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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 MADHUGIRI 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 MADHUGIRI TALUK, TUMKUR DISTRICT, KARNATAKA

Sl. No. **TOPIC**

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

TALUK AT A GLANCE	
Taluk	**Madhugiri**
District	Tumkur
State	Karnataka
Taluk area	1118.19 Sq km
Area Suitable for Artificial Recharge	1018.19 Sq km
Latitude & Longitude	Longitude of 77° 00' 38" E - 77° 27' 56" E Latitude of 13° 34′ 48.4″ N - 13° 55′ 23″ N
Normal Annual Rainfall	709 mm
Normal Monsoon Rainfall	408 mm
Normal Non- Monsoon Rainfall	301 mm
Geology	Granites, Granodiorite
WATER LEVEL	
Average Pre - Monsoon	>16 m bgl.
Average Post - Monsoon	>10 m bgl. * Almost all the representative OW are dry
GROUND WATER RESOURCES ESTIMATION	
Net ground water available	76.08 MCM
Ground water draft for irrigation	91.11 MCM
Groundwater draft for domestic & industrial water supply	5.98 MCM
Total ground water draft	97.10 MCM
Stage of ground water development (%)	128%
Non committed monsoon runoff available for the taluk	14.60 MCM
Total volume of weathered zone available for Recharge	8145.5 MCM
Storage Potential Weathered/unsaturated zone available for Recharge	162.91 MCM
ARTIFICIAL RECHARGE /CONSERVATION MEASURES	
Structures Proposed (tentative)	Check Dam – 90 Percolation Tank – 6 Point Recharge structures – 10
Tentative total cost of the project	Rs.351.75 lakhs
Excepted recharge	1.72 MCM
Expected rise in water level by recharging 1.72 MCM of rain fall run off	0.08 m

PLAN ON ARTIFICIAL RECHARGE TO GROUND WATER AND WATER CONSERVATION IN MADHUGIRI 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 Madhugiri Taluk, Tumkur District, having an area of 1118.19 sq km has been prepared in this report.

2. Objectives of the Scheme

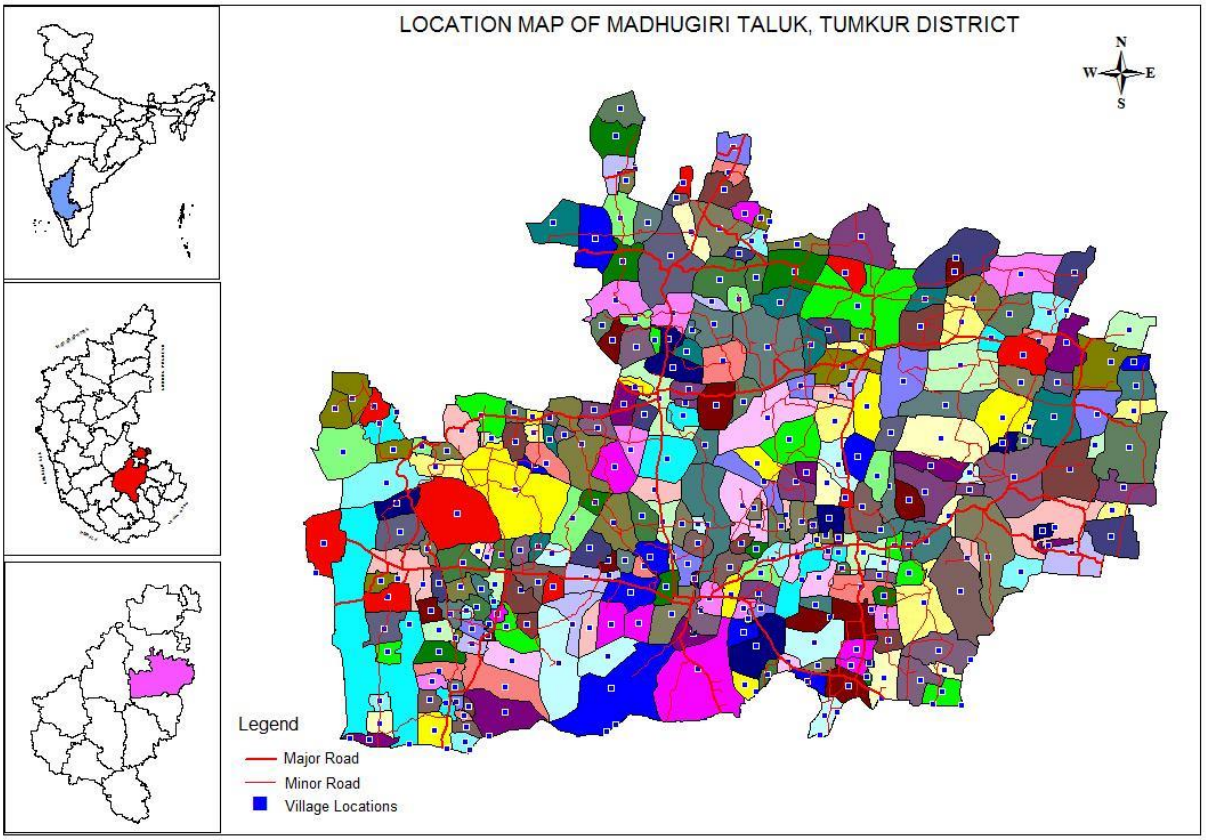
- To augment ground water resources by harvesting and conserving non committed surplus monsoon run off using artificial recharge measures.
- To overcome the inadequacy of surface water to meet the ever- increasing water demands.
- To arrest decline in ground water levels.
- To recover and transform this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

