtually all of these human uses require fresh water. 97 percent, and only 3 percent is fresh water of which slightly over two thirds is frozen in glaciers and polar ice caps. The remaining unfrozen fresh water is mainly found as groundwater, with only a small fraction present above ground or in the air. Fresh water is a renewable resource, yet the world's supply of clean, fresh water is steadily decreasing. Water demand already exceeds supply in many parts of the world and as the world population continues to rise, so too does the water demand. Awareness of the global important of preserving water for ecosystem service has only recently emerged as, during the 20th century, more than half the world's wetland have been lost along with their valuable environment service. Biodiversity-rich freshwater ecosystems are currently declining faster than marine or land ecosystems.

The framework for allocation water resources to water users (where such a framework exists) is known as water rights. Surface water is water in a river, lake or fresh water wetland. Surface water is naturally

replenished by precipitation and naturally lost through discharge to the oceans, evaporation, transpiration and sub-surface seepage. Sub-surface water, or groundwater, is fresh water located in the pore space of soil and rocks. It is also water that is flowing within aquifers below the water table. Sometimes it is useful to make a distinction between sub- surface water that is closely associated with surface water and deep sub-surface water in an aquifer (sometimes called "fossil water").

Interest of the Area- Banswara district is located between 23° 11' and 23° 56' latitude and 73° 58' and 74° 49' longitude covering an area of 5037 sq.km. The District is part of udaipur Division and is divided into 3 sub-divisions namely Banswara, Ghatol, Kushalgarh. Administratively the district is divided into 5 tehsils and 8 development blocks. Total number of villages in the district is 1524 and it also has 3 urban towns. Rural and Urban population of the district 1.39 lakh and 1.07 lakh respectively.

Systematic Hydrogeological survey in the district was carried out by Central Ground Water Board 1980. Reappraisal hydroeological survey in parts of district was carried out during 2006 - 2007. Average annual rainfall (1971-2007) of the district is 935.5 mm. However normal rainfall for the period 1901 to 1970 is 870 mm. The annual rainfall gradually decreases from southern part to northern part. The maximum average rainfall is 1118 mm at Dhanpur and minimum average rainfall is 790 mm at Loharia.



IRS 1B LISS III data for October 2005 and January 2006

Use of Remote Sensing & GIS – All models described above require large data about soils, land use/land cover, climate etc. All these required data are mostly non- available for large study are. The collection of information and data is costly and time consuming. In the present day methodology, Remote Sensing and GIS provide a fast and economical solution to many problems. Remote Sensing data being synoptic and repetitive provides continuous information about land use/land cover. Which is a major input for al the models. GIS gives a tool to analyses the large quantity of data pertaining to various layers.

Objective of study

- Study of hydrological survey of southern part of Rajasthan
- Analysis of hydrological survey carried out by Remote Sensing and GIS technique.

Material and Method

Remote Sensing and GIS is used to Analyses underground water level (UGW) of the Banswara district. Reading and study of related literature survey and projects reports and AISLUS atlas (1990) are used for this study. Assessment of data availability and data gap is done from various likely multi- institutional, multi-disciplinary and multi- location source groups. Used Satellite data, Topographical map are used for primary data generation and Technology development/ advancement. Used LISS III Satellite data under UTM projection and WGS 84 datum. For generation of various seamless mosaics of Temporal – remotely sensed data is developed.

Source of Data and Software

1. IRS 1B LISS III data for October 2005 and January 2006
    - 95/54
    - 95/55
2. Survey of India toposheets at 1:2,50,00 scale
    - 45L Chittaurgarh
    - 46I Banswara

