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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 KORATAGERE TALUK, TUMKUR 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 KORATAGERE TALUK, TUMKUR DISTRICT, KARNATAKA

Sl. No. **TOPIC**

PLAN ON ARTIFICIAL RECHARGE TO GROUND WATER AND WATER CONSERVATION IN KORATAGERE TALUK, TUMKUR DISTRICT, KARNATAKA

TALUK AT A GLANCE	
Taluk	**Koratgere**
District	Tumkur
State	Karnataka
Taluk area	644 Sq km
Area Suitable for Artificial Recharge	591 Sq km
Latitude & Longitude	Longitude 77° 01' 32" E - 77° 23' 33" E Latitude of 13° 19′ 03″ N – 13° 37′ 21″ N
Normal Annual Rainfall	788 mm
Normal Monsoon Rainfall	452 mm
Normal Non- Monsoon Rainfall	336 mm
Geology	Granites, Gneisses and Schists
WATER LEVEL	
Average Pre - Monsoon	>15 m bgl.
Average Post - Monsoon	>10 m bgl. * Almost all the representative OW are dry
GROUND WATER RESOURCES ESTIMATION	
Net ground water available	47.30 MCM
Ground water draft for irrigation	70.52 MCM
Groundwater draft for domestic & industrial water supply	5.16 MCM
Total ground water draft	75.69 MCM
Stage of ground water development (%)	160 %
Non commited monsoon runoff available for the taluk	11.5 MCM
Total volume of weathered zone available for Recharge	8274 MCM
Storage Potential Weathered/unsaturated zone available for Recharge	165.48 MCM
ARTIFICIAL RECHARGE /CONSERVATION MEASURES	
Structures Proposed (tentative)	Check Dam – 71 Percolation Tank – 5 Point Recharge structures – 8
Tentative total cost of the project	Rs.279.82 lakhs
Excepted recharge	1.39 MCM
Expected rise in water level by recharging 1.39 MCM of rain fall run off.	0.12 m

PLAN ON ARTIFICIAL RECHARGE TO GROUND WATER AND WATER CONSERVATION IN KORATAGERE TALUK, TUMKUR DISTRICT, KARNATAKA

1. Introduction

Groundwater 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 ecosystems. The groundwater dependence of agrarian states like Karnataka is high. In view of the growing concerns of sustainability of ground water sources, immediate attention is required to augment groundwater resources in stressed areas. Irrigated agriculture in the state is putting additional stress on the groundwater system and needs proper management of the resources. Under this background, a plan on artificial Recharge to Ground water in Koratagere Taluk, Tumkur District, having an area of 644 sq km has been prepared 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 **Over-Exploited** 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 improve the ground water quality by dilution.
- To increase the agricultural production by judicious use of ground water by implementing water use efficiency measures.
- To achieve self-sufficiency in water supply in the taluk.
- To conserve and develop ground water resources for sustainable management.
- Implementing sustainable Ground Water Resources Management Plan.

