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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 MULBAGAL TALUK, KOLAR DISTRICT, KARNATAKA

Central Ground Water Board
South Western Region
Bangalore
December 2015

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

Sl. No. **TOPIC**

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

TALUK AT A GLANCE	
Taluk	**Mulbagal**
District	Kolar
State	Karnataka
Taluk area	823 Sq km
Area Suitable for Artificial Recharge	772.49 Sq km
Latitude & Longitude	Longitude 78° 21' 57" E - 78° 25' 46" E and Latitude of 13° 21′ 10″ N - 13° 16′ 46″ N
Normal Annual Rainfall	827 mm
Normal Monsoon Rainfall	451 mm
Normal Non- Monsoon Rainfall	376 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	47.40 MCM
Ground water draft for irrigation	98.10 MCM
Groundwater draft for domestic industrial water supply	2.91 MCM
Total ground water draft	101.01 MCM
Stage of ground water development (%)	213 %
Non committed monsoon runoff available for the taluk	15.10 MCM
Total volume of weathered zone available for Recharge	3862 MCM
Storage Potential Weathered/unsaturated zone available for Recharge	77.25 MCM
ARTIFICIAL RECHARGE / CONSERVATION MEASURES	
Structures Proposed (tentative)	Check Dam – 93 Percolation Tank – 6 Point Recharge Structures – 10
Tentative total cost of the project	Rs.361.20 lakhs
Excepted recharge	1.75 MCM
Expected rise in water level by recharging 1.75 MCM of rain fall run off.	0.11 m

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

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 Mulbagal Taluk, Kolar District, having an area of 823 sq km has been prepared in this report.

2. Objectives of the Scheme

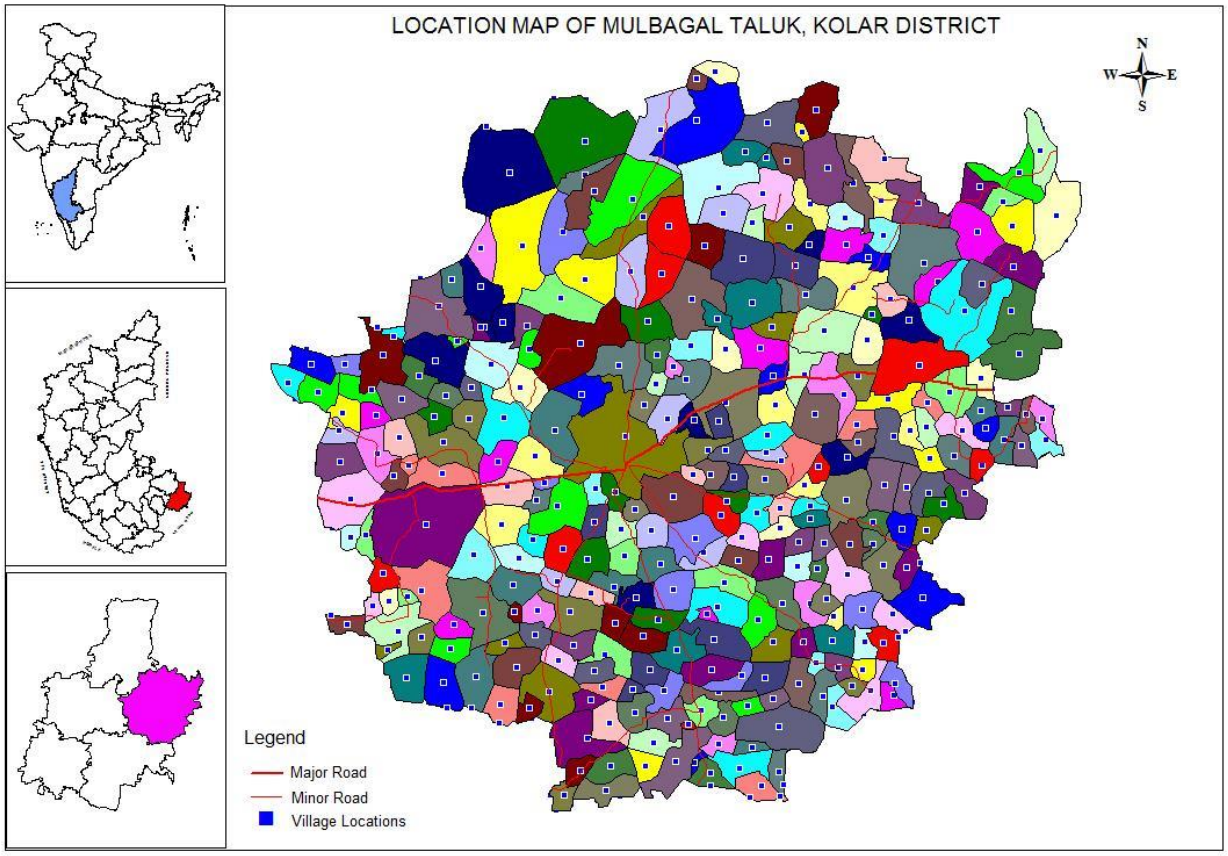
- To augment ground water resources by harvesting and conserving non committed surplus monsoon run off using artificial recharge measures.
- To overcome the inadequacy of surface water to meet the ever- increasing water demands.
- To arrest decline in ground water levels.
- To recover and transform this '**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