Research Design-

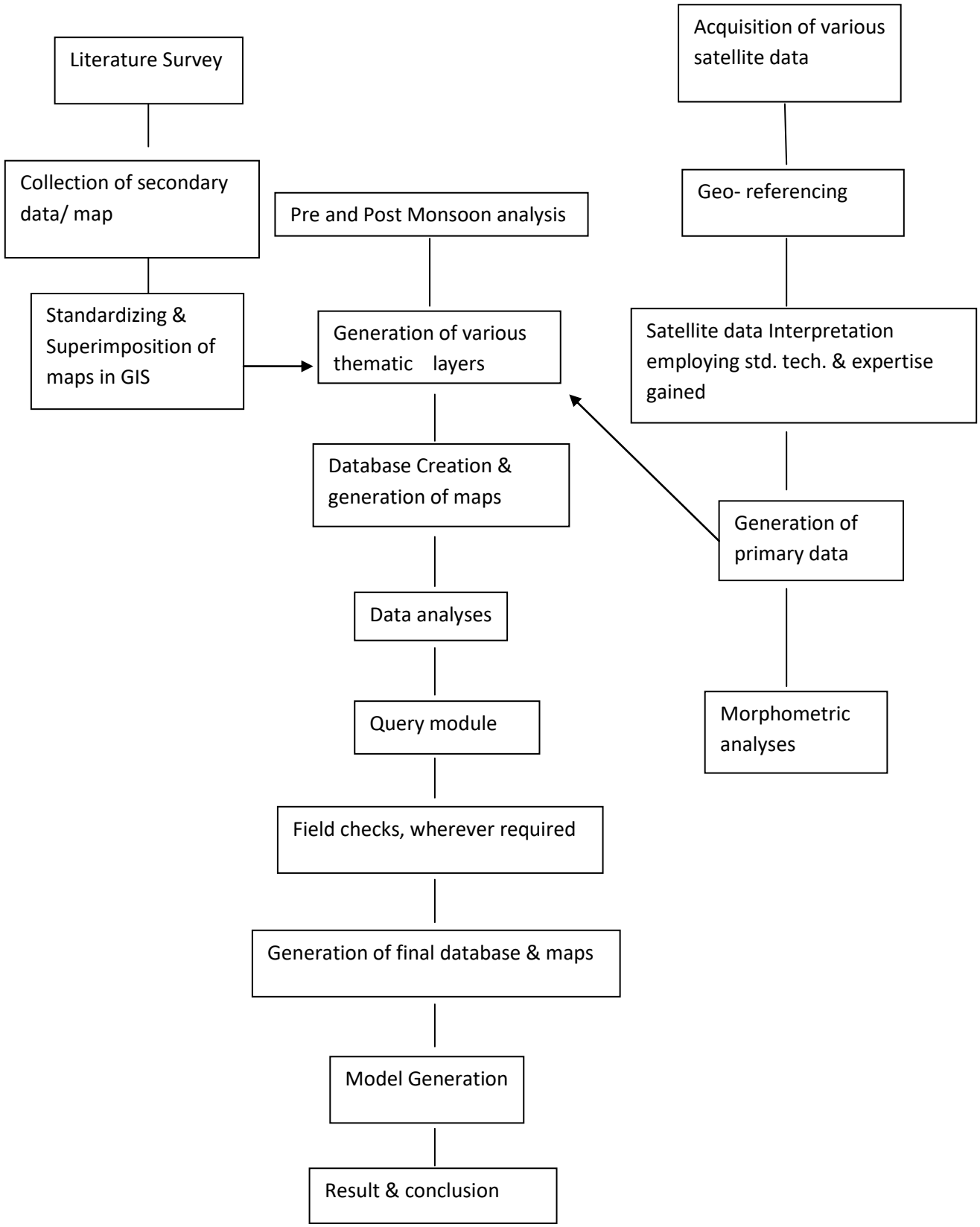
