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Government of India
Ministry of Water Resources,
River Development & Ganga Rejuvenation
Central Ground Water Board

PLAN ON

ARTIFICIAL RECHARGE TO GROUND WATER AND WATER CONSERVATION IN BANGARPET TALUK, KOLAR DISTRICT, KARNATAKA

Central Ground Water Board
South Western Region
Bangalore
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PLAN ON ARTIFICIAL RECHARGE TO GROUND WATER AND WATER CONSERVATION IN BANGARPET TALUK, KOLAR DISTRICT, KARNATAKA

Sl. No. **TOPIC**

PLAN ON ARTIFICIAL RECHARGE TO GROUND WATER AND WATER CONSERVATION IN BANGARPET TALUK, KOLAR DISTRICT, KARNATAKA

AT A GLANCE	
Taluk	Bangarpet
District	Kolar
State	Karnataka
Taluk area	864.3 Sq. km.
Area Suitable for Artificial Recharge	827 Sq. km.
Latitude & Longitude	Longitude 78° 05' 10" E - 78° 28' 25" E Latitude 12° 45′ 43″ N - 13° 05′ 00″ N
Norma Rainfall	793 mm
Norma Monsoon Rainfall	426 mm
Normal Non- Monsoon Rainfall	367 mm
Geology	Granites, Gneisses and Schists (Migmatites and Granodiorites, Banded Ferruginous Quartzites, Granitoid Gneiss)
WATER LEVEL	
Pre - Monsoon	Approximately >23 m bgl.
Post - Monsoon	Average 23 m bgl. * Almost all the representative OW are dry
GROUND WATER RESOURCES ESTIMATION	
Net ground water available	47.79 MCM
Ground water draft for irrigation	92.35 MCM
Groundwater draft for domestic & industrial water supply	2.92 MCM
Total ground water draft	95.27 MCM
Stage of ground water development (%)	199 %
Non-committed monsoon runoff available for the taluk	13.80 MCM
Total volume of weathered zone available for Recharge	8270 MCM
Storage Potential Weathered/unsaturated zone available for Recharge	165.40 MCM

ARTIFICIAL RECHARGE /CONSERVATION MEASURES	
Structures Proposed (tentative)	Check Dam – 85 Percolation Tank – 6 Point Recharge structures – 9
Tentative total cost of the project	Rs. 333.9 lakhs
Excepted recharge	1. 66 MCM
Expected rise in water level by recharging 1.66 MCM of rainfall run-off	0.1 m

PLAN ON ARTIFICIAL RECHARGE TO GROUND WATER AND WATER CONSERVATION IN BANGARPET TALUK, KOLAR DISTRICT

1. Introduction:

Ground water is an essential component of the environment and economy. It sustains the flow in our rivers and plays an important role in maintaining the fragile ecosystem. The dependence on groundwater in agrarian states like Karnataka is high. In view of the growing concerns of sustainability of ground water sources, immediate attention is required to augment ground water resources in stress areas. Irrigated agriculture in the state is putting additional stress on the ground water system and needs proper management of the resources. This fast-depleting resource has to be augmented by suitable scientific interventions. Under this background, a plan on artificial Recharge to Ground water in Bangarpet Taluk, Kolar District, having an area of 864.30 sq. km. has been prepared and presented in this report.

