Project Proposal

FOR

Sustainable and Efficient Water Use and Protection Measures in Villages Of Rajasthan

CRIME INVESTIGATION BOARD (TRUST)

Administrative Adress:

Plot no. 3 ; Green Nagar Dalda Factory ; Tonk Road

Durgapura Jaipur – 302018

Registration Office:

4626, Shora Kothi , Pahadganj , Delhi-110055

Mob.No: 9769150981

1. **About Us:**

Rastriya Bhristachar Niroodhak and Atyachar Vidrodhi Tiger Sansthan is a Registered Trust under Registration No. 1442 Date 09/08/2007. It is actively working on PAN India basis with State offices in 15 States. Current member strength is 47000+ across all states. It is actively working for the purpose and mission of its formation. Under which it has primary work on:

   a. Disaster Management & Relief measures in affected areas & communities.
   b. Distribution of Clothes, Books, Medicines, Bags, Blankets, Medicines to the needy ones.
   c. Skill development and Livelihood Program.
   d. Water Conservation and Protection measures in rural area.
   e. Drug deaddiction's camps in urban slums & rural area.
   f. Medical Check-up camps in urban slums.
   g. Plantation and Agro-forestry on panchayat Level.

2. **Background:**

A. Kota

(i) Location:

Kota district is located in the southeastern part of Rajasthan. It is bounded in the north by Sawai Madhopur district, in the east by Baran district and the state of Madhya Pradesh, in the south by Jhalawar and Chittaurgarh districts along with state of Madhya Pradesh and finally in the west by Bundi district. It stretches between 24° 32' 02.17" to 25° 51' 19.33" north latitude and 75° 36' 55.19" to 76° 34' 57.10" east longitude covering an approximate area of 5,122.3 sq kms. The whole district is the part of 'Chambal River Basin'.

(ii) Administrative Set-up:

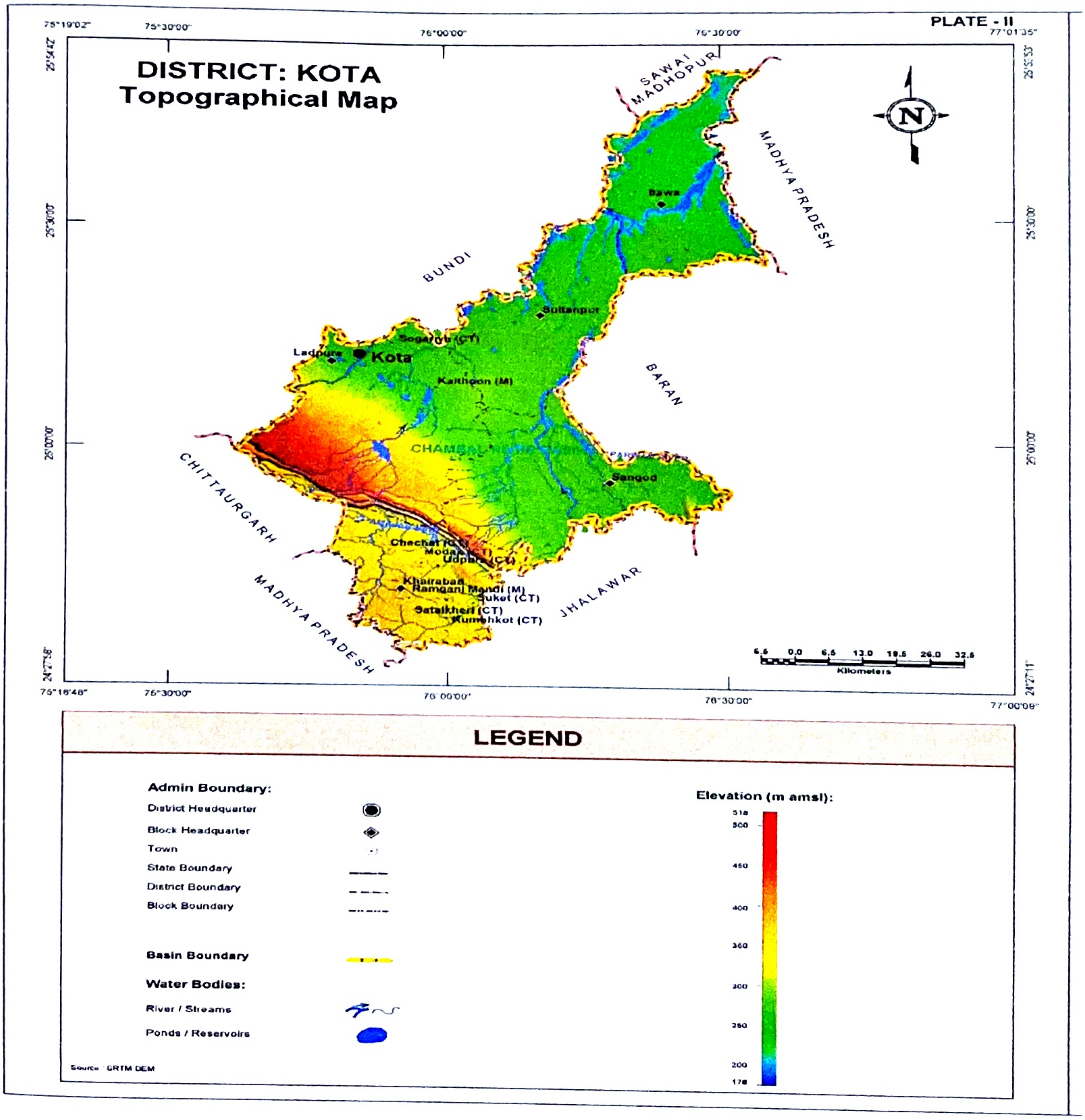
Kota district is administratively divided into five blocks. The following table summarizes the basic statistics of the district at block level.

S. No.	Block Name	Population (Based on 2001 census)	Area (sq km)	% of District Area	Total Number of Towns and Villages
1	Itawa	1,55,646	906.2	17.7	169
2	Khairabad	2,28,479	734.6	14.3	166
3	Ladpura	8,68,213	1,478.2	28.9	185
4	Sangod	1,65,600	1,095.9	21.4	212
5	Sultanpur	1,50,587	907.4	17.7	171
Total		**15,68,525**	**5,122.3**	**100.0**	**903**

Kota district has 903 towns and villages, of which five are block headquarters as well.

(iii) Climate:

Kota district has a semi-arid climate. Summers are long, hot and dry, starting in late March and lasting till the end of June. The monsoon season follows summer with comparatively lower temperatures, but higher humidity and frequent, torrential downpours. The monsoons subside in October and temperatures rise again moderately. The brief but pleasant winter starts in late November and lasts until the last week of February. Temperatures hover between 26.7°C (max) to 12°C (min). The average annual rainfall in the Kota district is 707.7 mm. Most of the rainfall can be attributed to the southwest monsoon which has its beginning around the last week of June and may last till mid-September. Pre-monsoon showers begin towards the middle of June with post-monsoon rains occasionally occurring in October. The winter is largely dry, although some rainfall does occur as a result of the Western Disturbance passing over the region.