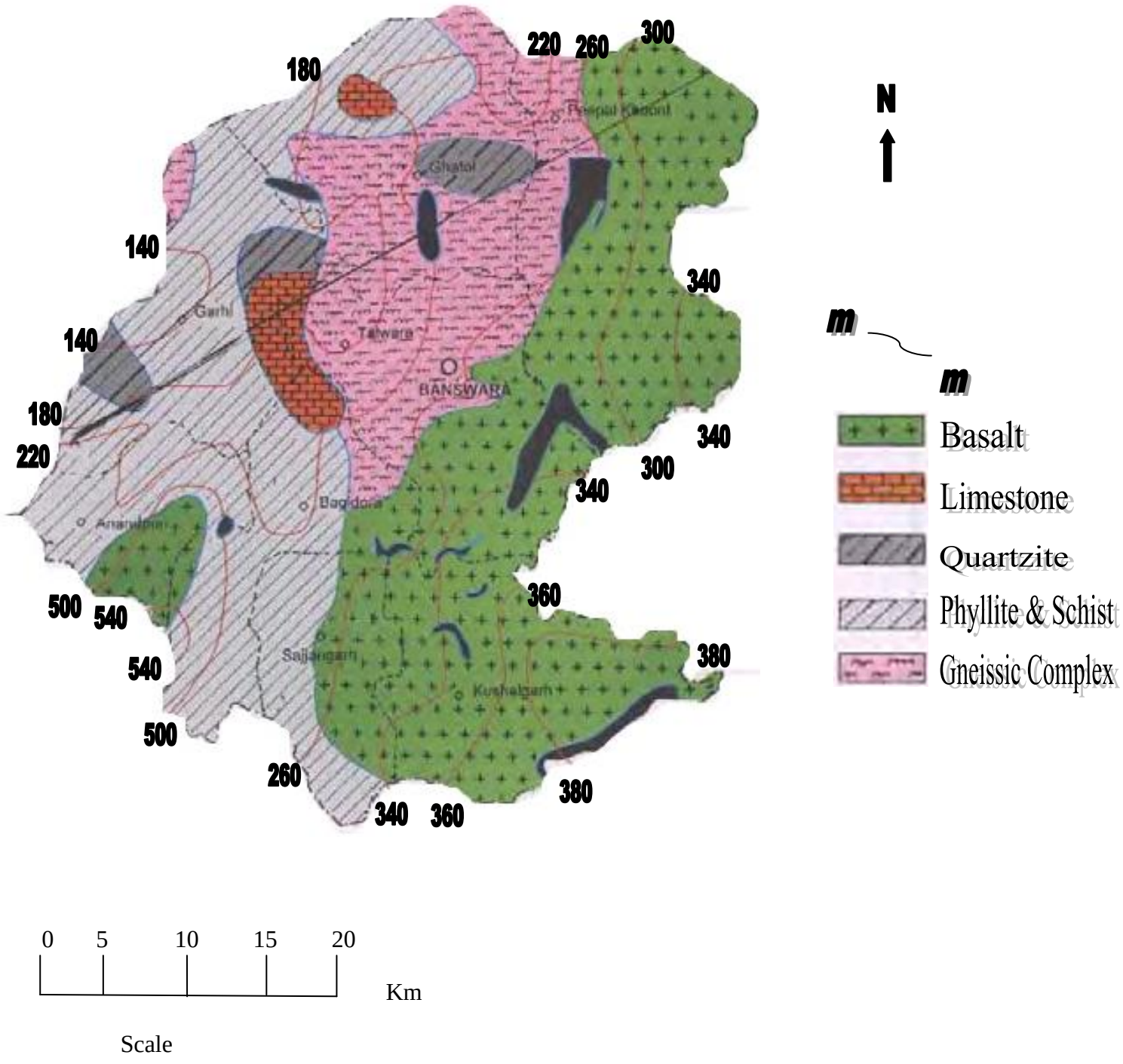