Madhugiri taluk is located in the NE part of Tumkur district of Karnataka**.** The taluk covers a geographic area of 1118.19 sq.km and lies between Longitude of 77° 00' 38" E and 77° 27' 56" E and Latitude of 13° 34′ 48.4″ N and 13° 55′ 23″ N. There are 354 villages falling in the taluk. The taluk is having a total area of 1118.19 sq km. The population of taluk as per Census 2001 is 29,159. There are 28 Panchayats and 363 villages in the taluk. Location map of the taluk is presented in Fig-1.

Fig-1



3.2 Physiography and Drainage

Geomorphologically, the taluk has denudational uplands on gneisses and granites. Asia's second largest monolith is located in Madhugiri (1200 m). The elevation in the taluk ranges from 840 to 1200 mamsl. 932.97 sq km area of the taluk is covered by plain topography, 75.13 sq km by pediment zone, 99.73 sq km by hills and plateaus. Major area of the taluk falls in Pennar basin whereas small part falls in Lower Tungabhadra basin and drainage pattern is dendritic. Maps showing geomorphology and drainage pattern are presented in Fig-2 and 3.

Fig-2

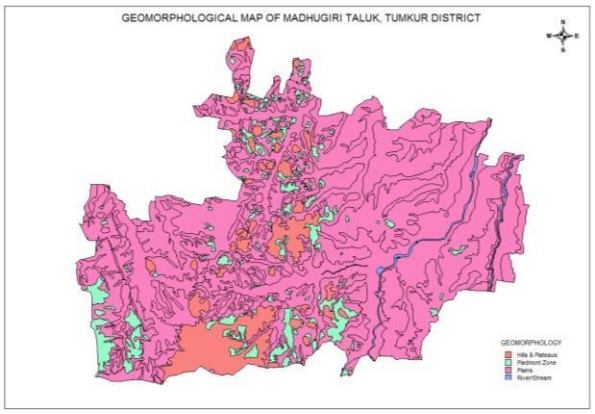
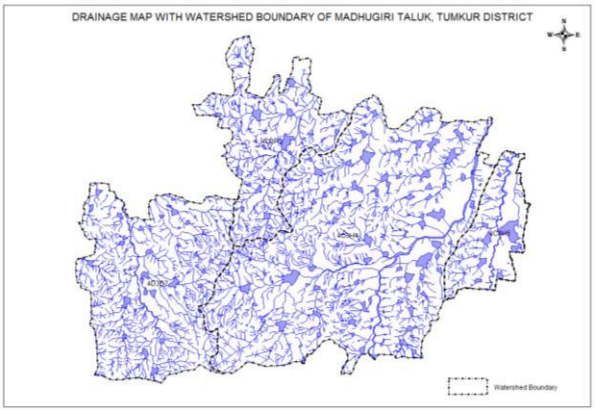


Fig-3



3.3 Land Use and Soil

As on 2011-12 forest covers 3279ha, net irrigated area is 10647 and net area sown is 37218 ha. 37% area of the taluk is underlain by alfisol soils, 10% by entisol and 47% by inceptisol soils. Maps showing land use land cover and soil distribution are presented in Fig-4 and 5.