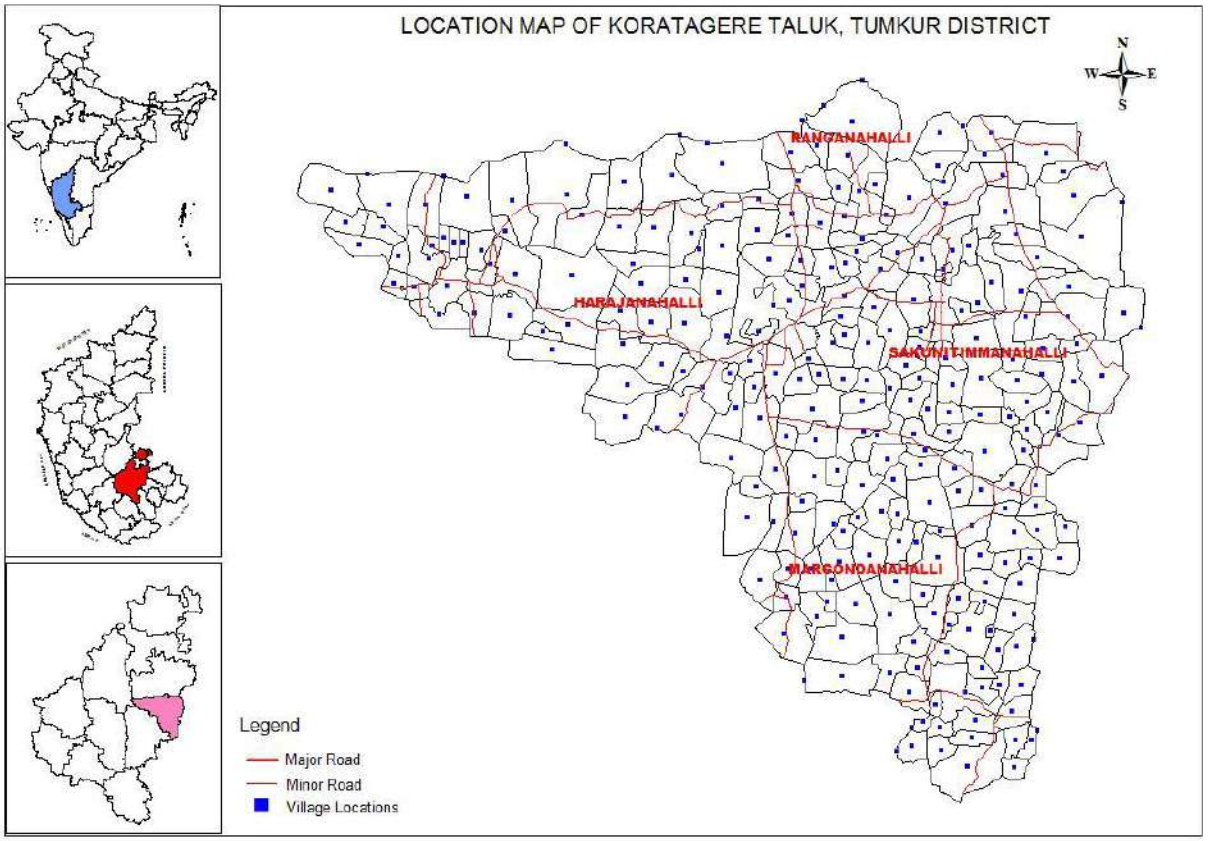
3. Study area details

3.1 Location

Koratgere taluk is located in the NE part of Tumkur district of Karnataka. The taluk covers geographic area of 644 sq.km and lies between Longitude of 77° 01' 32" E and 77° 23' 33" E and Latitude of 13

2001 is 20,450. There are 28 Panchayats and 363 villages in the taluk. There are 61 major tanks in the taluk. A map showing location of taluk is presented in Fig-1.

Fig-1



3.2 Physiography and Drainage

The Taluk is drained by Pennar, Lower Tumgabhadra and Lower Cauvery river systems. Geomorphologically, major part is covered with the denudational uplands. Hills occur in the norh western and south western part of the taluk. Highest elevation in the taluk ranges is 776 mamsl. Plain forms 534 sq km in the taluk, whereas piedmont zone, hills and rivers constitute 63, 47 and 5 sq km respectively. The drainage pattern in the taluk is dendritic. The hilly areas are full of ravines and gullys. Maps showing geomorphology and drainage pattern are shown in Fig-2 and 3.