Mulbagal taluk is located in the NE part of Kolar district of Karnataka. The taluk is bounded in the North and east by Tamil Nadu State and in the west by Kolar and Srinivaspur taluks and in the south by Bangarpet taluk. The taluk covers a geographic area of 823 sq.km and lies between Longitude of 78° 21' 57" E and 78° 25' 46" E and Latitude of 13° 21′ 10″ N and 13° 16′ 46″ N. The population of taluk as per Census 2011 is 57,276. There are 28 Panchayats and 363 villages in the taluk.

Fig-1



3.2 Physiography and Drainage

Geomorphologically, Mulbagal Taluk is a rugged and undulating to plain land with a number of scattered hill rocks. The highest elevation in the taluk is 827m amsl. Taluk is a part of Ponniyar basin. 675.96 sq km are of the taluk is covered by plain topography, 139.34 sq km by pediment zone, 7.3 sq km by hills and plateaus and 0.36 sq km by Rivers and Streams. Drainage pattern is dendritic. Maps showing geomorphology and drainage pattern are shown in Fig 2 and 3.

Fig-2

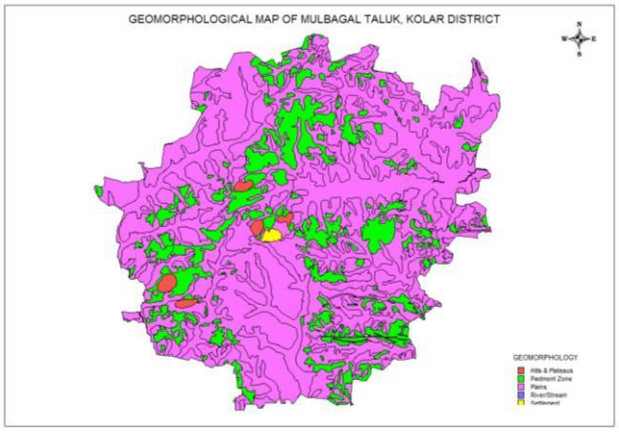
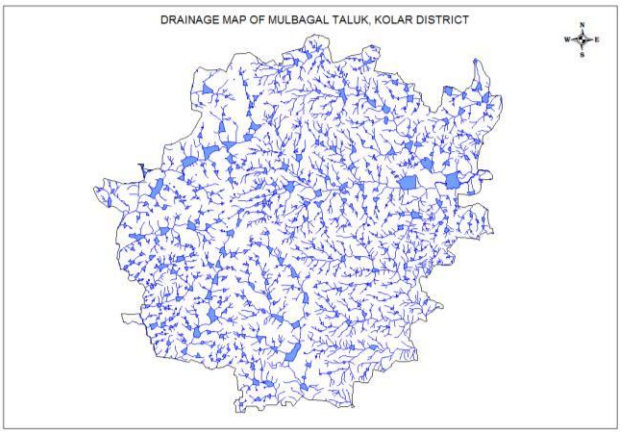


Fig-3



3.3 Land Use and Soil:

As on 2011-12, forest covers 21.22 Sq km, and net area sown is 464.40 Sq km. 34% area of the taluk is underlain by alfisol soils, 41% by entisol and 25% by inceptisol soils. Maps showing soil distribution and land use are presented in Fig-4 and 5.