Fig-4

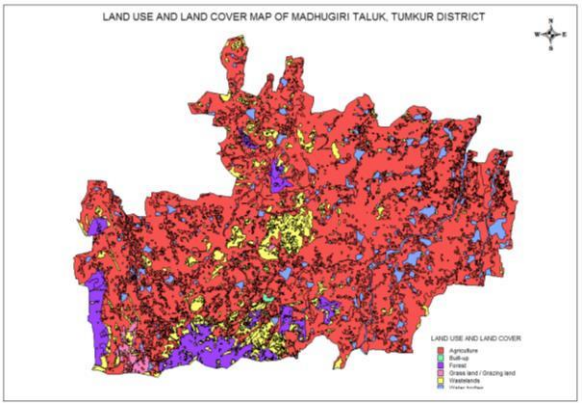
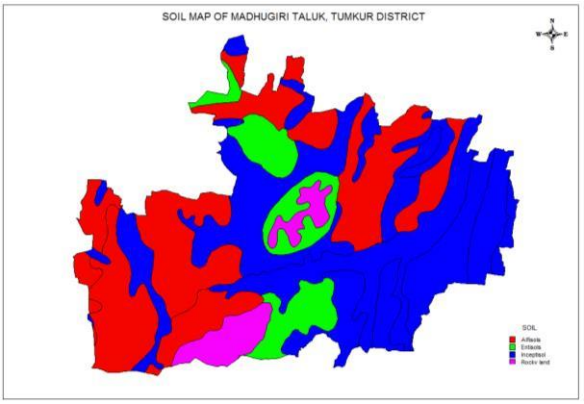


Fig-5



3.4 Hydrometeorology

Normal rainfall in the taluk is 709 mm. Major part of the precipitation is form North-East monsoon. The district falls in the semi -arid tracts of Karnataka. The temperature varies from 15° to 36 °C. The details of rainfall of the taluk are given in **Table 1.**

Table 1: Details of Rainfall in Madhugiri Taluk

Normal Monsoon Rainfall	Normal Non-monsoon Rainfall	Normal Annual Rainfall
408	301	709

3.5 Geology

Major water bearing formations occurring in the taluk are Granite, Granodiorite. Weathered thickness of formations varies according to varying rock types from 10 m to 30 m. Map showing geology and lineament of the taluk is shown in Fig-6 and weathered section map is presented in Fig-7.

Fig-6

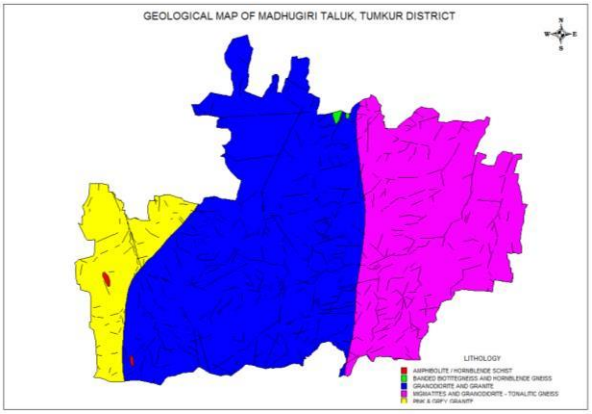
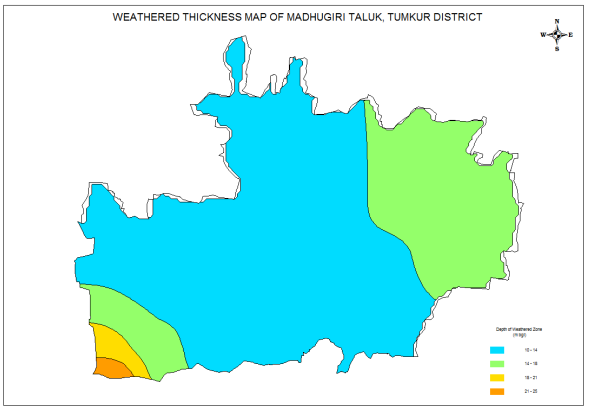