2. Objectives of the Scheme:

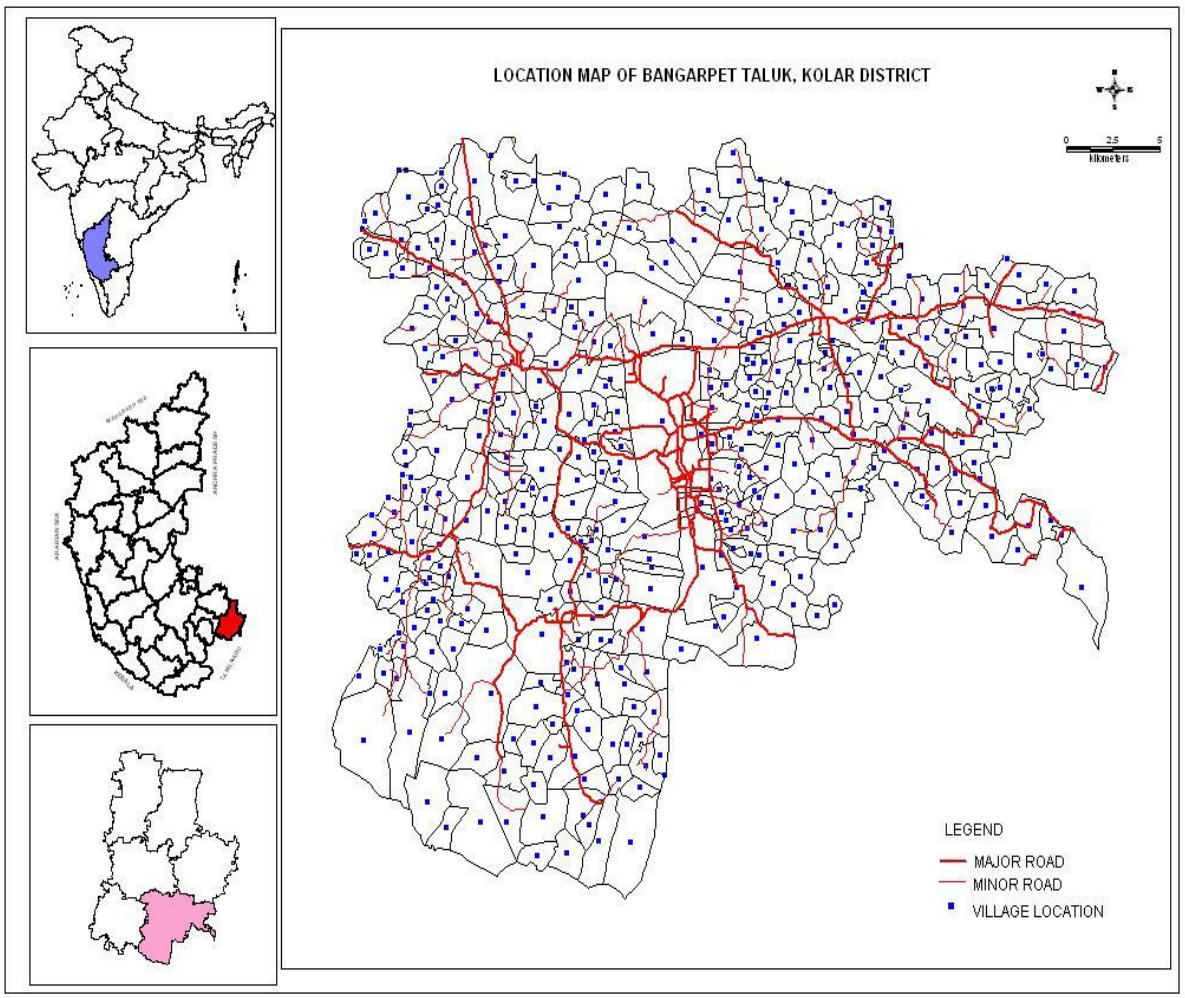
- To augment ground water resources by harvesting and conserving non committed surplus monsoon run off using artificial recharge measures.
- To overcome the inadequacy of surface water to meet the ever-increasing water demands.
- To arrest decline in ground water levels.
- To recover and transform this ‘OE’ taluk into ‘safe’ category.
- To enhance availability of ground water at specific place and time and utilize it for domestic and irrigation purposes.
- To reduce soil erosion.
- To conserve and develop ground water resource for sustainable management.
- To increase the agricultural production by judicious use of ground water by deploying water use efficiency measures.
- To achieve self-sufficiency in water supply in the Taluk.
- To implement sustainable ground water resources management plan.

3. Study area details:

3.1 Location

Bangarpet taluk is located in the southern-eastern part of Kolar district of Karnataka (Fig-1). The taluk covers a geographic area of 864.3 sq.km and lies between Longitude of 78°05'10" E and 78°28'25" E and Latitude of 12°45′43″ N and 13°05′00″ N. Location map of the taluk is presented in Fig-1.

Fig-1: Location of the Bangarpet taluk, Kolar district, Karnataka



3.2 Physiography and Drainage:

Geomorphologically, Bangarpet taluk is a rugged and undulating to plain land with a number of scattered hillocks. Lateritic masses are occurring as irregularly distributed patches. Highest elevation in the taluk is 843 m a msl. Taluk is a part of Ponniyar basin and is drained by two main rivers namely Palar and Dakshin Pinakini. The drainage pattern in the taluk is dendritic**.** Maps showing geomorphology and drainage pattern are presented in Fig-2 and 3.