B. Baran:

(i) Location:

Baran district is located in the southeastern part of Rajasthan. It is bounded in the east by state of Madhya Pradesh, southwest by Jhalawar district and northwest by Kota district. It stretches between 24⁰ 23' 35.85" to 25⁰ 26' 39.94" North latitude and 76⁰ 11' 34.16" to 77⁰ 25' 56.74" East longitude covering area of 6,994 sq kms. Major part of the district has a systematic drainage system, as whole district is part of 'Chambal River Basin'.

(ii) Administrative Set-up:

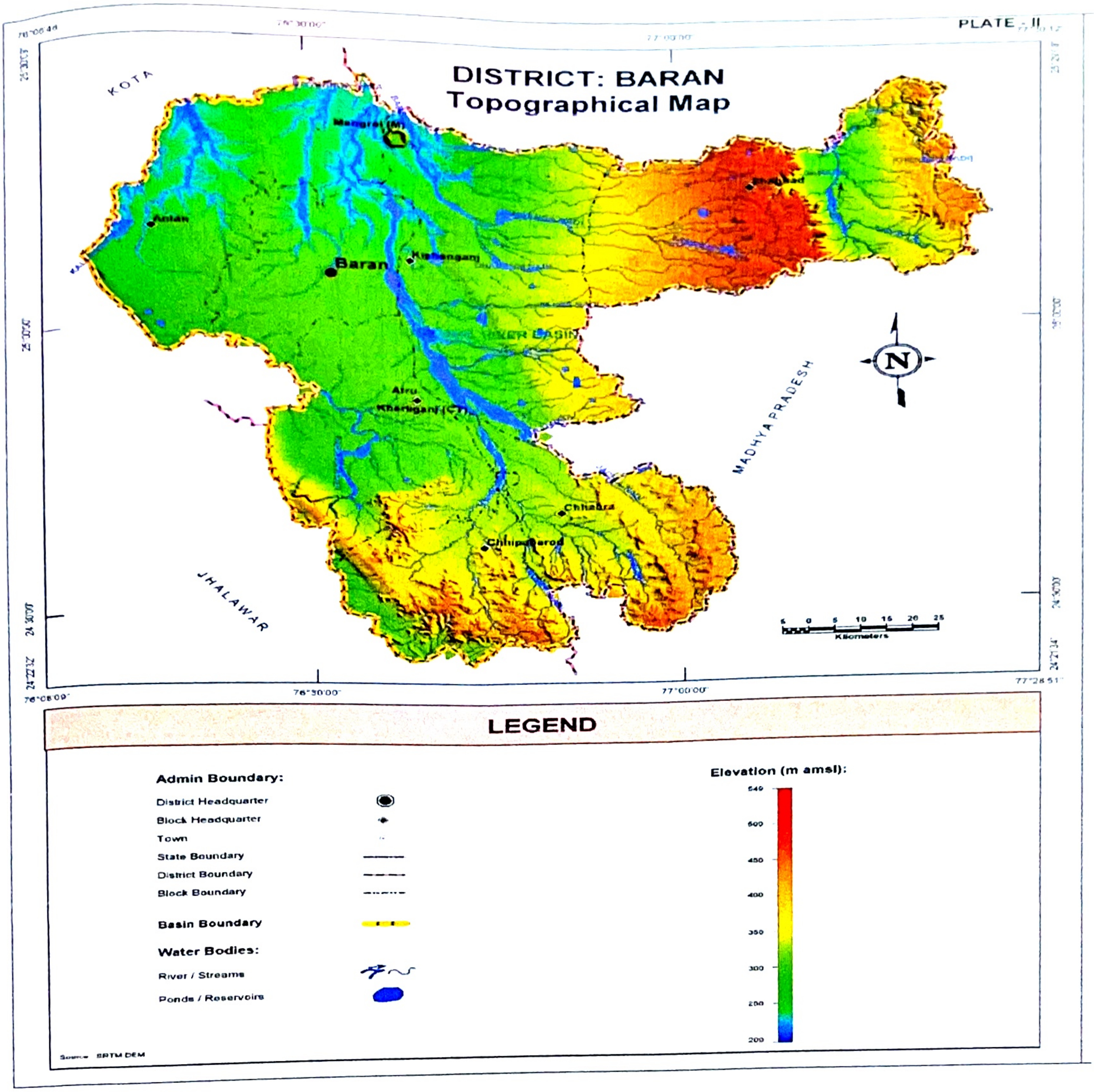
Baran district is administratively divided into seven Blocks. The following table summarizes the basic statistics of the district at block level.

S. No.	Block Name	Population (Based on 2001 census)	Area (sq km)	% of District Area	Total Number of Towns and Villages
1	Antah	1,97,385	1,033.3	14.8	158
2	Atru	1,32,944	946.4	13.5	139
3	Baran	1,81,807	638.8	9.1	103
4	Chhabra	1,22,268	798.9	11.4	193
5	Chhipabarod	1,43,885	684.3	9.8	181
6	Kishanganj	1,35,218	1,450.4	20.7	203
7	Shahbad	1,08,146	1,441.9	20.7	236
	Total	**10,21,653**	**6,994.0**	**100.0**	**1,213**

Baran district has 1,213 towns and villages, of which seven are block headquarters as well.

(iii) Climate:

The district has a sub-humid climate, moderately dry and receives fairly good rainfall in monsoon seasons. The winter season extends from November to February and summer season from March to mid of June. The period from mid of June to September is the monsoon season followed by the months October to mid of November constitutes the post monsoon or the retreating monsoon. The mean annual rainfall in the district is 838.7mm. January is the coldest month with the average daily maximum temperature of 24.3 ^{o}C and the average daily minimum temperature in the range of 8-10 ^{o}C.



C. Tonk

(i) Location:

Tonk district is located in the eastern part of Rajasthan. It is bounded in the north by Jaipur district, in the east by Sawai Madhopur district, south by Bundi and by Ajmer district in the west. It stretches between 25° 40' 31.58" to 26° 33' 51.29" north latitude and 75° 06' 46.84'' to 76° 19' 38.24'' east longitude covering area of 7,190.5 sq kms. Apart from small areas being part of Chambal River basin in the south and southeast, remaining part of the whole district is part of 'Banas River Basin'. The district is drained mainly by the Banas River and its tributaries.

(ii) Administrative Set-up:

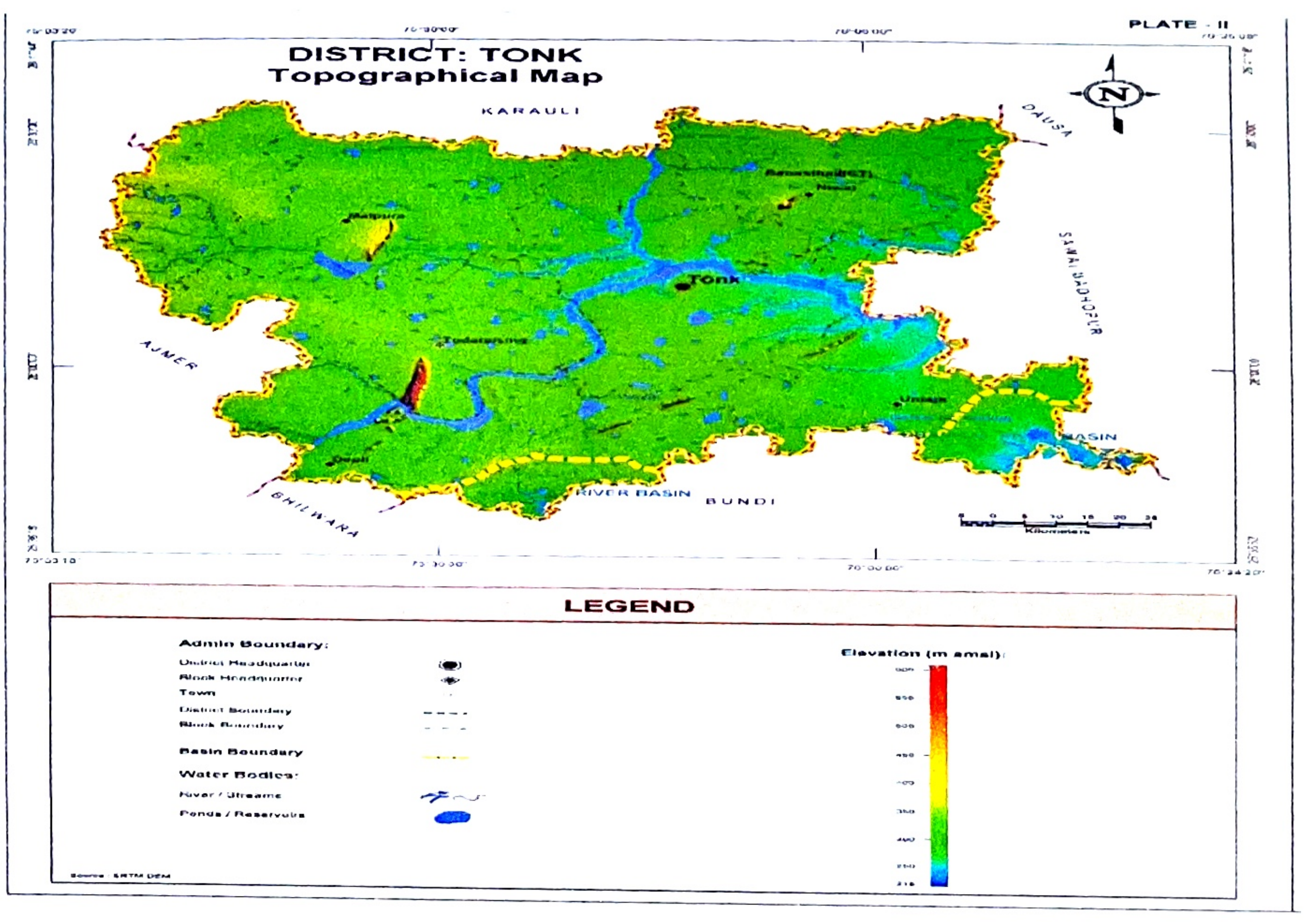
Tonk district is administratively divided into six blocks. The following table summarizes the basic statistics of the district at block level.

S. No.	Block Name	Population (Based on 2001 census)	Area (sq km)	% of District Area	Total Number of Towns and Villages
1	Deoli	1,89,297	1,236.0	17.2	172
2	Malpura	2,04,168	1,546.8	21.5	139
3	Niwai	2,03,340	946.8	13.1	203
4	Todaraisingh	1,31,348	1,023.9	14.2	119
5	Tonk	3,40,051	1,466.0	20.4	254
6	Uniara	1,43,343	971.0	13.6	213
	Total	**12,11,547**	**7,190.5**	**100.0**	**1,100**

Tonk district has 1,100 towns and villages, of which six are block headquarters as well.

(iii) Climate:

The climate of Tonk district is different from typical semi-arid Rajasthan and is more akin to Madhya Pradesh's sub-humid climate. The area does remain dry for good part of the year and humidity increases only during the monsoon months. Summers are hot and during the peak summer months of May-June the temperature soars to more than 45°C. In winter months that stretch from November to February the mean temperature is low, around 22 °C but the lowest temperatures dip to around 4-5°C. Rainfall is moderate as the average annual rainfall in this district is about 508mm and rains are received during the monsoon months of July to September.



D. Sawai Madhopur

(i) Location:

Sawai Madhopur district is located in the eastern part of Rajasthan. It is bounded in the north by Dausa and northeast by Karauli districts, in the east by state of Madhya Pradesh, South by Kota while Tonk district constitutes its western boundary. It stretches between 25° 44' 00.90" to 26° 43' 34.33" north latitude and 75° 58' 36.70" to 76° 59' 04.98" east longitude covering area of 5,051.9 sq kms. The district is part of three river basins viz. 'Banas River Basin', 'Chambal River Basin' and 'Gambhir River Basin'. Of these, the Banas River basin is most prominent and drains significantly large part of the district in central and northern parts whereas the Chambal River drains in southern part of the district. The Gambhir river basin occupies small area in the northeastern corner.

(ii) Administrative Set-up:

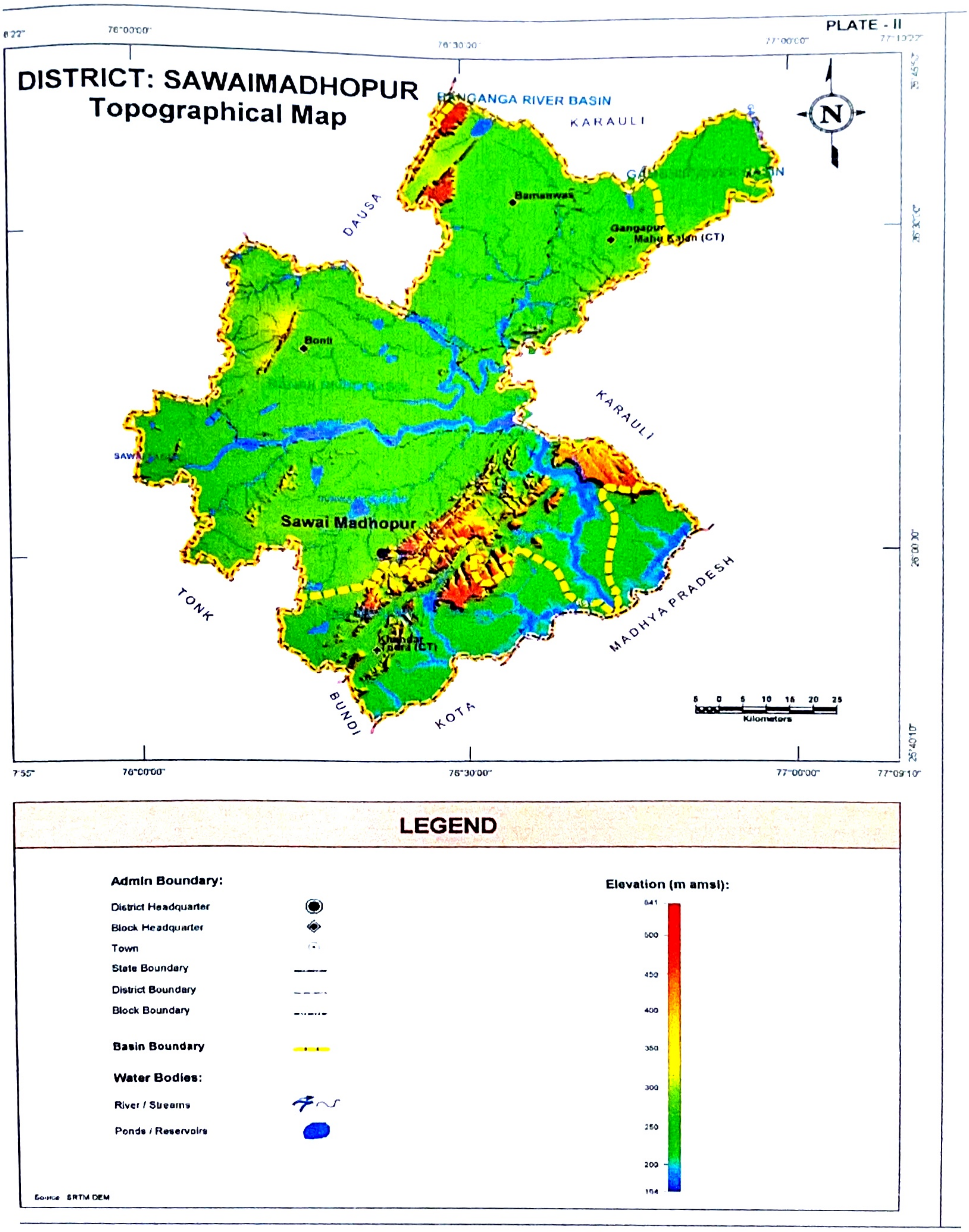
Sawai Madhopur district is administratively divided into five blocks. The following table summarizes the basic statistics of the district at block level.