Fig-7



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 - 2014)

Most of the wells have dried up/ drying up in the taluk due to decline of water level. Water level data is available for some of the wells, which is not representative of general water table conditions in the area. These are isolated wells where the depth to water level are shallow and are mostly located in low lying/valley areas/adjacent to water bodies.

Out of 19 observation wells 11 have dried up and no sufficient NHS observation well located in the taluk is having continuous data for decade 2005 - 2014. Hence, decadal mean water level map could not be prepared. However, in general depth to water level in the area is more than 16 mbgl.

4.2 Decadal Water Level Trend (2005-2014)

It is observed that out of 19 wells 11 have dried up. In addition to this a lot of dug wells in the taluk have dried up. The wells for which, water level is available are not representative of water level condition of the area as they are shallow and located in low lying area or near surface water bodies.

4.3 Dynamic Ground water Resource

The 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 2011. The resources are presented in **Table 2.** The taluk falls under **Over Exploited** category.

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

Sl. No.	Particulars	Resources as on 2011
1.	Net Annual Ground water Availability (HAM)	7608
2.	Existing Ground water draft for irrigation (HAM)	9111
3.	Existing ground water draft for drinking and industrial purposes (HAM)	598
4.	Existing ground water draft for all uses (HAM)	9710
5.	Stage of ground water development	128%
6.	Categorization	**Over-Exploited**

5. Planning for Ground water Recharge / Conservation

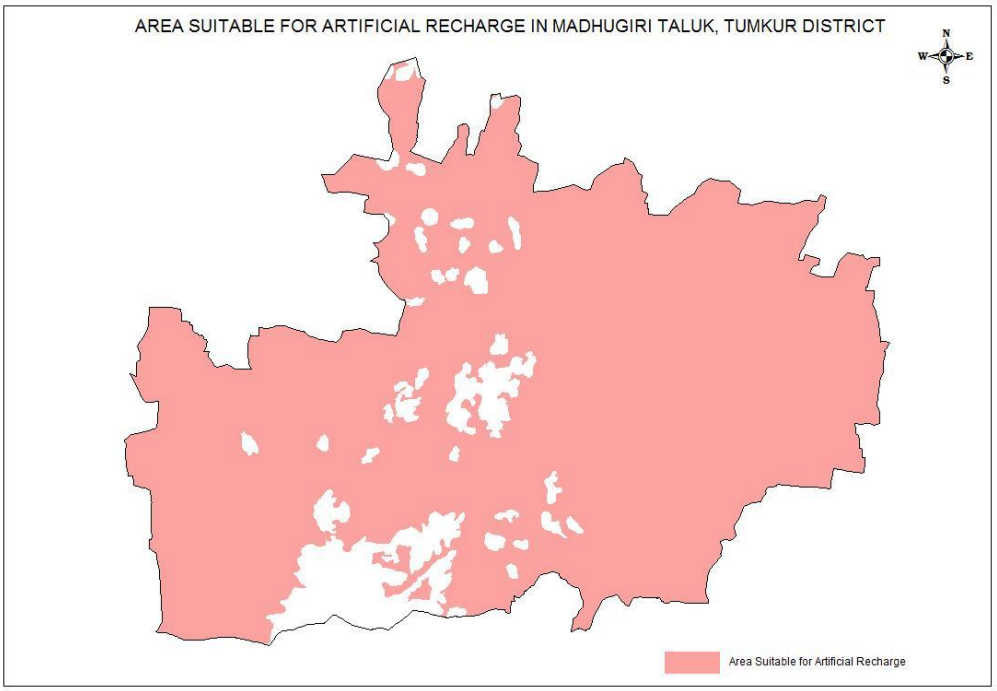
5.1 Justification for Artificial Recharge