Fig-4

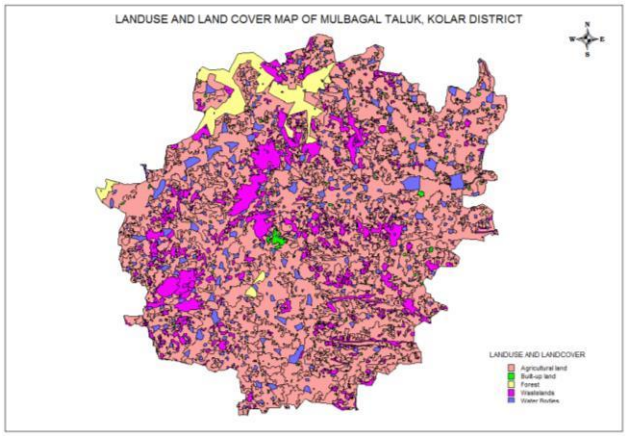
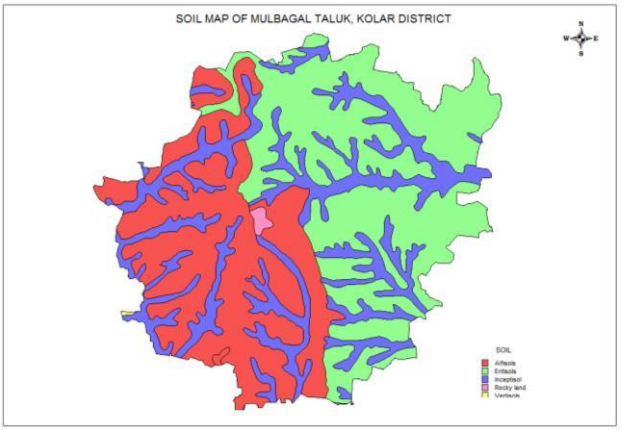


Fig-5



3.4 Hydrometeorology

Normal rainfall in the taluk is 827 mm and the normal monsoon rainfall of the taluk is 451 mm. Major part of the precipitation is form North-East monsoon. The district falls in the semi - arid tracts of Karnataka. Temperature is in the range of 12°C to 36 °C. The details of rainfall of the taluk are given in Table 1.

Table 1: Details of Rainfall in Mulbagal Taluk

Normal Monsoon Rainfall (mm)	Normal Non-monsoon Rainfall (mm)	Normal Annual Rainfall (mm)
451	376	827

3.5 Geology

Major water bearing formations occurring in the taluk are Granites gneisses, Amphibolite and Metaphelitic schists. Weathered thickness of formations varies according to varying rock types from 10 m to 80 m. Geological map with lineament and weathered thickness maps are shown in Fig-6 and 7.