S. No.	Block Name	Population (Based on 2001 census)	Area (sq km)	% of District Area	Total Number of Towns and Villages
1	Bamanwas	1,49,429	772.6	15.3	150
2	Bonli	2,09,833	1,049.0	20.7	180
3	Gangapur	2,84,605	633.2	12.5	124
4	Khandar	1,55,383	1,392.4	27.5	181
5	Sawai Madhopur	3,13,303	1,204.7	24	163
Total		**11,12,553**	**5,051.9**	**100.0**	**798**

The district has 798 towns and villages of which five are block headquarters as well.

(iii) Climate:

The climate of the district can be classified as sub-humid. It is characterized by very hot summers and very cold winters with fairly good rainfall during south-west monsoon period. In May, the maximum temperature may sometimes go up to 47 °C and winter temperatures dipping down to 2 °C. The potential evapotranspiration rates are high, especially during May and June. The mean annual rainfall of the district is 606.6mm. The most of the rainfall is received during the monsoon months.



E. Karauli

(i) Location:

Karauli district is located in the eastern part of Rajasthan. It is bounded in the north by Dausa and Bharatpur districts, in the east by Dhaulpur district, south by state of Madhya Pradesh and Sawai Madhopur district in the west. It stretches between 26° 01' 27.02" to 27° 00' 11.61" north latitude and 76° 28' 34.98" to 77° 24' 12.00" east longitude covering an area of 4,985 sqkms. This district is part of four river basins namely 'Gambhir River Basin', 'Banas River Basin', 'Chambal River Basin' and 'Parbati River Basin'.

(ii) Administrative Set-up:

Karauli district is administratively divided into five blocks. The following table summarizes the basic statistics of the district at block level.Sapotra block is the largest in area occupying about 1955 sq kms whereas the smallest block is Todabhim spread over about 544 sq kms while population wise, Hindaun block has the highest population and Nadoti has lowest population.

S. No.	Block Name	Population (Based on 2001 census)	Area (sq km)	% of District Area	Total Number of Towns and Villages
1	Hindaun	3,47,264	649.5	13.0	128
2	Karauli	2,88,860	1,227.8	24.6	204
3	Nadoti	1,26,089	608.7	12.2	95
4	Sapotra	2,32,513	1,954.9	39.3	224
5	Todabhim	2,14,939	544.1	10.9	150
	Total	**12,09,665**	**4,985.0**	**100.0**	**801**

Karauli district has 801 towns and villages, of which five block headquarters as well.

(iii) Climate:

The climate of the district is characterized by subtropical, dry with distinct winter, summer and monsoon. Highest temperature during May-June has been recorded as 49 °C and lowest temperature in January recorded as 5 °C. Most of the rainfall is received during the monsoon season, which extends from July to September. Average rainfall of the district is 577.11 mm.