Fig-2

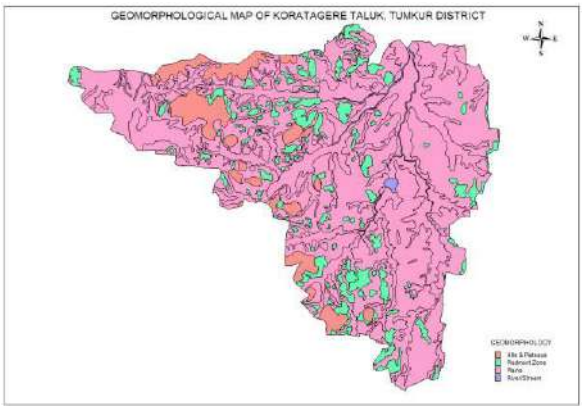
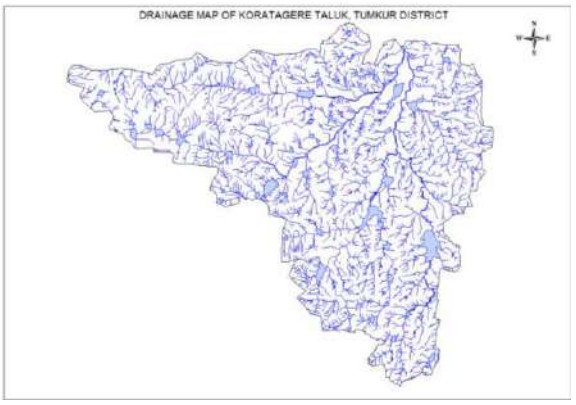


Fig-3



3.3 Land Use and Soil

As on 2011- 2012, forest covers 3476 ha, net irrigated area is 8019 and net area sown is 33605 ha in the taluk. 64% area of the taluk is underlain by inceptisol soils, 15% by alfisol and 8% by entisol soils. Maps showing land use land cover and soil distribution are presented in Fig-4 and 5.

Fig-4

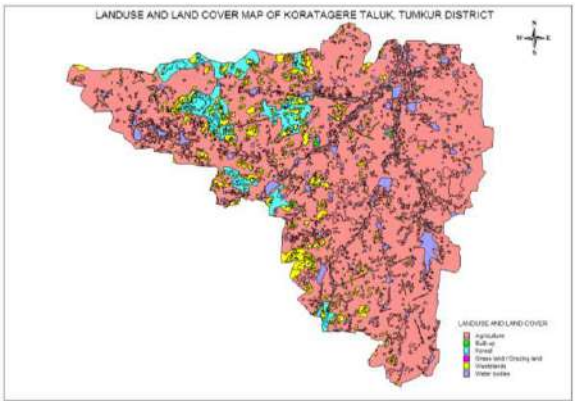
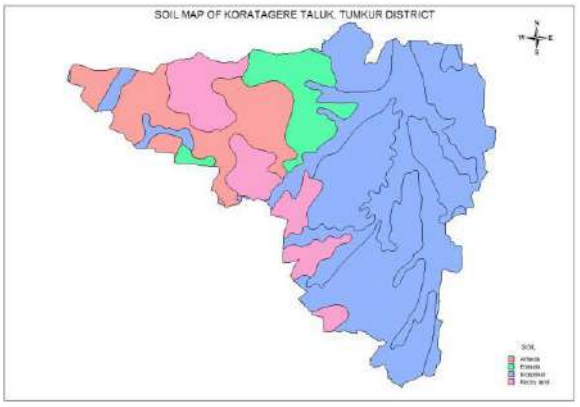


Fig-5



3.4 Hydrometeorology

The taluk is influenced by southwest and northeast monsoon and the normal annual rainfall is 788 mm with 47 rainy days. The taluk receives 452 mm of rainfall during monsoon period and remaining 336 mm during non monsoon. The temperature varies from 16° to 38 °C. The taluk is falls in chronically drought affected part of Karnataka. The details of rainfall are given in Table 1.

Table 1: Details of rainfall in the Koratagere taluk

Normal Monsoon Rainfall (mm)	Normal Non-monsoon Rainfall (mm)	Normal Annual Rainfall (mm)
452	336	788

3.5 Geology

Major water bearing formations occurring in the taluk are Peninsular Gneissic Complex, which includes Schistose rocks of Sargur group and Dharwar Super Group, Younger intrusive of Closepet Granite and basic dykes. Weathered thickness of formations varies according to varying rock types from 10 m to 40 m. Maps showing geology and depth to weathered section are presented in Fig-6 and 7.