Fig-6

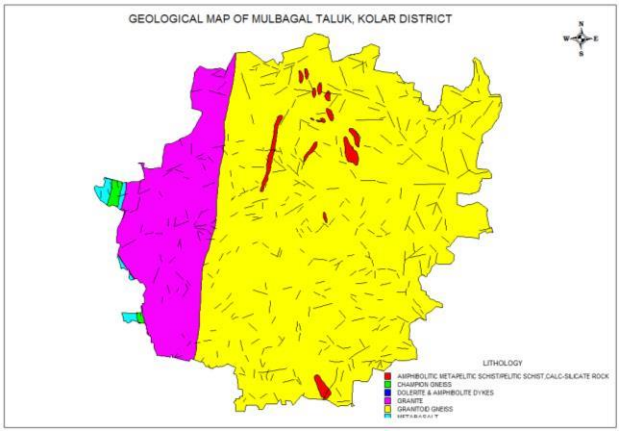
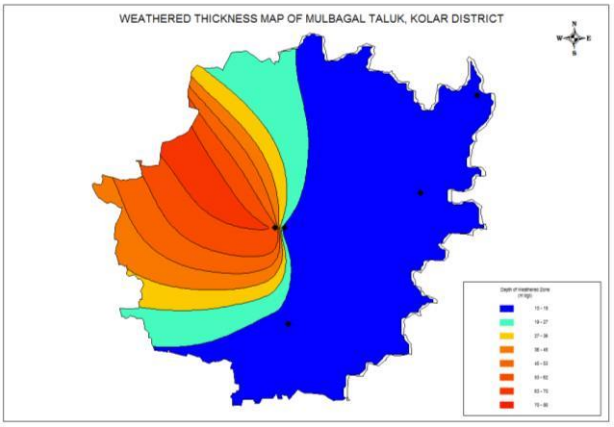


Fig-7



4. Hydrogeology

Ground water occurs in weathered formations in 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 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. Hence, piezometer water level data is used for map preparation. It is observed that major area of the taluk has water level in the range of 5 - 10 mbgl range. A zone stretching from north to south in the taluk has decadal mean depth to water level in the range of 10 - 20 mbgl. North Western portion has recorded mean decadal water level in the range of 20 - 30 mbgl. Average decadal mean water level is 10 mbgl. A map showing decadal mean post monsoon water level is given in Fig-8.

4.2 Decadal Post monsoon Water Level Trend (2005-15)

Water level data of 2005-14 were analyzed to determine the decadal water level trend. Wells have recorded both rising and falling trends. Major part of the taluk (about 95%) has recorded falling trend in the range of 0.011 to 0.466 m/yr whereas 5% of the area has recorded rising trend. Map showing decadal post monsoon water level trend has shown in Fig-9.

Fig-8

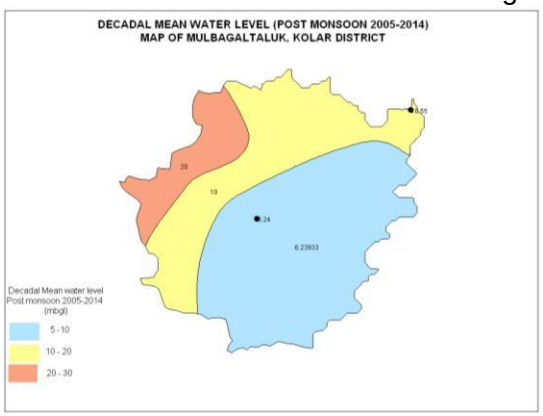
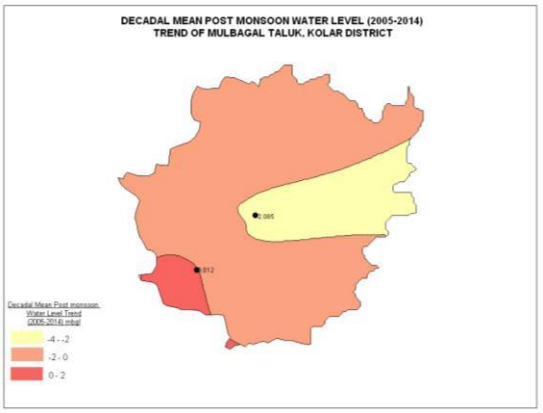


Fig-9



4.3 Dynamic Ground water Resource

The ground water resources were estimated for the taluk according to GEC 97 recommendation by CGWB and DMG, Govt. of Karnataka as on 2011. The resources are presented in **Table 2**. The taluk falls under **Over-Exploited** category.