Fig-2

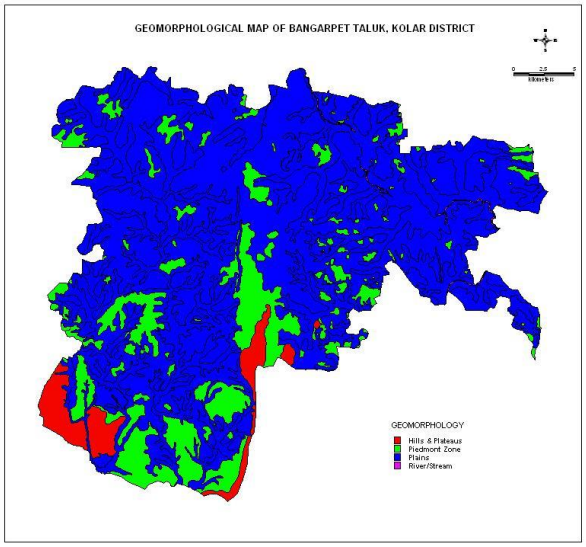
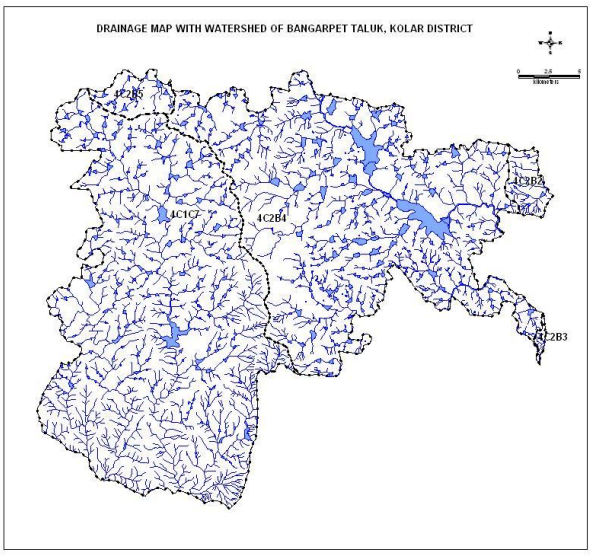


Fig-3



3.3 Land Use and Soil:

The area is underlain by loamy soil having fine sand as major constituent. Agriculture is practiced in major part of the taluk. As per 2012 data available, while forest covers 2758 ha, net area sown is 34132 ha. An area of 692.9 sq. km in the taluk is covered by plain topography; 134.1 sq.km by piedmont zone, 35.41 sq km by hills and plateaus. An area of 198.7 sq km is covered by Alfisols, 311.7 by Entisols, 230.1 by Inceptisol soils and an area of 27.3 sq km is covered by rocky land. Maps showing land use and soil distribution are presented in Fig-4 and 5.

Fig-4

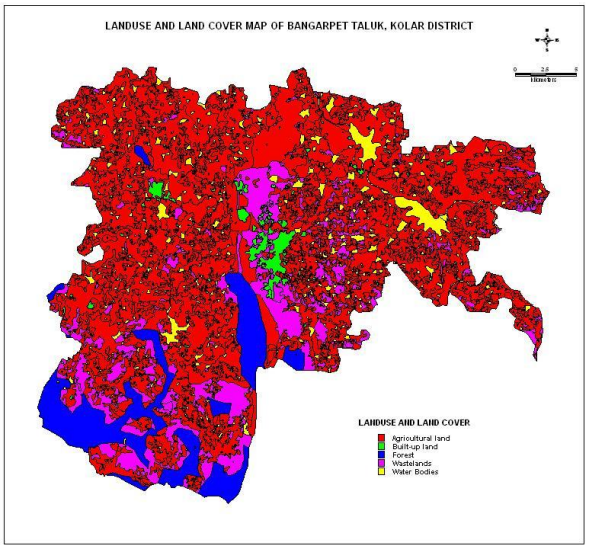
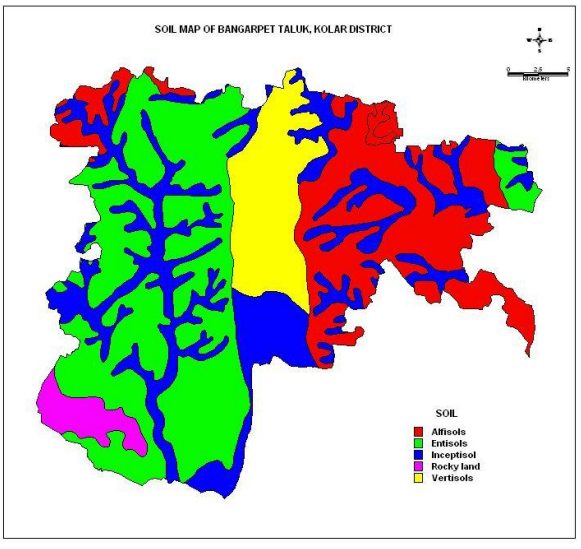