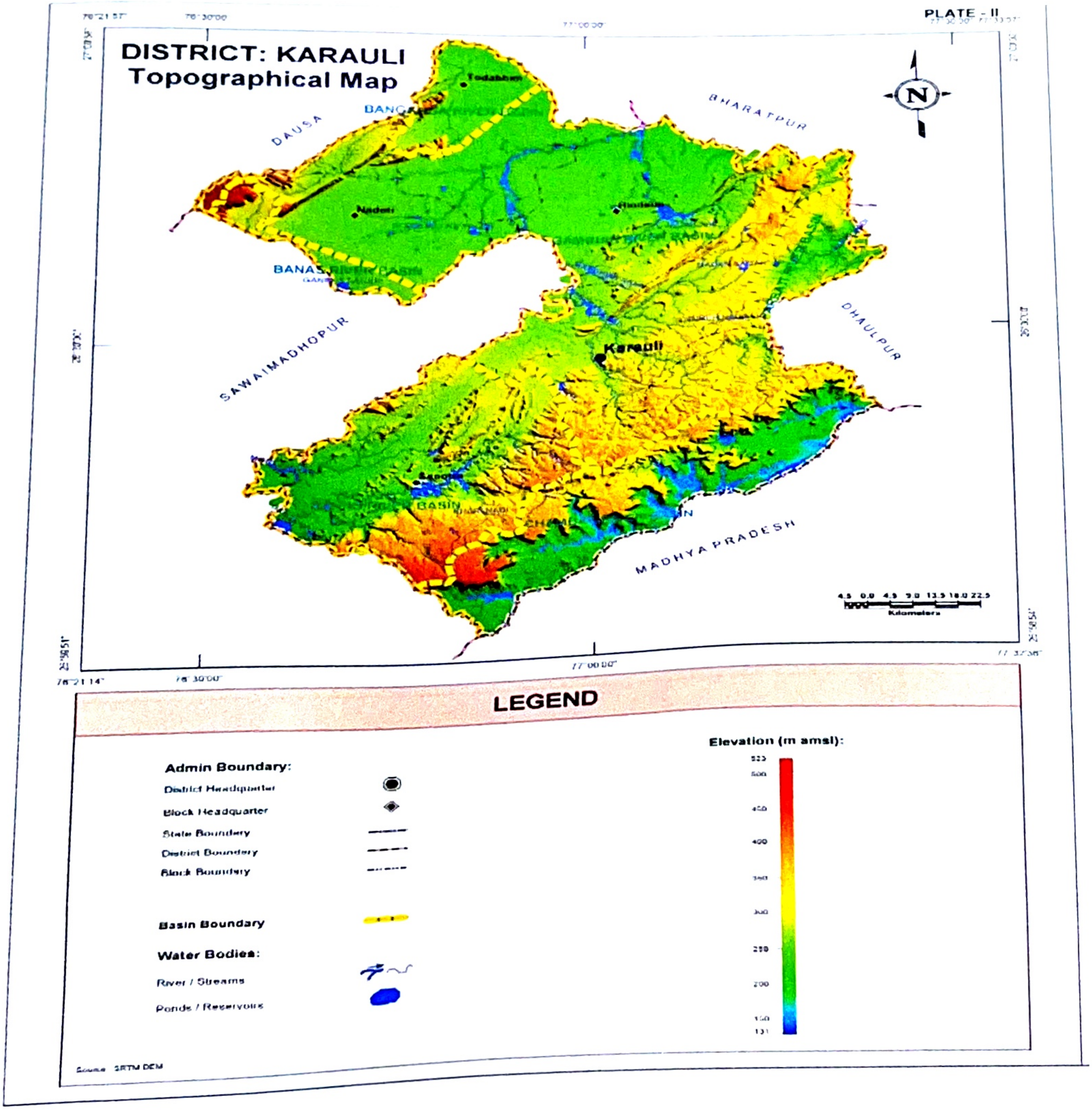


PLATE - II
DISTRICT: KARAULI
Topographical Map
DAUSA
BHARATPUR
DHAULPUR
SAWAIMADHOPUR
MADHYA PRADESH
BANAS RIVER BASIN
Todabhim
Nadoti
Karauli
N
Kilometers
LEGEND
Admin Boundary:
District Headquarter
Block Headquarter
State Boundary
District Boundary
Block Boundary
Basin Boundary
Water Bodies:
River / Streams
Ponds / Reservoirs
Elevation (m amsl):
Source SRTM DEM

3. Coverage:

Project is being planned for 5 districts covering 100 villages in the period of 24 months. The details of the coverage area is given below:

District	Block	No. of Villages in coverage
Tonk	Deoli	100
	Malpura	
	Niwai	
	Peeplu	
	Todaraisingh	
	Tonk	
	Uniara	
Total	**7**	
Baran	Antah	100
	Atru	
	Baran	
	Chhabra	
	Chhipabarod	
	Kishanganj	
	Shahbad	
Total	**7**	
Sawai Madhopur	Bamanwas	100
	Bonli	
	Chauth Ka Barwara	
	Gangapur	
	Khandar	
	Malarna Doongar	
	Sawai Madhopur	
Total	**7**	
Karauli	Hindaun	100
	Karauli	
	Mandrail	
	Nadoti	

	Sapotra	
	Todabhim	
Total	**6**	
Kota	Digod	100
	Ladpura	
	Pipalda	
	Ramganj Mandi	
	Sangod	
	Kanwas	
Total	**6**	
Grand Total	**33**	**500**

4. Objective:

The guiding principles under the project are:

- Sustainable and efficient use of water resources in the catchment areas, where ever feasible, including rain water harvesting, improved on-farm water use efficiency,
- Increase in water use efficiency Increase ground water recharge Reduce siltation Increase efficient use of conserved moisture

The project targets to sustainably increase the productivity of natural resources efficient water management. Primary project interventions shall be around the command areas and potential streams and drainage line areas of the upper catchments, complying with the overarching principles of four water concept. This includes optimizing the use of rainfall, surface water, ground water and soil moisture.

The project design therefore includes interventions which will result in efficient use of water, water conservation and diversion of saved water from command areas for use of other purposes. While tackling the problems of efficient use of water on one hand and conservation of water on the other, supportive programs like promoting change in cropping pattern and introducing crops having comparatively less water requirement have been considered so as to maintain sustainability of agriculture and also to incentivize agriculture production with minimum water and dissemination of appropriate technologies under the project.

5. Approach:

The sequencing of the multiple set of interventions in different areas falls into two distinct stages.

- Planning Phase – This phase focuses on preparation of the detailed Project Report. This plan, including baseline surveys, mapping, stakeholder consultations etc. will be executed by the (to which the project component / sub component is related with) and will be carried out over a period of 2 months (0-2 months).
- Implementation Phase – This phase involves implementing innovative strategies that are able to provide a balance between planning, considered during the conceptualization stage and subsequent demand driven planning & implementation that may arise at a later stage and will be carried out for the period of 22-24 months.

6. Intervention under Planning Phase:

i. Community Participation: Involving members of the community in the area and involving them in the various intervention measures being undertaken.

ii. Base Line Surveys:

a. Detailed survey and investigation including baseline survey, socio economic status, household profile (small, medium, large) in the villages of the area.

iii. Community Mobilization:

a. Awareness campaigning through individual contact, small group meetings, mass meetings, community envisioning, vision validation, other IEC activities etc.

b. Identification of active members from the community and involving them base on activities

c. Social mapping using PRA techniques and tools.

d. Water resource assessment is aimed to understand and assess the surface water availability and uses for various sectors including agriculture, domestic and industrial. This will help in identification of opportunities for water savings, increasing water based agricultural productivity.

7. Activities under Planning Phase:

i. Collection of basic required data:

Basic information/base line data of rainfall, temperature, location including geographical coordinates, water sources available & its present status, soils, soil profile, fertility status, forests, demographic features, household profile (small, medium, large) shall be collected using the secondary sources available.

ii. Base line survey base line survey of target area for carrying out need assessment:

Base line survey of target area will be carried out for need assessment and profiling of the area based on hydrogeology / socioeconomic indicators. The data & information collected through base line survey shall be analyzed for planning, designing and executing various intervention.

iii. Assessment of water resources availability and its uses:

Various information like no. of tanks, wells, tube wells and existing water harvesting structures, seasonal pre & post monsoon water levels, storage capacity of tanks, yield of wells, water levels of representative wells/WHSs, pumping methods/hours, area irrigated by tanks/wells/WHS in different seasons, cropping pattern, irrigation practices (flood irrigation, drip, sprinkler etc.), water demand for agriculture, crop production, water demand for drinking, domestic & quality of ground water, land-use pattern etc. will be collected.

8. **Activities under implementation Phase:**

a. **PRA exercises and interaction with the community leaders, social leaders, community member, Gram Panchayat / PRIs**

PRA is an important exercise to facilitate Community Mobilisation & Planning the intervention in the targeted area. Organisation will carry out PRA in the target area with the help of community members and social activist. Works will be identified according to community need.

b. Environment Building, Awareness Generation, Community Mobilisation and IEC activities

This would be a continuous process enabling functionaries to enhance their knowledge, skills & develop the correct orientation & perspectives thereby becoming more effective in performing their roles & responsibilities. Intensive IEC campaign will be organized to inculcate the sense of belonging among the community for all project activities. Individually addressed communication through participatory work between project & the local communities is important. To facilitate such communication prepare regular pamphlets/newsletter, other minor publications in an effective manner, Wall Paintings, Display Boards, Focused Group Meetings would be planned. IEC will create social consensus; necessary to motivate local beneficiaries to join & participate in local level group formation & other collective activities.