Chart 1 The Following line is proposed for the research

Hydro-geological Condition: Groundwater occurs under unconfined condition in saturated zone of rock formation. Its occurrence is controlled by topography, physiography and structural features of the geological formations. The movement of the groundwater in hard rock area is governed by size, openness, interconnection and continuity of structural weak planes. Ground water movement takes places through pore space between grains. Water bearing properties of different aquifers are described below

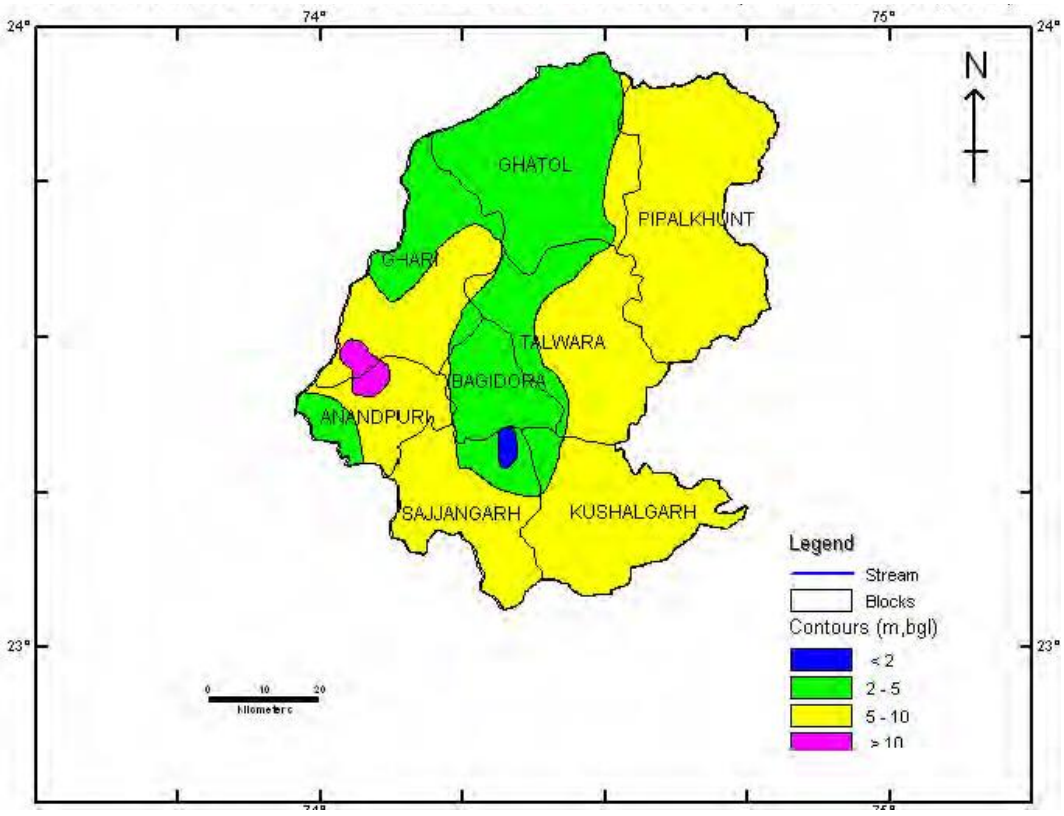
Fig. 1 HYDROGEOLOGICAL MAP OF BANSWARA DISTRICT



Groundwater Flow General Direction of ground water flow has been inferred from SE to Nw or E to W. Hydraulic gradient varies considerably. It is the minimum around Bagidora (1.6 m/km). The southern peripheral area around Pipal Khunt generally has steeper gradient.

Depth to Water Level (Pre Monsoon 2007) The depth to water level varies widely depending upon topography, drainage, bedrock geology etc. Depth to water varies from less than 2 m to more 10m bgl. Water level is shallower in central part (1.60 m) of the district. In general DTW varies from 2 to 10 m in greater part of the district. Deep water levels (> 10 m) are observed in parts of Anandpuri and Garhi blocks.

Fig. 2 Depth of Water Level Map of Banswara District (Pre-monsoon,2007)



Depth to water Level (Post Monsoon 2007)

During Nov.07 water level ranges widely from more than 5 to less than 10 m bgl. Water level is shallower in north eastern and central part of the district. In general DTW varies from more than 2 to 5 m,bgl in entire district. The Deepest water level 9.9 mbgl observed in Anandpuri block.

Fig. 3 Depth Of Water level Map of Banswara District (Post-monsoon, 2007)