Fig-6

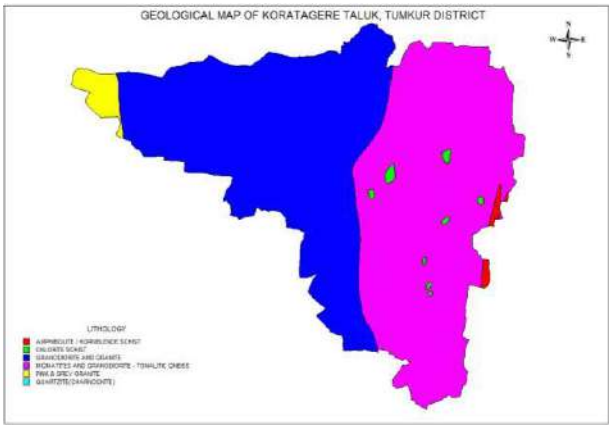
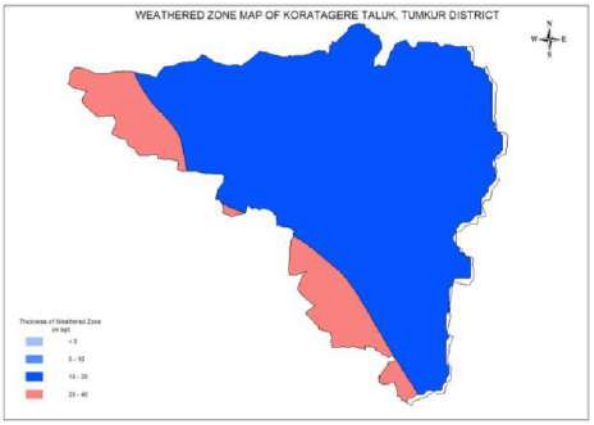


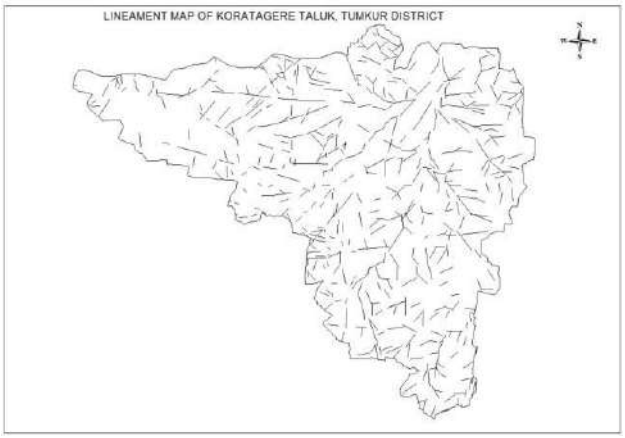
Fig-7



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. High density of lineaments is observed in the taluk trending in NE-SW direction. A lineament map is presented in Fig-8.

Fig-8



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

Mean post monsoon depth to water level data has been considered for delineating area of the taluk suitable for artificial recharge measures. Most of the wells in taluk have dried up due to declining water level. Few of the NHS observation dug wells for which, water level data is available are located in low lying /valley areas / adjacent to water bodies and are not

representative of the area. Out of two piezometers, one has recorded decadal mean post monsoon water level of 24 m bgl, whereas other one has been recorded as 2.2 m bgl. These are not enough to represent actual field conditions. Hence, thematic map generated is not considered. In general the depth to water level in the taluk is more than 15 mbgl.

4.2 Decadal Water Level Trend (2005-2014)

Decadal water level trend for pre monsoon was analysed for 13 wells for the taluk. It is observed that 6 wells have dried up due to decline of water level, 4 have recorded rising trend in the range of 0.08 to 1.08 m/year and falling trend is observed in 3 wells in the range of 0.11 to 0.23 m/year. In general there is a declining trend.