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

Sl. No.	Item	Resources as on 2011
1.	Net Annual Ground water Availability (HAM)	4740
2.	Existing Ground water draft for irrigation (HAM)	9810
3.	Existing ground water draft for drinking & industrial purposes (HAM)	291
4.	Existing ground water draft for all uses (HAM)	10101
5.	Stage of ground water development (HAM)	213%
6.	Categorization	Over-Exploited

5. Planning for Ground water Recharge / Conservation

5.1 Justification of Artificial Recharge

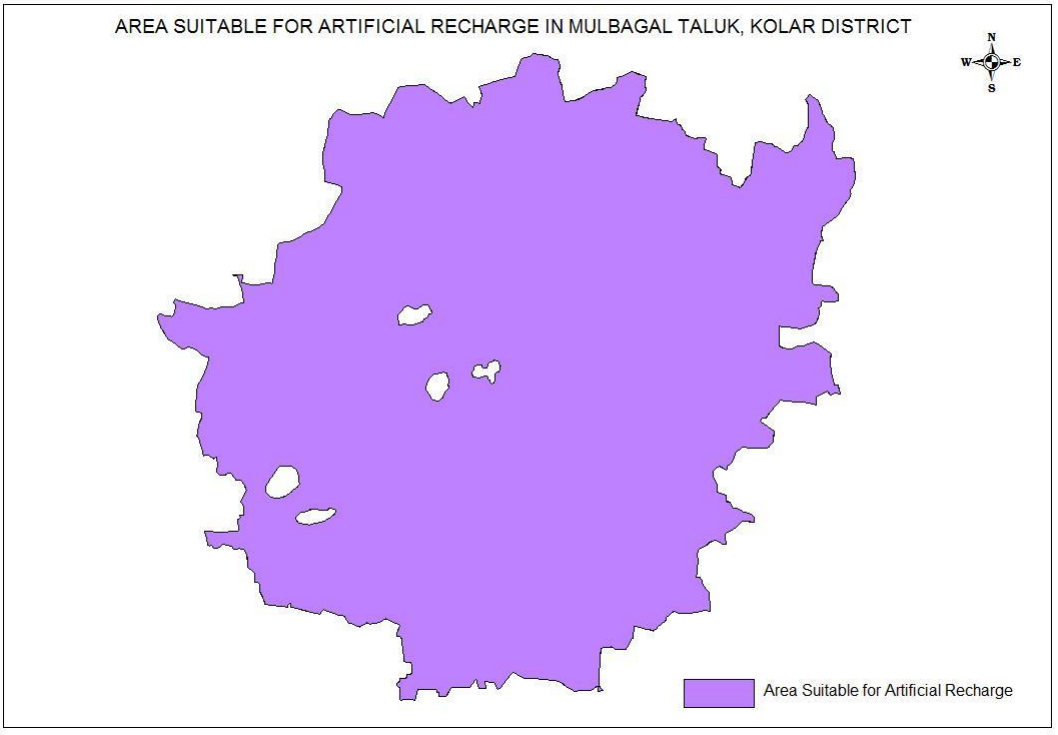
- Stage of development of ground water is 213% and the area falls in Over -Exploited category.
- Phreatic zone is totally dried up due over exploitation of ground water resource. Availability of sufficient unsaturated thickness in weathered zone provides sufficient space for artificial recharge in the project area.

- Farmers are losing their livelihood, laborers are losing jobs and many are forced to migrate for livelihood.
- The farming community is socio-economically backward.
- There is acute shortage of drinking water due to drying of water supply bore wells in many villages, mainly during summer months.
- 15.10 MCM of non committed surplus monsoon run off is available for recharge.
- Numerous Major Irrigation tanks exist in the taluk, which are silted. Rejuvenation of these tanks and recharge through these tanks will enhance the sustainability of 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 772.50 sq km was delineated for artificial recharge as shown in Fig-10.

Fig-10



5.3 Availability of Surplus Surface water for Artificial Recharge/ conservation

Non monsoon rainfall run off is the only source water for artificial recharge in the taluk. The non committed source water availability is 54.9 MCM. The details of source water availability are presented in Table 3.