Information Education and Communication (IEC) Campaign:

Results of surveys will provide basic and essential inputs for understanding the prevailing situation and designing the IEC strategy suitable to area. It is necessary to develop consensus amongst all stakeholders in the aquifer area for their active participation in every decision making process and to create awareness about the need for groundwater management by the community. This would be achieved through an intensive Information Education and Communication (IEC) campaign to inculcate the sense of belonging among the community for all project activities. Individually addressed communication through participatory work between project and the local communities is important. The intensive IEC will create the social consensus, necessary to motivate the local water users to join and participate in the local groundwater management committees

The specific IEC campaign would address following aspects.

i. The availability of water is limited and therefore, should be used efficiently.

ii. The limited water resources are still manageable to provide livelihood to the community as a whole if the community adopts various demand and supply side interventions and participatory approach.

iii. It is possible to maintain the present income if the groundwater resources are managed properly by the community who shall allocate the available water resources to different water uses.

iv. RainWater conservation is essential for sustainable development.

v. Effectively disseminate the technical inputs such as allocation of ground water for different uses, changes in water levels, water quality and management options, crop diversification suitable for local conditions.

vi. Installation of water use measurement devices (water meters) on all ground water withdrawal structures to regulate groundwater extraction and usage and monitoring of withdrawal of ground water for assessment of ground water resources.

vii. Low cost methods for improving on-farm water use efficiency such as alternate furrow irrigation, paired row irrigation, use of crop residues as mulches for reducing evaporation losses.

viii. Adopt possible mitigating measures i.e. switch over to efficient method of irrigation like drip and sprinkler, low water demand crops etc.

ix. Adopt crop diversification plan to shift from high volume low value crops to low volume high value crops, which require less inputs specially water. This would include adoption of horticulture crops and protected cultivation.

The IEC program will mobilize the community to come forward for managing the groundwater resources themselves and will create conductive environment necessary for the formation of local groundwater management organizations in the aquifer area for implementing the Project.

c. Trainings & Exposure visits of all the stake holders (farmers and other community members including women) including PRIs

The project success is heavily depending on successful implementation of trainings under the project. Objective of this activity is to build capacity of community, women, as well as project staff so that Project objective on may be achieved. The objective of exposure visits is to realize the community, PRIs, community groups, project staff etc. about the impact of the activities proposed in the project. The Exposure visits for community, PRIs, community groups, project staff etc. within the state and outside the state should be organized so that they could explore their knowledge as well as experiences about the technical and social innovations.

Training and capacity building:

Results of surveys will provide basic and essential inputs for understanding the prevailing situation and designing the Training and capacity building strategy suitable to area. The training is very significant activity towards achieving project development objective. It is necessary to develop consensus amongst all stakeholders in the aquifer area for their active participation in every decision making process and to create awareness about the need for groundwater management by the community. This would be achieved through an intensive training and capacity building campaign to inculcate the sense of belonging among the community, women as well as project staff or all project activities. Individually addressed communication through participatory work between project and the local communities is important. To facilitate such communication prepare training and capacity building in an effective manner using local language, The intensive training and capacity building will create the social consensus, necessary to motivate the local water users to join and participate in the local groundwater management committees. The specific training and capacity building campaign would include Mass awareness Camps, Orientation programs, Capacity building, Advance training, Exposure visits etc. and address following aspects:

- Data recording and monitoring of water levels.
- Motivate and encouraged the community for promoting water efficient irrigation techniques such as sprinklers and drips.
- Shift from high volume low value crops to low volume high value crops
- Community participation in groundwater conservation and management
- Water rights and water markets
- Legal aspects of groundwater development
- Economically and institutionally sustainable over the project period.
- Asset management and maintenance task and made suitable administrative and financial arrangements for their maintenance and further development.
- Exposure visits of Community to explore their knowledge as well as experiences about the technical and social innovations and successful work/project.

d. Measures for sustainable and efficient use of water resources

Actual assessment of water resources availability within the target area on the basis of analysis of baseline survey data & assess the utilizable water resources availability from all water sources (water harvest structures, ground water etc.) area for various purposes and also the projected demand.

ILLUSTRATIVE ENVIRONMENT AND WATER CONSERVATION STRUCTURES PROPOSED TO BE PLANED:

a. Contour Bund / Field Boundary Bund: It is one of the most commonly adopted indigenous technologies for in-situ moisture conservation. Contour bunds to be are constructed along the contours where ever farmers agree. If land is less or farmers are not allowing bunds on contours in the field, than, compromise contour bund called field / boundary bunds of about 45-60 cm height adjusted on the field boundary are constructed with table top cross section. Locally this practice is known as 'Medbandi' or 'Dhorapali'. Bunds are stabilized by grasses of local palatable/perennial species to supplement the fodder needs for animals.

b. Waste weirs: To protect contour / field bund from breaching & prevent crop damage, masonry outlet structures are constructed to drain away excess water. Proper outlet/ waste weirs provided in contour bunds alternate to avoid gully formation & increase travel path.

c. Diversion drains/channels and sump: for recharging open dug wells (FWC): In case the watershed area falls below the unprotected area or hilly area from which. Uncertain amount of water comes and enters in the area, then the diversion channel is excavated to intercept the runoff from the area situated above & to conduct it safely to outlet. Sometimes, diversion drains are also dug to divert the flow of flowing water from the fields into the dead open well for re-charging purpose.

d. Dugout Farm Ponds: The farm ponds, at a lower elevation, are constructed to harvest the excess runoff after in-situ moisture conservation. Farm pond helps in providing supplemental irrigation as well as increasing cropping intensity. Size of farm pond & design would depend on rainfall, catchment area of farm, runoff data, slope, runoff water availability. Plastic lined farm ponds are cheaper & best suited on individual farms if the soil blow is permeable.

e. Agro Forestry including block plantation, shelter belts, sand dune stabilization:
Agroforestry is a broad term encompasses symbiosis of silvi-culture, agriculture and livestock without much competitions and same time increasing the unit land production. If we see tree planting in agriculture fields it may be at the borer of the fields' tree and crop in alternate rows or strips, Trees and trees mixture. Agroforestry is a farming system integrating crop and /or livestock with trees and shrubs. The resulting biological interactions provides multiple benefits i.e. diversified farm income, increased biological production, better water quality and improved habitat for both humans and wildlife.

f. Raising Nurseries for fodder, timber, fuel wood and horticulture: In consultation with the farmers and as per demand of local vegetative material, nurseries will be established / promoted in the area. Necessary support for raising the seedlings/saplings, fertilizer, water etc. will be provided. No expenditure on land rant/cost will be allowed.

g. Continuous Contour Trenches (CCTs): V-shaped ditches strictly along contour, with side slope for cut section with MPTs at gully junctions to reduce the velocity of runoff. Bunds are constructed downstream along the trenches with material taken out of them. Main objective is to create favorable moisture conditions. Plants are put in trench along berm.

h. Constructing the box shaped staggered trenches across the deeper slopes: Staggered trenches are excavated trenching of shorter lengths in a row along the contour with interspace between them. In the alternate row, the trenches will be located directly below one another. The length of the staggered contour trenches could be 3 to 4 m with interspaces between them in the same row of about 2 to 3 m. The trapezoidal trenches of 0.3 to 0.5 m bottom width and 0.5:1 side slope are preferred.

i. **Fencing of Pasture Lands:** To mitigate the fodder requirement, pasture development is proposed. The encroachment is the main problem of pasture development. The pasture land is developed by fencing of the area either by ditch cum bund, vegetative, stone wall or other suitable fencing. Most commonly, in the watershed area, the available pasture land is protected by ditch cum bund fencing. From the excavated soil of the trench, the bund is prepared inside the area along the trench, so that the animals cannot step in from outside of the area into the area.