- Stage of development of ground water is 128% 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.
- 14.60 MCM of non committed surplus monsoon run off is available for recharge.
- 31 Major tanks existing in the project are silted. Rejuvenation of these tanks 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 1018.19 sq km was delineated for artificial recharge as shown in **Fig-8.**

Fig-8



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 14.60 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	408 mm
Area of identified for AR	1018.19 sq km
Run off Coefficient (Strange's Method)	7.8%
Monsoon Run off	32.40 MCM
Utilisable Monsoon Run off (50%)	16.20 MCM
Committed Monsoon Run off (10% of utilisable run off)	1.60 MCM
Non committed monsoon run off	14.60 MCM

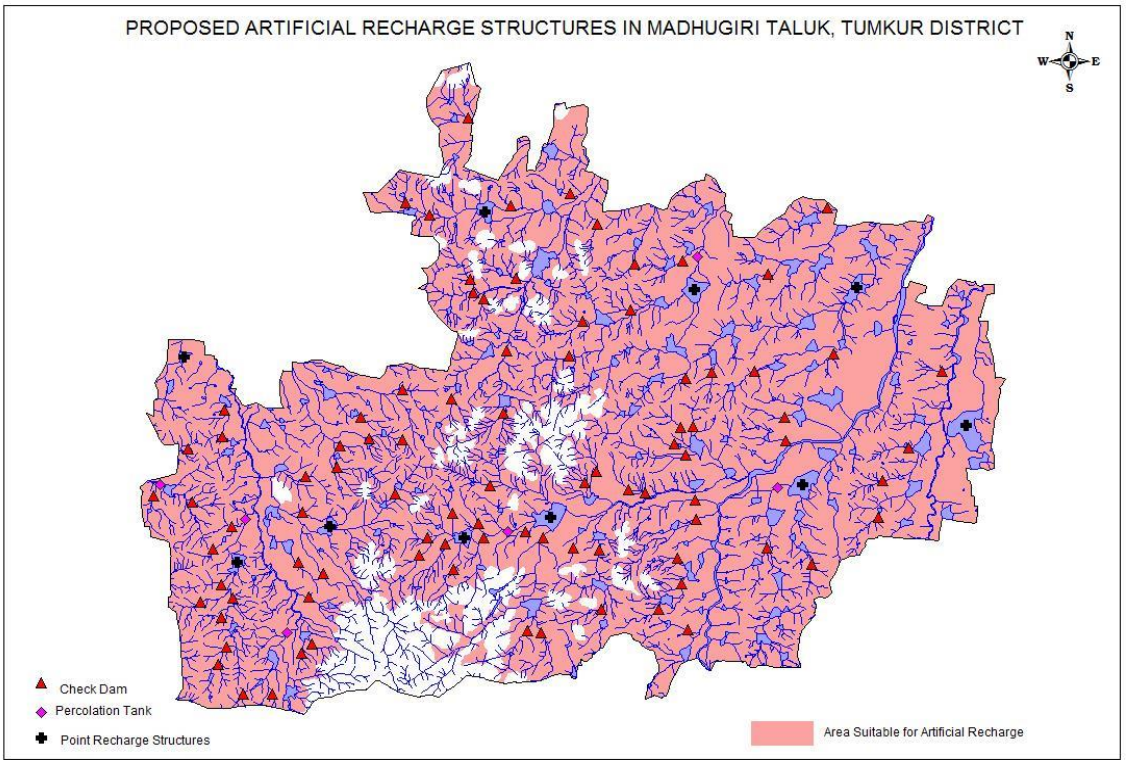
6. Proposed interventions including Tentative Locations of Artificial Recharge/conservation Structures

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 as given in Table 4 and locations are shown in Fig-9.