Decadal water level trend for post monsoon was analysed for 13 wells. It is observed that 6 wells have dried up due to declining water levels and in the rest of the wells, rising trend of water level is recorded in 4 wells in the range of 0.004 to 0.193m/year and falling trend is observed in 3 wells in the range of 0.106 to 0.431m/year. In general there is falling trend in the post monsoon period.

The data indicates that there is declining trend of water level in pre and post-monsoon seasons during the decade 2005-2014.

4.3 Dynamic Ground Water Resource

Ground water resources were estimated for the taluk according to GEC 97 recommendation by CGWB and Department of Mines and Geology, Government of Karnataka as on March 2011. The resource is presented in Table 2. The falls under over exploited category as stage of development is 160%.

Table 2: Ground water Resources of Koratagere Taluk, (March 2011)

Sl. No.	Item	Resource as on 2011
1.	Net Annual Ground water Availability (HAM)	4730
2.	Existing Ground water draft for irrigation (HAM)	7052
3.	Existing ground water draft for drinking and industrial purposes (HAM)	516
4.	Existing ground water draft for all uses (HAM)	7569
5.	Stage of ground water development	160%
6.	Categorization	**Over-Exploited**

5. Planning for Ground water Recharge / Conservation

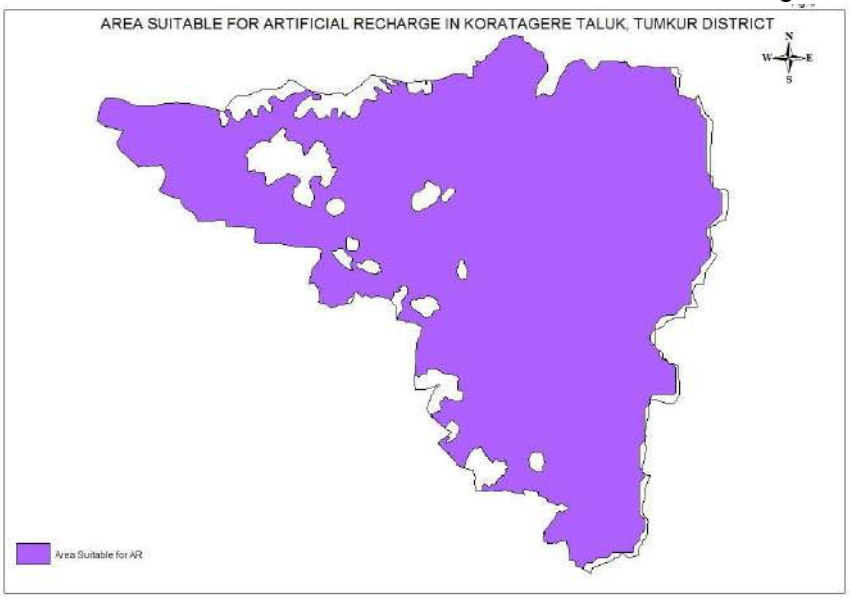
5.1 Justification for Artificial Recharge

- Stage of development of ground water is 160% and the area falls in **Over Exploited** category.
- Phreatic zone is totally dried up due to over exploitation of ground water resource. Availability of average 13m unsaturated thickness in weathered zone provides sufficient volume for artificial recharge in the project area.
- Farmers are losing their livelihood, labours are losing job and many are forced to migrate for livelihood.
- The farming community is socio-economically backward & SC/ST.
- 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 in summer months.
- 11.50 MCM of non committed surplus monsoon run off is available for recharge.
- 61 Major tanks existing in the project area, are silted. Rejuvenation of these tanks and subsequent 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 591 sq km was delineated for artificial recharge as shown in Fig-9.

Fig-9



5.3 Availability of Surplus Surface water for Artificial Recharge/ conservation

Non monsoon rainfall run off is the only source of water for the artificial recharge in the project area. Source water availability is 11.50 MCM. The details of source water availability are presented in Table 3.