Table 3: Details of Source Water Availability in Mulbagal Taluk

Normal Monsoon Rainfall	451 mm
Area of identified for AR	772.50 sq km
Run off Coefficient (Strange's Method)	9.6%
Monsoon Run off	33.40 MCM
Utilisable Monsoon Run off (50%)	16.7 MCM
Committed Monsoon Run off (10% of utilisable run off)	1.7 MCM
Non-committed monsoon run off	15.10 MCM

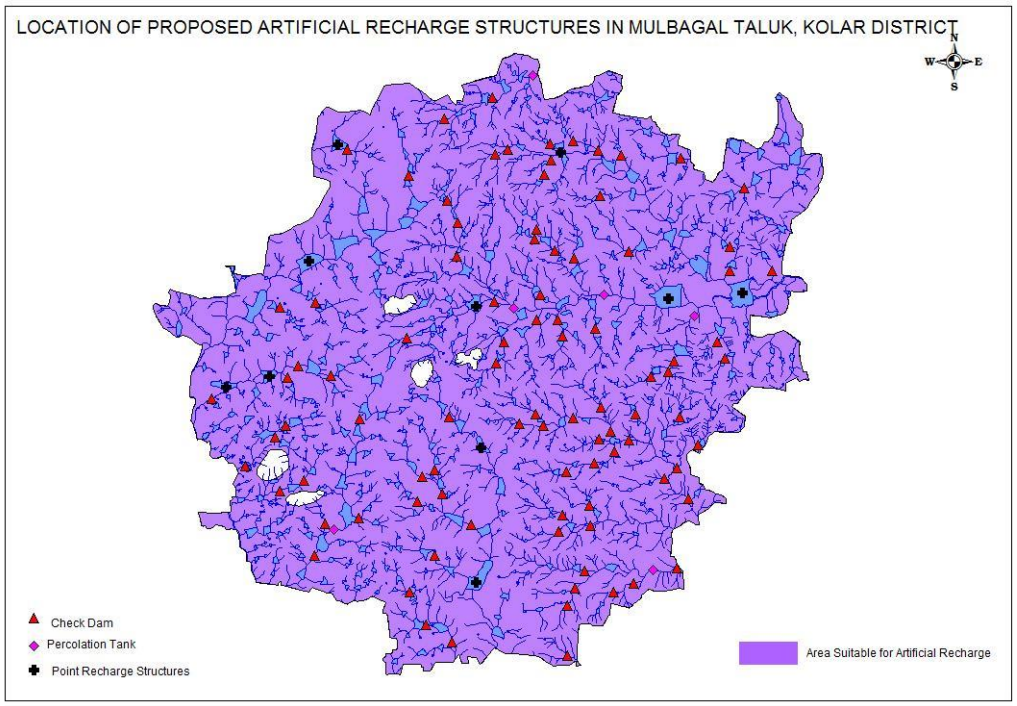
6. Proposed interventions including Tentative Locations of Artificial Recharge/ Conservation Structures

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 be taken up for water conservation purpose. The proposed structures are as given in Table 4 and locations are shown in Fig-11.

Table 4: Artificial Recharge Structures Proposed in Mulbagal Taluk

Structures Proposed	Number of Structures Proposed
Check Dam	93
Percolation Tank	06
Point Recharge Structure	10
Total	109

Fig-11



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 93 Check Dams are feasible in the taluk. Location details with coordinates are given in Table-5. The cost of these 93 Check dams is estimated at 279 lakhs. The total storage capacity of check dams is estimated at 1.23 MCM. The volume of ground water likely to be recharged through these check dams is estimated to be 0.86 MCM.