Table 4: Artificial Recharge Structures Proposed

Structure Proposed	No of Structures Proposed
Check Dam	90
Percolation Tank	6
Point Recharge Structure	10
Total	**106**

Fig-9



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 90 Check Dams are feasible in the taluk. Location details with coordinates are given in Table-5. The cost of these 90 Check dams is estimated at 270 lakhs. The total storage capacity of check dams is estimated at 1.19 MCM. The volume of ground water likely to be recharged through these check dams is estimated to be 0.83 MCM

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

Sl. No.	Longitude	Latitude
1	77.0810	13.5905
2	77.0651	13.5903
3	77.0520	13.6063
4	77.0563	13.6152
5	77.0427	13.6391
6	77.0535	13.6480
7	77.0493	13.6669
8	77.0594	13.6790
9	77.0383	13.6920
10	77.0536	13.6308
11	77.0540	13.7266
12	77.0554	13.7404
13	77.0359	13.7202
14	77.0177	13.6950
15	77.1018	13.6168
16	77.0963	13.6120
17	77.1001	13.6417
18	77.0944	13.6599
19	77.1079	13.6540
20	77.0985	13.7051
21	77.0970	13.6865
22	77.1170	13.7213
23	77.1152	13.7101
24	77.1763	13.7466
25	77.1282	13.7364
26	77.1326	13.7252
27	77.1593	13.6636
28	77.1636	13.6731
29	77.1732	13.6697
30	77.1771	13.6858
31	77.1774	13.6561
32	77.1935	13.6729
33	77.1906	13.6807
34	77.2157	13.6761
35	77.2241	13.6228
36	77.2168	13.6241

37	77.2391	13.7688
38	77.1503	13.7514
39	77.2535	13.7080
40	77.2474	13.7022
41	77.1500	13.7249
42	77.1972	13.7004
43	77.1648	13.8434
44	77.2397	13.8547
45	77.1883	13.8027
46	77.1865	13.8097
47	77.2552	13.6664
48	77.2412	13.6677
49	77.2253	13.6730
50	77.1850	13.8946
51	77.2078	13.8483
52	77.2463	13.7875
53	77.2060	13.7716
54	77.1934	13.7990
55	77.2043	13.7390
56	77.3542	13.7367
57	77.2722	13.7932
58	77.3053	13.7317
59	77.2951	13.7224
60	77.3013	13.7170
61	77.2797	13.6967
62	77.3377	13.7610
63	77.2998	13.8192
64	77.3452	13.8121
65	77.2969	13.6623
66	77.2871	13.6351
67	77.2740	13.8177
68	77.4065	13.7031
69	77.4040	13.6841
70	77.3804	13.7700
71	77.3065	13.6929
72	77.3685	13.6587
73	77.4378	13.7609
74	77.3067	13.6827
75	77.3154	13.7606
76	77.2986	13.7312
77	77.2709	13.6983
78	77.3547	13.7242
79	77.2109	13.8099
80	77.4200	13.7205
81	77.1462	13.6961
82	77.0599	13.6409
83	77.3011	13.7573
84	77.2564	13.6352
85	77.3026	13.6245
86	77.2989	13.6487
87	77.3446	13.6677
88	77.2541	13.8389
89	77.3771	13.8472
90	77.1521	13.8497

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 Tanks in Madhugiri Taluk

Sl. No.	Longitude	Latitude
1	77.0883	13.6227
2	77.0663	13.6824
3	77.0208	13.7010
4	77.2065	13.6765
5	77.3502	13.6994
6	77.3077	13.8215

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: Tentative Locations of Proposed Point Recharge Structrues in Madhugiri Taluk

Sl. No.	Longitude	Latitude
1	77.1944	13.8450
2	77.4508	13.7321
3	77.3635	13.7009
4	77.3056	13.8040
5	77.2293	13.6839
6	77.1112	13.6790
7	77.0620	13.6602
8	77.0335	13.7687
9	77.1829	13.6727
10	77.3924	13.8053

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 1.72 MCM of water will be recharged to ground water system, which may create an additional irrigation potential of 208 hectares.

Table 8: Tentative cost estimates of structures proposed in Madhugiri 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	90	3.0	270	1.188	0.83	208
Percolation Tank	6	7.5	45	1.08	0.76	
Point Recharge Structure	10	2.0	20	0.15	0.14	
TOTAL	106		**335**	**2.418**	**1.72**	
Impact Assessment (5% of estimate)			16.75			
Grand Total			**351.75**			

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.