Table 3: Details of Source Water Availability in Koratagere Taluk

Normal Monsoon Rainfall	452 mm
Area of identified for AR	591 sq km
Run off Coefficient (Strange's Method)	9.6%
Monsoon Run off	25.6 MCM
Utilisable Monsoon Run off (50%)	12.8 MCM
Committed Monsoon Run off (10% of utilisable run off)	1.3 MCM
Non committed monsoon run off	11.50 MCM

6. 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 given in Table 4 and locations are shown in Fig-10.

Fig-10

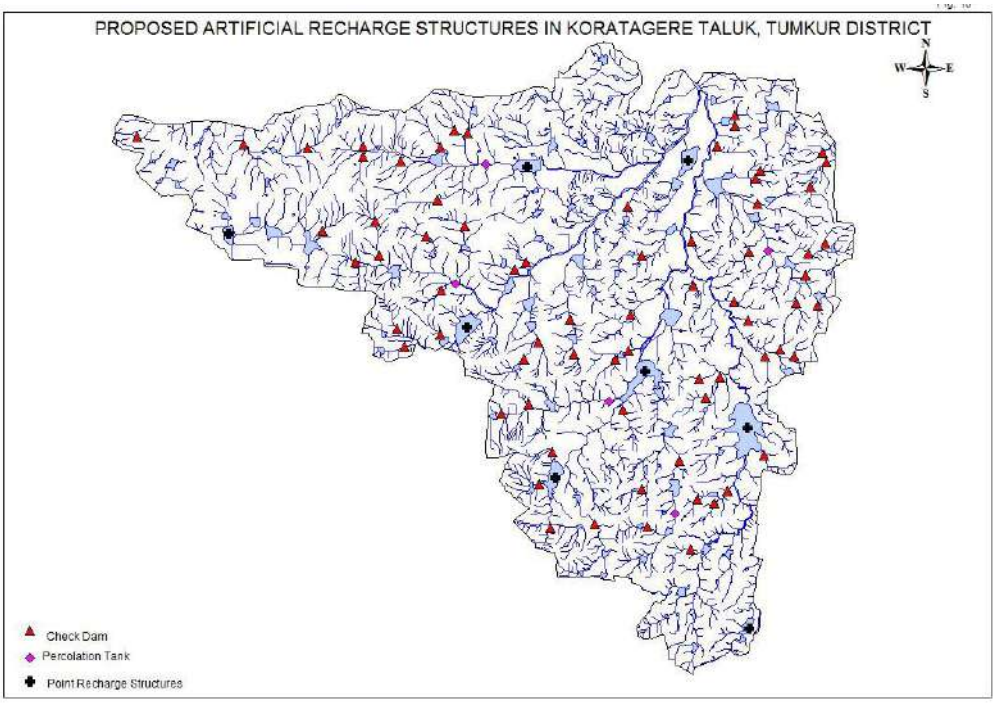


Table 4: Artificial Recharge Structures Proposed

Structure Proposed	No of Structures Proposed
Check Dam	71
Percolation Tank	05
Point Recharge Structure	08
Total	**84**

6.1 Check Dam

- 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 71 Check Dams are feasible in the taluk. Location details with coordinates are given in Table-5. The cost of these 71 Check dams is estimated at 213 lakhs. The total storage capacity of check dams is estimated at 0.94 MCM. The volume of ground water likely to be recharged through these check dams is estimated to be 0.66 MCM

Table 5: Tentative Locations of Proposed Check Dams in Koratagere Taluk

Sl. No.	Longitude	Latitude
1	77.1485	13.5672
2	77.1651	13.4840
3	77.1543	13.5358
4	77.1447	13.5167
5	77.1563	13.5198
6	77.0888	13.5735
7	77.0361	13.5768
8	77.1989	13.5340
9	77.1796	13.5288
10	77.1670	13.5650
11	77.1482	13.5726
12	77.1937	13.5800
13	77.2003	13.5789
14	77.1281	13.5315
15	77.1855	13.5464