Fig-5



3.4 Hydrometeorology:

Normal rainfall in the taluk is 793 mm with about 72 rainy days. Major part of the precipitation is form Northeast monsoon. The taluk falls in the semi-arid tracts of Karnataka. Temperature is in the range of 12° C to 40° C. The details of rainfall of the taluk are given in Table-1.

Table 1: Details of Rainfall in Bangarpet Taluk

Normal Monsoon Rainfall (mm)	Normal Non- monsoon Rainfall (mm)	Total Normal Annual Rainfall (mm)
426	367	793

3.5 Geology:

Major water bearing formations occurring in the taluk are Migmatites and granodiorites, Banded Ferruginous Quartzites, Granitoid Gneiss, Schists and granites. Weathered thickness of formations varies between 14 m to 30 m for different rock types. Lineaments are trending mainly in NE–SW and NW-SE directions. Map showing geology and lineament are presented in Fig-6 and 7.

Fig-6

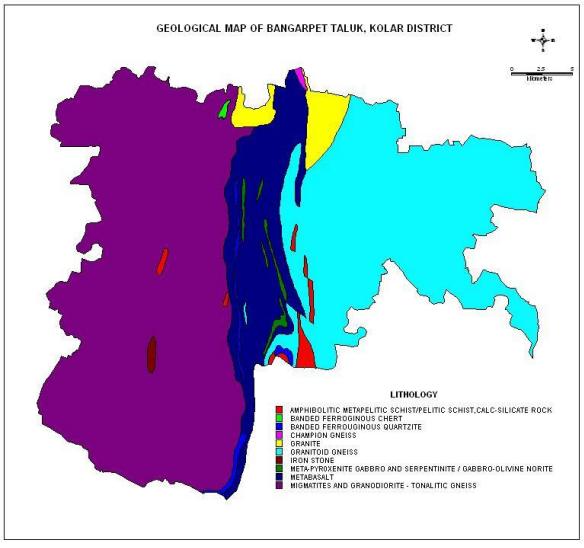
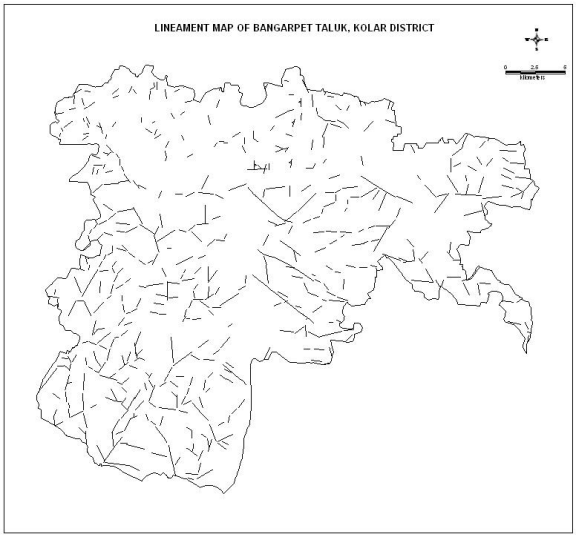