j. **Check Dams:** In second and third order streams with earthen dam in center and surplus weir on side (No check Dam in the main stream and no cement structure in the stream course). The earthen bund / check dams should not be constructed in the main stream where maximum flood **discharge will be very high.**

k. **Sunken pits** in gullies in first and second order streams: The method of providing sunken pits in gullies was found to be useful, serving the twin purpose of erosion control in gullies, as well as increasing the recharge. A small rough stone apron in the bed of the pit, is provided to withstand the falling flow of water. The length of pit at the bed level can be about 4.00 meter and the clear distance from one pit to another pit can be 4.00 meters.

l. **Restoring and de-silting very small tanks lying within the watershed:** This is an important activity, in which with little efforts, we can increase the capacity of the existing water resources. Suitable water surplusing arrangement for safe disposal of water can also be provided. Necessary surve is required for the purpose.

m. **Loose stone check dam:** The gully control structure will be constructed by locally available loose stone without any binding material. So these structures are called Loose Stone Check Dam. The gullies will be plugged by stone with height not more than 1m with upstream slope, nearly vertical and downstream slope 1.5:1. The depth of foundation will be kept about 0.4 m and with about 0.6 m inside the natural ground on each side to prevent flood water out flanking the structure. Upstream side of the structure will be filled by the soil at slope 2:1 with grasses.

n. **Construction of masonry structures:** In some places where vegetative measures and simple practice alone are inadequate to handle the concentration of water, permanent masonry structures structure will be provided.

o. Gully control structures: It consists of constructing earthen bunds of suitable dimension across the small nallah or gullies to hold the runoff water. Temporary storage of runoff against the bunds carries deposition of silt & water is drained off in controlled manner. The water impounding facilitates percolation of water, which otherwise will flow with intense velocity.

p. Construction of Water harvesting structures/Tanks: Where ever feasible small water harvesting structures called ponds / talai's will be constructed. Repair, rehabilitation of old tanks & talai would be undertaken on priority.

q. Sub surface dams: At the downstream of the watershed: This work has to be executed at a suitable place on the downstream side of the watershed. Geo-physical surveys have to be conducted to determine the exact location. Excavation of the trench for the sub surface dam may be done manually adopting a trench section, preferably during summer season. Puddle clay from the nearest tank bed has to be conveyed and filled in the trench for a width of 0.90 meter. The puddled clay has be mixed with water and made into plastic balls of about 0.40 meter diameter and deposited in the trench and trampled with legs. On either side of the puddle clay, an HDPE film of about 200 microns thick may be provided to ensure blanket cut-off wall. As the puddle clay wall comes up, earth filling on the sides has to be done. These are highly cost effective measure for ground water retention.

r. Modification of Village tanks as recharge structure: Most villages have village ponds/ tanks to store rainwater for uses other than human consumption like livestock consumption and at the same time help in recharging groundwater in the aquifers in their vicinity.

s. Check Dams / Cement Plug nala bunds: Check dams are constructed across small streams having gentle slope and are feasible both in hard rock as well as alluvial formation. The site selected for check dam should have sufficient thickness of permeable bed or weathered formation to facilitate recharge of stored water within short span of time.

A series of small bunds or weirs are made across selected nala sections such that the flow of surface water in the stream channel is impeded and water is retained on pervious soil/tock surface for longer body. Nala bunds are constructed across bigger nalas of **second order streams** in areas having gentler slopes. A nala bund acts like a mini percolation tank.

t. Gabion Structure: This is a kind of check dam being commonly constructed across small stream to conserve stream flows with practically no submergence beyond stream course. The boulders locally available are stored in a steel wire. This is put up across the stream's mesh to make it as a small dam by anchoring it to the streamside. The height of such structures is around 0.5 m and is normally used in the streams with width of about 10 to 15 m. The excess water overflows this structure storing some water to serve as source of recharge.

u. Scattered pits: Staggered trenches are excavated trenches of shorter lengths in a row along the contour with interspace between them. In the alternate row, the trenches will be located directly below one another. The length of staggered trenches is 3-3.65 m with interspaces between them in same row of about 2.4 to 3 m.

v. Anicuts/Tanks: Where ever feasible small water harvesting structures called Anicut, ponds/ talai's are constructed. Suitable site selection is important.

w. Farm Ponds: The substantial runoff will be lost from the area during the rainy season. This runoff not only lost but it will promote soil erosion in the area. So this runoff should be harvested in the area it-self whether it is private land or community land. The farm ponds will be constructed in private land to harvest the excess runoff after in-situ moisture conservation.

x. Sub- surface Techniques: Subsurface techniques aim at recharging deeper aquifers that are overlain by impermeable layers, preventing the infiltration from surface sources to recharge them under natural conditions. The most common methods used for recharging such deeper aquifers are a) Injection wells or recharge wells, b) Recharge pits and shafts, c) Dug well recharge, d) Borehole flooding and e) Recharge through natural openings and cavities.

y. Injection Wells or Recharge Wells: Injection wells or recharge wells are structures similar to bore/tube wells but constructed for augmenting the ground water storage in deeper aquifers through supply of water either under gravity or under pressure. The aquifer to be replenished is generally one with considerable desaturation due to overexploitation of ground water. Artificial recharge of aquifers by injection wells can also be done in coastal regions to arrest the ingress of seawater and to combat problems of land subsidence in areas where confined aquifers are heavily pumped.

z. Gravity Head Recharge Wells: In addition to specially designed injection wells, existing dug wells and tube/bore wells may also be alternatively used as recharge wells, as and when source water becomes available. In areas where considerable de-saturation of aquifers have already taken place due to over-exploitation of ground water resources resulting in the drying up of dug wells and lowering of piezometric heads in bore/tube wells, existing ground water abstraction structures provide a cost-effective mechanism for artificial recharge of the phreatic or deeper aquifer zones as the case may be.

aa. Recharge Pits: Recharge pits are normally excavated pits, which are sufficiently deep to penetrate the low-permeability layers overlying the unconfined aquifers. They are similar to recharge basins in principle, with the only difference being that they are deeper and have restricted bottom area. In many such structures, most of the infiltration occurs laterally through the walls of the pit as in most layered sedimentary or alluvial material the lateral hydraulic conductivity is considerably higher than the vertical hydraulic conductivity. Abandoned gravel quarry pits or brick kiln quarry pits in alluvial areas and abandoned quarries in basaltic areas can also be used as recharge pits wherever they are underlain by permeable horizons. Nalah trench is a special case of recharge pit dug across a streambed. Ideal sites for such trenches are influent stretches of streams. Contour trenches, which have been described earlier also belongs to this category.

bb. Indirect Methods: Indirect methods for artificial recharge to ground water does not involve direct supply of water for recharging aquifers, but aim at recharging aquifers through indirect means. The most common methods in this category are induced recharge from surface water sources and aquifer modification techniques.

cc. Dug Well Recharge: In alluvial as well as hard rock areas, there are thousands of dug wells which have either gone dry or the water levels have declined considerably. These dug wells can be used as structures to recharge. During rainy seasons, a substantial quantity of rainwater is lost as runoff. If this runoff is diverted into a pit constructed at a lower elevation in the area and from there, after filtration, induced into an existing well, it would then enhance the recharge to the aquifers. The ground water reservoir, storm water, tank water, canal water etc. can also be diverted into these structures to directly recharge the dried aquifer. By doing so the **soil moisture** losses during the normal process of artificial recharge, are reduced. The recharge water is guided through a pipe to the bottom of well, below the water level to avoid scoring of bottom and entrapment of air bubbles in the aquifer. The quality of source water including the silt content should be such that the quality of ground water reservoir is not deteriorated.

dd. Recharge Shaft: These are the most efficient and cost effective structures to recharge the aquifer directly. In the areas where source of water is available either for some time or perennially e.g. base flow, springs etc. the recharge shaft can be constructed.

ee. Ground Water Dams or Sub-Surface Dykes or Underground Bandharas (UGB): These are basically ground water conservation structures and are effective to provide sustainability to ground water structures by arresting sub surface flow. A ground water dam is a sub-surface barrier across stream which retards the natural ground water flow of the system and stores water below ground surface to meet the demands during the period of need. The main purpose of ground water dam is to arrest the flow of ground water out of the sub-basin and increase the storage within the aquifer.