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

Sl. No.	Longitude	Latitude
1	78.2736	13.1570
2	78.3838	13.0430
3	78.3974	13.0342
4	78.3794	13.1050
5	78.3887	13.1208
6	78.3820	13.1175

7	78.3927	13.1090
8	78.3084	13.1104
9	78.3319	13.0942
10	78.3127	13.1672
11	78.3264	13.0778
12	78.3182	13.1731
13	78.3272	13.2050
14	78.3085	13.2026
15	78.3741	13.1874
16	78.3435	13.2819
17	78.4006	13.2451
18	78.4686	13.1032
19	78.4569	13.0278
20	78.4572	13.0531
21	78.4612	13.0614
22	78.4808	13.0598
23	78.4911	13.0639
24	78.4662	13.0704
25	78.5138	13.0715
26	78.4073	13.0936
27	78.5073	13.1164
28	78.4528	13.0902
29	78.4692	13.0930
30	78.4321	13.1443
31	78.4446	13.1430
32	78.4406	13.1491
33	78.4601	13.1469
34	78.4742	13.1525
35	78.4796	13.1402
36	78.4887	13.1359
37	78.4925	13.1489
38	78.5122	13.1758
39	78.5152	13.1476
40	78.5346	13.1851
41	78.5385	13.1771
42	78.4564	13.1199
43	78.4711	13.1244
44	78.4812	13.1302
45	78.4734	13.1362
46	78.4202	13.1744
47	78.4240	13.1852
48	78.4193	13.2057
49	78.4412	13.1962
50	78.4548	13.1880
51	78.4520	13.1966
52	78.4713	13.1919
53	78.5003	13.1680
54	78.5091	13.1701
55	78.5244	13.1334
56	78.5137	13.1221
57	78.4262	13.2822
58	78.4182	13.3080
59	78.4507	13.2312
60	78.4486	13.2765
61	78.4480	13.2846

62	78.4600	13.2864
63	78.4728	13.2812
64	78.4848	13.2791
65	78.5158	13.2774
66	78.4738	13.2588
67	78.4450	13.2695
68	78.3937	13.2972
69	78.3951	13.2561
70	78.5483	13.2625
71	78.5630	13.2209
72	78.4403	13.2368
73	78.4412	13.2416
74	78.4607	13.2272
75	78.4432	13.2089
76	78.5407	13.2208
77	78.3755	13.0596
78	78.3886	13.0778
79	78.3493	13.0967
80	78.3116	13.1434
81	78.3062	13.1375
82	78.2908	13.1231
83	78.3350	13.1683
84	78.3498	13.1466
85	78.3209	13.1158
86	78.3960	13.1474
87	78.4544	13.0985
88	78.5197	13.1064
89	78.4887	13.2306
90	78.5411	13.2330
91	78.4197	13.2793
92	78.3753	13.2688
93	78.3999	13.2281

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 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 at 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: Location of Proposed Percolation Tank in Mulbagal Taluk

Sl. No.	Longitude	Latitude
1	78.47607	13.20884
2	78.52263	13.19810
3	78.43920	13.31894
4	78.42908	13.20208
5	78.33649	13.09093
6	78.50133	13.07049

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 10 numbers of Point Recharge Structures are feasible in the taluk. Location details with coordinates are given in the Table-7. The cost of these 10 PRS is estimated at 20.0 lakhs. The annual storage capacity of PRS is estimated at 0.15 MCM. The volume of ground water likely to be recharged through PRS is estimated to be 0.14 MCM.

Table 7: Location of Proposed Point Recharge Structures in Mulbagal Taluk

Sl. No.	Longitude	Latitude
1	78.4098	13.0646
2	78.3030	13.1681
3	78.2809	13.1627
4	78.5089	13.2070
5	78.5476	13.2101
6	78.3232	13.2257
7	78.3385	13.2844
8	78.4534	13.2806
9	78.4098	13.2032
10	78.4124	13.1322

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 Govt. Schedule Rates. It is estimated that annually about 1.75 MCM of water will be recharged to ground water system which may create an additional irrigation potential of 211 hectares.

Table 8: Tentative cost estimates of structures proposed in Mulbagal 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	93	3.0	279	1.2276	0.86	211
Percolation Tank	6	7.5	45	1.08	0.76	
Point Recharge Structure	10	2.0	20	0.15	0.14	
TOTAL	**109**		**344**	**2.4576**	**1.75**	
Impact Assessment (5% of estimate)			17.20			
Grand Total			**361.20**			

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 to have impact assessment at rate of 5% of the total cost of the project for 5 years from the completion of artificial recharge.