Fig-7



4. Hydrogeology:

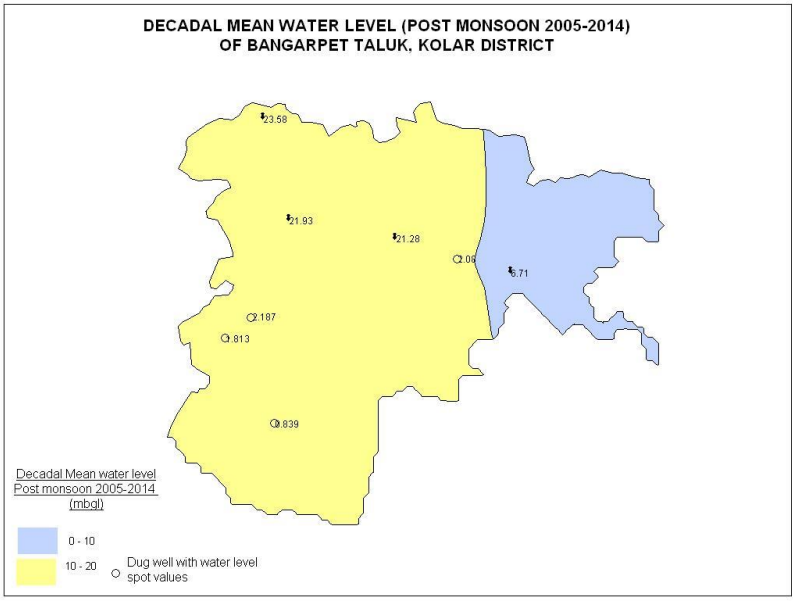
Ground water occurs in weathered formations under phreatic conditions (in small isolated and highly localized patches) at shallow level and in semi-confined to confined conditions in fractured formations at deeper level.

4.1 Decadal Post monsoon Mean Depth to Water Level (2005-14)

Decadal mean post-monsoon water levels were analysed for delineating the area suitable for artificial recharge. Most of the wells in taluk have dried up due to declining water level. There are few wells for which water level data is available for which decadal data is available. However, the wells are not representative of general water table conditions as they are isolated wells and they are shallow and are mostly located in low lying /valley areas / adjacent to water bodies.

The decadal post monsoon water level has been prepared based on water level data of piezometers. It is observed that decadal mean depth to water level in the taluk is in the range of less than 10 m in NW part of the taluk and in the major part of the taluk it in the range of 10-20mbgl. a map showing decadal mean water level is presented in Fig-8.

Fig-8



4.2 Decadal Water Level Trend (2005-2014)

An attempt was made to analyse decadal water level trend of the taluk. It is observed that the wells are either not having continuous data of pre and post-monsoon period or they have dried up. This indicates that there is declining trend of water level in the taluk.

4.3 Dynamic Ground Water Resource:

The taluk is categorized as Over Exploited as on March 2011. The net annual ground water availability in 4779 HAM, Ground water draft for irrigation is 9235 HAM and the ground water draft for drinking and industrial purposes is 292 HAM. Further, the stage of ground water development is estimated as 199%. The data are given in Table-2.

Table-2: Ground water Resources of Bangarpet taluk as on 2011

Sl. No.	Item	Resources as on 2011
1.	Net Annual Ground water Availability (HAM)	4779
2.	Existing Ground water draft for irrigation (HAM)	9235
3.	Existing ground water draft for drinking & industrial purposes (HAM)	292
4.	Existing ground water draft for all uses (HAM)	9527
5.	Stage of ground water development (HAM)	199%
6.	Categorization	Over-Exploited

5. Planning for Ground water Recharge / Conservation

5.1 Justification for Artificial Recharge

- Stage of development of ground water is 199% and the area falls in Over -Exploited category.
- Phreatic zone is totally dried up due over exploitation of ground water resource. Availability of sufficient unsaturated thickness in weathered zone provides sufficient space for artificial recharge in the project area.
- Farmers are losing their livelihood and laborers are losing jobs and many are forced to migrate for livelihood.
- The farming community is socio-economically backward.
- The topography is undulating, most of the cultivable land has become low productive due to soil erosion
- There is acute shortage of drinking water due to drying of water supply bore wells in many villages, mainly during summer months.
- 13.80 MCM of non-committed surplus monsoon run off is available for recharge.
- There are many MI tanks existing in the taluk which are silted. Rejuvenation of these tanks and recharge through these tanks will enhance the sustainability of the ground water structures in the project area.

5.2 Identification of area Suitable for Artificial Recharge

Area suitable for artificial recharge was delineated considering geology, hydrogeology, geomorphology, soil type, drainage pattern, lineament, thickness of weathered section, decadal mean depth to water level, decadal water level trend and source water availability in the taluk. An area of 827 sq km was delineated for artificial recharge.

5.3 Availability of Surplus Surface water for Artificial Recharge/ conservation:

Monsoon rainfall run off is the only source water for the artificial recharge in the project area. Source water availability is 13.80 MCM. The details of source water availability are presented in Table-3.