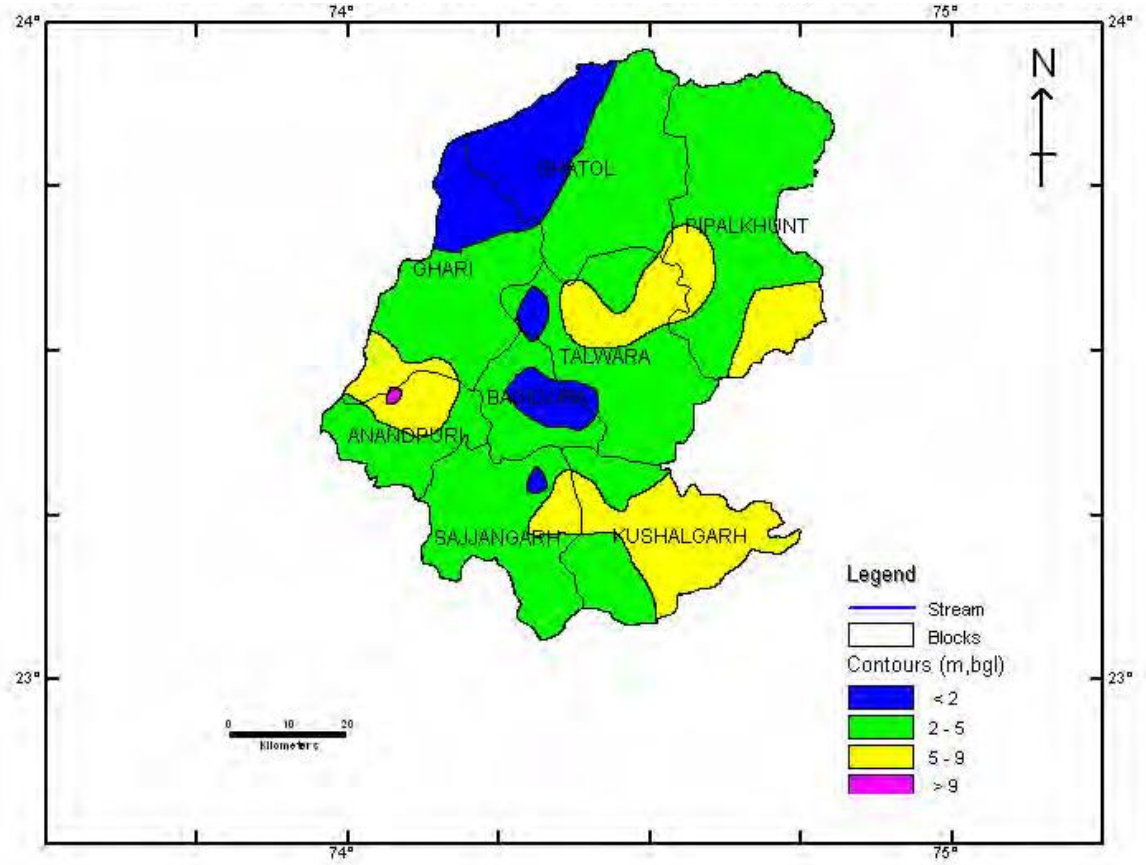


Table 1 : Showing the Panchyat samiti wise Underground water capacity of Banswara District

Name of panchyat samiti	Geograpical area (Sq. Km.)	UGW units (Sq. Km.)	Minimum water level	Maximum water level	No. of wells	Water suplay capacity per day (in litters)
Anandpuri	337.40	329.38	3.12	18.68	1160	40000-60000
Bagidora	522.34	500.49	1.54	21.22	1181	50000-75000
Ghardi	710.53	700.44	1.92	12.35	2272	40000-50000
Ghatol	778.40	680.91	0.65	12.35	1914	40000-80000
Kushalgharh	651.80	507.89	3.59	43.45	1418	30000-75000
Pipalkhut	884.23	603.91	2.83	24.09	1885	50000-75000
Sajangharh	392.29	349.97	1.79	13.80	764	50000-75000
Taiwara	759.93	615.93	1.04	50.00	1987	50000-90000

Ground Water Development Strategy

Ground Water Management

Stage of ground water development in the district is 72.97 %, which indicate that there is scope of ground water development in the district. The stage of development in non command area is 68.72 % and in command area it is 90.61 %. As the district is covered by hard rock areas further ground water development in non command area should be based on proper hydro-geological and geo-physical surveys.

Water Conservation and Artificial Recharge

Ground water Management

Due to over development of groundwater further exploitation of this precious resource must be checked. Artificial recharge is a difficult task in the district as the country rock is composed exclusively of hard rocks, water level gradient is steep and storage capacity is low. Under such condition there is likelihood that recharged water will reappear as base flow. Any induced water application will create localized mound with no change in trend of declining water level in adjacent areas.