The underground dam has following advantages: -

- Since the water is stored within the aquifer, submergence of land can be avoided and land above reservoir can be utilised even after the construction of the dam.
- No evaporation loss from the reservoir takes place.
- No siltation in the reservoir takes place.
- The potential disaster like collapse of dams can be avoided.
- The aquifer to be replenished is generally one which is already over exploited by tube well pumpage and the declining trend of water levels in the aquifer has set in. Because of the confining layers of low permeability the aquifer can not get natural replenishment from the surface and needs direct injection through recharge wells.
- In alluvial areas injection well recharging a single aquifer or multiple aquifers can be constructed in a fashion similar to normal gravel packed pumping well. The only difference is that cement sealing of the upper section of the well is done in order to prevent the injection pressures from forcing leakage of water through the annular space of borehole and well assembly.
- In hard rock areas casing and well screens may not be required. An injection pipe with opening against the aquifer to be recharged may be sufficient. However, in case of number of permeable horizons separated by impervious rocks like vesicular basalts or cavernous limestones, a properly designed injection well may be constructed with slotted pipe against the aquifer to be recharged.

ff. Ditch and Furrow Method:

In areas with irregular topography, shallow, flat bottomed and closely spaced ditches or furrows provide maximum water contact area for recharge water from source. This technique requires less soil preparation than the recharge basins and is less sensitive to silting.

gg. Percolation Tanks (PT)

These are the most prevalent structures as a measure to recharge the ground water reservoir both in alluvial as well as hard rock formations. The efficacy and feasibility of these structures is more in hard rock formation where the rocks are highly fractured and weathered.

hh. Important Aspects of Percolation Tanks:

- A detailed analysis of rainfall pattern, number of rainy days, dry spells, and evaporation rate and detailed hydrogeological studies to demarcate suitable percolation tank sites.
- In semi-arid climate, the storage capacity of percolation tank is designed such that the water percolates to ground water reservoir by January since the evaporation losses would be high subsequently.

- Percolation tanks are normally constructed on **second to third order stream** since the catchment so also the submergence area would be smaller.
- The submergence area should be in uncultivable land as far as possible.
- Percolation tank be located on highly fractured and weathered rock for speedy recharge. In case of alluvium, the boundary formations are ideal for locating Percolation Tanks.
- The aquifer to be recharge should have sufficient thickness of permeable vadose zone to accommodate recharge.
- The benefitted area should have sufficient number of wells and cultivable land to develop the recharge water.
- Detailed hydrological studies for run off assessment be done and design capacity should not normally be more than 50% of total quantum of rainfall in catchment.
- Waste weir or spillway is suitably designed to allow flow of surplus water based on single day maximum rainfall after the tank is filled to its maximum capacity.
- Cut off trench is provided to minimize seepage losses both below and above nalla bed.
- To avoid erosion of embankment due to ripple action stone pitching be provided upstream upto HFL.
- Monitoring mechanism in benefitted as well as catchment area using observation well and staff gauges be provided to assess the impact and benefits of percolation tank.

9. Team Management:

Following team shall be handling all the activities of the project. They shall be planning, executing, supervising and monitoring the programs / activities as per the work plan.

At Head Office	
Position	**Nos**
Project Director	1
Technical Director-Hydrology/Civil	1
Community Mobilisation Expert	1
IEC Expert	1
Admin / HR Executive	2
Accounts Executive	1
Computer Operator	1
Support Staff	1
At District Office	
Team Leader	1
Civil Engineer	1
Community Mobilisation Expert	2
IEC Expert	2
Foreman	4

10. Work Plan

Item	Months											
	1	2	3	4	5	6	7	8	9	10	11	12
Baseline Survey												
Secondary Data Collection												
Field Survey												
Awareness Generation												
PRA												
Training and Exposure Visit												
Water Conservation Structure												
Drainage Line Treatment & Repair Maintenance												

Output / Deliverables of the Project :

a. Awareness programs

b. Collecting information on water handling practices, hygiene practices, the prevalence of water-borne diseases, and the willingness for behavioral change

c. Mapping drinking water sources

d. Conduct exposure visits for women, village representatives, members of village institutions, staff members

e. Conduct trainings of village institution members to build technical skills

f. Repair, treat, and revive hand-pumps, water bodies

g. Conduct operation and maintenance trainings

h. Conduct trainings for women and village institution members to build technical skills

i. Follow-up meetings on the eco-sanitation toilets

j. Conduct a hydrogeological study on each settlement and map the groundwater, studying water use and agricultural patterns

k. Train these youth and involve them in the technical work

l. Prepare booklets and posters in the local language to impart information

12. Budget Estimate:

A. Activities and Intervention

Planning Phase (per district)				
Item	Unit	Rate	No. of villages	Amount
Baseline Survey	Nos.	12000	100	1200000
Secondary Data Collection	LS			200000
Field Survey	Nos.	18000	100	1800000
Total (per district)				**3200000**
For 5 district (A)				**16000000**

Implementation Phase (per village)					
Item	Interval	No. of events	Rate	12 Months	24 Months
Awareness Generation	Quarterly	1	15000	60000	120000
PRA	Yearly	1	25000	25000	50000
Training and Exposure Visit	Bi-annual	1	40000	80000	160000
Water Conservation Structure	LS				500000
Drainage Line Treatment & Repair Maintenance	LS				150000
Total (per village)					**980000**
For 500 villages (B)					**490000000**

B. Salary and Allowances:

Head Office				
Position	Nos	Monthly Salary	Duration	Total
Project Director	1	100000	24	2400000
Technical Director-Hydrology/Civil	1	100000	24	2400000
Community Mobilisation Expert	1	80000	24	1920000
IEC Expert	1	80000	24	1920000
Admin / HR Executive	2	20000	24	960000
Accounts Executive	1	20000	24	480000
Computer Operator	1	20000	24	480000
Support Staff	1	10000	24	240000
Total (C)				**10800000**
District Office				
Team Leader	1	50000	24	1200000
Civil Engineer	1	40000	24	960000
Community Mobilisation Expert	2	40000	24	1920000
IEC Expert	2	40000	24	1920000
Foreman	4	25000	24	2400000
Total per district				**8400000**
For 5 Districts (D)				**42000000**

Total Budget Estimate	
Planning Phase (per district) (A)	16000000
Implementation Phase (per village) (B)	490000000
Team Management	
Head Office (C)	10800000
District Office (D)	42000000
Total Budget Requirement	**558800000**