Table 3: Details of Source Water Availability in Bangarpet Taluk

Normal Monsoon Rainfall	426 mm
Area of identified for AR	827 Sq km
Run off Coefficient (Strange's Method)	8.7%
Monsoon Run off	30.70 MCM
Utilisable Monsoon Run off (50%)	15.30 MCM
Committed Monsoon Run off (10% of utilisable run off)	1.5 MCM
Non committed monsoon run off	13.8 MCM

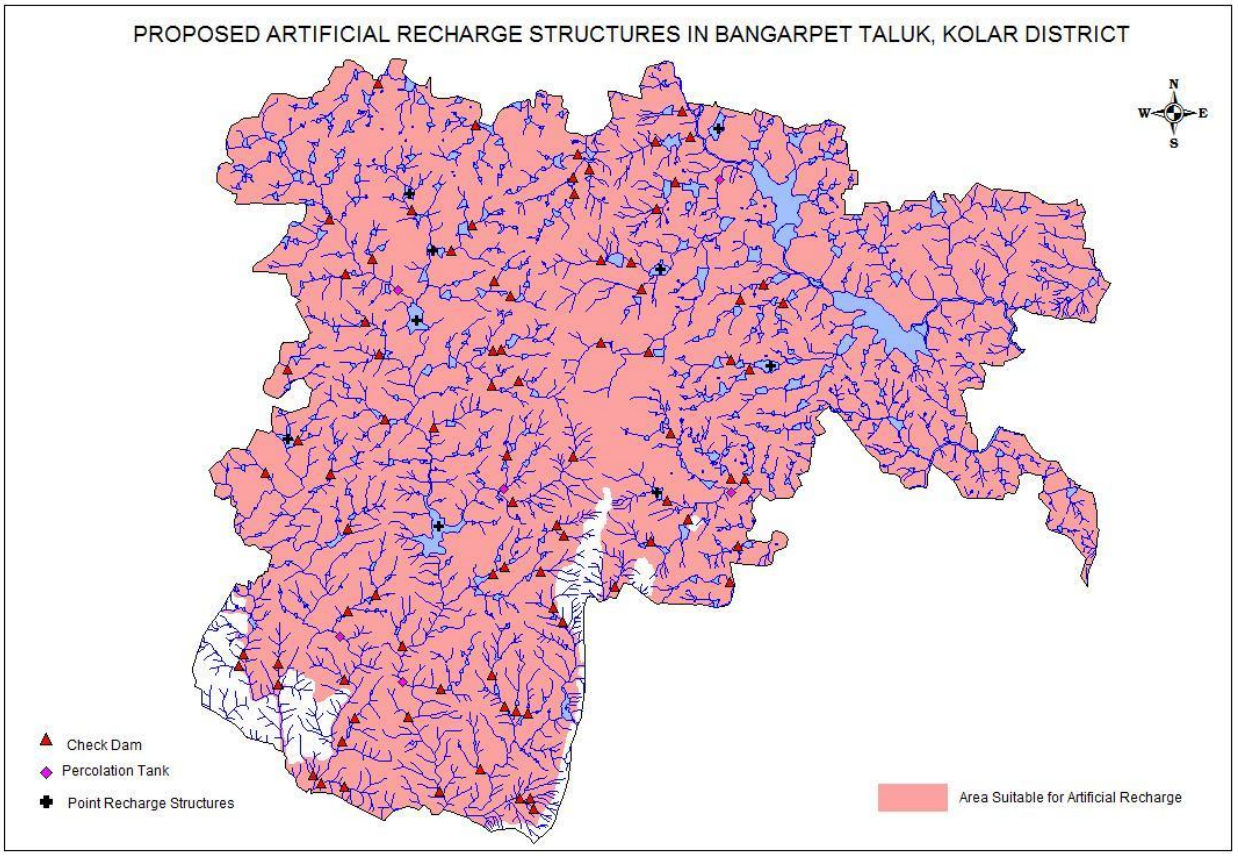
5. Proposed interventions including Tentative Locations of Artificial Recharge/conservation Structures

The feasible artificial recharge structures proposed in the taluk are Check dam, Percolation Tank and Point Recharge Structures. In addition to this, de-silting of tanks and micro irrigation may also may be taken up for water conservation purpose. The proposed structures are as given in Table-4 and locations are shown in Fig-9.