Since the stage of the ground water development has already crossed 70%, for sustainable utilization of water resources conjunctive use of surface and groundwater is inevitable. Water Harvesting is the only solution through construction of bunds, anicuts, and rooftop harvesting structures. The area has undergone polyphase deformation in geological past, which has resulted in a complex structure (folded, faulted and jointed) that may not be conducive for such structures. Therefore, site of these structures should be selected carefully. Impact assessment of water harvesting structures (WHS) reveals that there is increase in cropping area, cropping intensity, crop production and labor employment observed in the project area. Erosion from nalah bank minimizes. Cropping pattern and cropping intensity changed. Harvested water provides supplementary irrigation during long dry spell. In view of the above, such WHS programmers may be taken up in the district for further development of surface water and ground water resources to enhance agricultural production.

GROUND WATER RELATED ISSUES & PROBLEMS

Almost entire district is facing problem of ground water scarcity. However, there are some areas vulnerable for pollution and depleted water table. Major issues in the district are as follows:

Ground water Depletion Hazard

Comparison of pre monsoon water level between 1998 to 2007 shows that two namely Pipalkhunt and Ghatol has decline in water level during pre and post monsoon period . The long term depleting nature of water level causes reduction in storage, which leads to water scarcity in summer seasons.

Water Quality Hazard

In the district, fluoride (>1.5 mg/lit) is found in 10% villages and habitation. The nitrate hazard more than 45 mb/lit is found in 50% of villages.

Occurrence of Drought

The rainfall variation during last decade has been a critical water sector hazard. During 1998–07 the rainfall deficit years were 99, 00,01 and 02 and are classified as serious drought years. The constant rise in population, urbanization, industrialization and agricultural growth has caused decrease in per capita availability of water.

Recommendations

1. Ground water draft is very high in all the blocks. Stages of Ground Water Development in the district has reached 72.97% due to indiscriminate use. It has to be controlled by preventing further development.

2. Water scarcity is a perpetual phenomenon in Banswara. Permanent solution to drinking water problem should be devised using Underground water.

3. Revival of traditional ground water storage system i.e. Baori, open wells, Tanka etc for rainwater conservation for use in day to day life will reduce ground water draft.

4. Awareness programme and training on rainfall harvesting will be beneficial to check decline in water level and justified use.

5. Taking advantage of uneven topography of the area, small WHS or earthen dams, upstream of irrigation commands, at suitable sites, may be constructed to store rainwater. This will increase recharge to ground water which ultimately result in increase of yield of wells.

6. Modern agricultural management techniques have to be adopted for effective and optimum utilization of the water resources. Maintaining irrigation through minimum pumping hours as per minimum requirement of water by the crop and also selecting most suitable cost effective cropping pattern can achieve this.

7. Surface runoff can be harnessed by constructing tanks at feasible sites in the area occupied by the hard rock terrain for supplementing irrigation potential to increase the agricultural production.

8. High water requirement crops be discouraged. Proper agriculture extension services should be provided to the farmers so that they can go for alternate low water requirement economical crops.

Review of Literature

Collection of Mahi Bajaj Sager related data from Government of Rajasthan, ICAR Department Borvat Banswara, Forest Department of Banswara, Department of Mines and Geology Banswara, National Bureau of soil Survey and Land use Planning Udaipur , Soil and Water Engineering CTAE Udaipur, Agriculture Technology Management Agency (ATMA) Banswara, Mahi department Banswara,

Government of Rajasthan Water Resources Department. RRSSC/ISRO Jodhpur provided approval on Remote Sensing and GIS maps for Mahi Region.

Meena R. B.K. Sharma, L.L. Sharma and V.S. Durve in their Journal of environment science and Engginering - Assessment of Hand Pump waters in three tribal Dominated Districts of Southern Rajasthan .April 2008

CENTRAL GROUND WATER BOARD Ministry of water Resources Government of India March 2009

Ph.D Thesis Seasonal Changes in Erosion Pattern for Mahi Reservoir Using Remote Sensing & GIS Technique 2013