16	77.1869	13.4813
17	77.3295	13.4060
18	77.2171	13.4434
19	77.3625	13.4710
20	77.3556	13.4740
21	77.3481	13.4708
22	77.2737	13.4694
23	77.2803	13.4736
24	77.2282	13.4696
25	77.3258	13.4611
26	77.2531	13.4721
27	77.2353	13.4778
28	77.3154	13.4603
29	77.3055	13.4205
30	77.2867	13.4070
31	77.2633	13.3902
32	77.2898	13.3885
33	77.3113	13.3777
34	77.2425	13.4246
35	77.2306	13.4477
36	77.3635	13.4970
37	77.3685	13.5100
38	77.3742	13.4954
39	77.3704	13.5529
40	77.3787	13.5645
41	77.3769	13.5693
42	77.2811	13.4910
43	77.3397	13.4885
44	77.3332	13.5823
45	77.3334	13.5873
46	77.3437	13.5568
47	77.3457	13.5605
48	77.3401	13.5216
49	77.3782	13.5257
50	77.3699	13.5208
51	77.2513	13.4888
52	77.2867	13.5199
53	77.2799	13.5431
54	77.3126	13.5049
55	77.2238	13.5129
56	77.2292	13.5167
57	77.1691	13.4754
58	77.1872	13.5028
59	77.2357	13.4092
60	77.2413	13.3881

61	77.2773	13.4450
62	77.3188	13.4511
63	77.3142	13.4016
64	77.3231	13.4000
65	77.3476	13.4232
66	77.3326	13.4974
67	77.3118	13.5266
68	77.3243	13.5723
69	77.3446	13.5445
70	77.1207	13.5717
71	77.1869	13.5720

6.2 Percolation Tank

- 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 5 numbers of percolation tanks are feasible in the project area. Location details with coordinates are given in the Table-6. The cost of 5 percolation tanks is estimated at 37.5 lakhs. The annual storage capacity of tanks is estimated at 0.90 MCM. The volume of ground water recharged through these Percolation Tanks is estimated to be 0.63 MCM.

Table 6: Location of Proposed Percolation Tanks in Koratagere Taluk

Sl. No.	Longitude	Latitude
1	77.2090	13.5637
2	77.1941	13.5059
3	77.3494	13.5218
4	77.3031	13.3952
5	77.2704	13.4493

6.3 Point Recharge Structure (PRS)

- In hard rock 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 8 numbers of Point Recharge Structures are feasible in the taluk. Location details with coordinates are given in the Table-7. The cost of these 8 PRS is estimated at 16.0 lakhs. The annual storage capacity of PRS is estimated at 0.12 MCM. The volume of ground water likely to be recharged through PRS is estimated to be 0.11 MCM.

Table 7: Tentative Locations of Proposed Point Recharge Structures in Koratagere Taluk

Sl. No.	Longitude	Latitude
1	77.33920	13.43639
2	77.22987	13.56239
3	77.08152	13.53007
4	77.30982	13.56567
5	77.20001	13.48510
6	77.28815	13.46355
7	77.24384	13.41250
8	77.34016	13.33943

7. Tentative Cost Estimate

Tentative cost estimates of structures/ interventions proposed in the taluk 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 1.39 MCM of water will be recharged to ground water system, which may create an additional irrigation potential of 168 hectares.

Table 8: Tentative cost estimates of structures proposed in Koraragere 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	71	3.0	213	0.937	0.66	168
Percolation Tank	5	7.5	37.50	0.900	0.63	
Point Recharge Structure	8	2.0	16	0.120	0.11	
TOTAL	84		266.5	**1.957**	**1.39**	
Impact Assessment (5% of estimate)			**13.23**			
Grand Total			**279.82**			

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 Govt 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 DPR								
❖ 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 projects Impact assessment has to be carried out to ensure that projects 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 completion of artificial recharge.