Table 4: Artificial Recharge Structures Proposed in Bangarpet Taluk

Structures Proposed	Number of Structures Proposed
Check Dam	85
Percolation Tank	6
Point Recharge Structure	9
Total	100

Fig-9



6.1 Check Dams

- Check dams are constructed across small streams having gentle slope. The site selected should have sufficient thickness of permeable bed or weathered formation to facilitate recharge of stored water within short span of time.
- The water stored in these structures is mostly confined to stream course and the height is normally less than 2 m and excess water is allowed to flow over the wall. In order to avoid scouring from excess run off, water cushions are provided at downstream side.
- To harness the maximum run off in the stream, series of such check dams can be constructed to have recharge on regional scale.

A total number of 85 check dams are feasible in the taluk. Location details with coordinates are given in the Table-5. The cost of 85 Check dams is estimated at 225 lakhs. The total storage capacity of these check dams is estimated at 1.122 MCM. The volume of ground water likely to be recharged through these check dams is estimated to be 0.79 MCM.

Table-5: Tentative Locations of Check Dams in Bangarpet Taluk

Sl. No.	Longitude	Latitude
1	78.2300	12.7779
2	78.2316	12.7737
3	78.2258	12.7781
4	78.2092	12.7902
5	78.2243	12.8137
6	78.2141	12.8289
7	78.2193	12.8160
8	78.2290	12.8128
9	78.1924	12.8231
10	78.1786	12.8114
11	78.1560	12.8111
12	78.1508	12.8013
13	78.1235	12.8249
14	78.1515	12.8269
15	78.1518	12.7830
16	78.1417	12.7841
17	78.1382	12.7878
18	78.1235	12.8334
19	78.1650	12.8618
20	78.1532	12.8552
21	78.2195	12.8735
22	78.2147	12.8706
23	78.2345	12.8715
24	78.2414	12.8903
25	78.2442	12.8862
26	78.2484	12.9187
27	78.1662	12.9609
28	78.1318	12.9256
29	78.1185	12.9119
30	78.1531	12.8889
31	78.1893	12.9306
32	78.2143	12.9479
33	78.2177	12.9630
34	78.2143	12.9626
35	78.2603	12.9656
36	78.2801	12.9619
37	78.1455	12.9117
38	78.1689	12.9343
39	78.1278	12.9547
40	78.1604	12.9745
41	78.1451	13.0163
42	78.1801	13.0202
43	78.1657	13.0726

44	78.2073	13.0554
45	78.2485	13.0339
46	78.2551	13.0369
47	78.2833	13.0486
48	78.2979	13.0504
49	78.2944	13.0611
50	78.2916	13.0316
51	78.2058	13.0140
52	78.1967	13.0033
53	78.1071	12.8328
54	78.2401	12.8567
55	78.2603	12.9998
56	78.2440	12.8506
57	78.2220	12.9848
58	78.2228	12.9001
59	78.3287	12.9897
60	78.2729	12.9987
61	78.2772	12.9880
62	78.2840	13.0210
63	78.2899	12.9284
64	78.3232	12.9547
65	78.3153	12.9584
66	78.3373	12.9822
67	78.3148	12.8672
68	78.2488	13.0269
69	78.2253	12.9500
70	78.1635	13.0003
71	78.3152	12.9098
72	78.3214	12.9098
73	78.2150	12.9909
74	78.2205	12.9191
75	78.2884	12.9005
76	78.2662	12.8650
77	78.2812	12.8839
78	78.2970	12.8931
79	78.3184	12.8820
80	78.1522	12.9939
81	78.2505	13.0432
82	78.3193	12.9836
83	78.1090	12.8376
84	78.1918	12.7809
85	78.1763	12.8406

6.2 Percolation Tanks

- Percolation tank is an artificially created surface water body, submerging in its reservoir a highly permeable land so that surface runoff is made to percolate and recharge the ground water storage.
- Percolation tank should be constructed preferably on second to third order streams, located on highly fractured and weathered rocks, which have lateral continuity down-stream.
- The recharge area down-stream should have sufficient number of wells and cultivable land to benefit from the augmented ground water.
- The size of percolation tank should be governed by percolation capacity of strata in the tank bed. It is necessary to design the tank to provide a ponded water column generally between 3 & 4.5 m.
- Percolation tanks are mostly earthen dams with masonry structure only for spillway. The purpose of the percolation tank is to recharge the ground water storage and hence seepage below the seat of the bed is permissible. For dams up to 4.5 m height, cut-off trenches are not necessary and keying and benching between the dam seat and the natural ground is sufficient.

Total 6 numbers of percolation tanks are feasible in the project area. Location details with coordinates are given in the Table-6. The cost of 6 percolation tanks is estimated to be 45 lakhs. The annual storage capacity of tanks is estimated at 1.08 MCM. The volume of ground water recharged through these Percolation Tanks is estimated to be 0.76 MCM.

Table-6: Tentative Locations of Percolation Tanks in Bangarpet Taluk

Sl. No.	Longitude	Latitude
1	78.2187	12.9054
2	78.1495	12.8447
3	78.1763	12.8258
4	78.1744	12.9873
5	78.3154	12.9040
6	78.3101	13.0327

6.3 Point Recharge Structure (PRS)

- In hard aquifer, when impervious layers overlie deeper aquifers, natural recharge is hindered. Hence, measures are adopted to recharge the deeper aquifers through a recharge bore well. Such a well is also called as 'Inverted well' because of the water movement in reverse direction.
- It needs a filter bed around the recharge bore well to remove silt load and other suspended materials in the source water.
- The filter bed depth bed is generally 2-3 m, with 3-4 m in length and width. It is refilled with coarse material at the bottom followed by finer material towards the top. Each successive layer is separated by *netlon* mesh.
- The bore well casing in the recharge pit limit should be slotted and covered with coir mat/*netlon* mesh to restrict the entry of finer particles into the aquifer. The complete structure with the above-mentioned design is known as Point Recharge Structure (PRS).

Total 9 numbers of Point Recharge Structures are feasible in the taluk. Location details with coordinates are given in the Table-7. The cost of these 9 PRS is estimated to be 18.0 lakhs. The annual storage capacity of PRS is estimated at 0.135 MCM. The volume of ground water likely to be recharged through PRS is estimated to be 0.120 MCM.

Table-7: Tentative Locations of Point Recharge Structures in Bangarpet Taluk

Sl. No.	Longitude	Latitude
1	78.1820	12.9749
2	78.1914	12.8899
3	78.1892	13.0036
4	78.2840	12.9039
5	78.3317	12.9563
6	78.2851	12.9958
7	78.1275	12.9258
8	78.1792	13.0272
9	78.3098	13.0540

7. Tentative Cost Estimate

Tentative cost estimates of structures/interventions proposed in the micro watershed are given in table 8. The unit rates are followed as per master plan of Artificial Recharge and State Government Schedule Rates. It is estimated that annually about 1.66 MCM of water will be recharged to ground water system which may create an additional irrigation potential of 200 hectares.

Table-9: Tentative Cost Estimates of structures proposed in Bangarpet Taluk

Structures	No	Unit Cost (Rs Lakhs)	Estimated Cost (Lakhs)	Annual Storage Capacity (MCM)	Volume of water likely to recharged (MCM)	Additional Irrigation Potential Likely to be created (Hectares)
Check Dam	85	3.0	225.0	1.122	0.79	200
Percolation Tank	6	7.5	45.0	1.08	0.76	
Point Recharge Structure	9	2.0	18.0	0.135	0.12	
TOTAL	**100**		**318.0**	**2.337**	**1.66**	
Impact Assessment (5% of estimate)			15.9			
Grand Total			**333.9**			

Note: Type, number and cost of structure may vary according to site after field visit/inputs.

8. Implementation Modalities

The implementation of the scheme will be done by the State Government department selected by the State Authority. Further, it is to add that more than 50% MGNREGA works are related to water conservation/sustainable management. A convergence guideline has been made between National Rural Employment Guarantee Act (NREGA) (Ministry of Rural Development) & Programmes of Water Resources (MoWR, RD & GR). Hence, the proposal may be implemented under the convergence scheme or in any other similar scheme.

a. Time schedule:

Steps	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	5th Quarter	6th Quarter	7th Quarter	8th Quarter
• Identification of line department /implementing agency and preparation of								
• Approval of scheme and release of sanction of funds								
• Implementation of ARS								

Phase = one quarter or 3 months or equivalent to financial quarter

b. Operation and Maintenance:

In all the projects, impact assessment has to be carried out to ensure that project is economically viable, socially equitable and environmentally sustainable by inter- related socio-economic, cultural and human-health impacts, both beneficial and adverse. Accordingly, it is proposed a have impact assessment at rate of 5% of the total cost of the project for 5 years from the date of completion of artificial recharge structures.