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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 CHINTAMANI TALUK, CHKBALLAPUR DISTRICT, KARNATAKA

Central Ground Water Board
South Western Region
Bangalore
December 2015

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AT A GLANCE	
Taluk	Chintamani
District	Chikballapur
State	Karnataka
Taluk area	892.6 Sq km
Area Suitable for Artificial Recharge	856.5 Sq km
Latitude & Longitude	Longitude 77° 54′ 57″ E – 78° 12′ 34″ E Latitude of 13″ 15′ 56″ N – 13°40′ 30″ N
Normal Rainfall	726 mm
Normal Monsoon Rainfall	389 mm
Normal Non-Monsoon Rainfall	337 mm
Geology	Granites and Gneisses
WATER LEVEL	
Pre - Monsoon	>15 m bgl
Post - Monsoon	>10 m bgl * Almost all the representative OW are dry
GROUND WATER RESOURCES ESTIMATION	
Net Ground water available	59.16 MCM
Ground water draft for irrigation	97.01 MCM
Groundwater draft for domestic and industrial water supply	2.55 MCM
Total Ground water draft	99.56 MCM
Stage of Ground water development (%)	168 %
Non-committed monsoon runoff available for the taluk	10.50 MCM
Total volume of weathered zone available for Recharge	8565 MCM
Storage Potential Weathered/unsaturated zone available for Recharge	171.30 MCM

ARTIFICIAL RECHARGE /CONSERVATION MEASURES	
Structures Proposed (tentative)	Check Dam – 65 Percolation Tank – 4 Point Recharge structures – 7
Tentative total cost of the project	Rs.250.95 lakhs
Excepted recharge	1.20 MCM
Expected rise in water level by recharging 0.83 MCM of rain fall run off	0.07 m

PLAN ON ARTIFICIAL RECHARGE TO GROUND WATER AND WATER CONSERVATION IN CHINTAMANI TALUK, CHIKBALLAPUR 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 Chintamani Taluk, Chikballapur District, having an area of 892.60 sq km has been prepared and presented in this report.

2. Objectives of the Scheme:

The objectives of the scheme are given below.

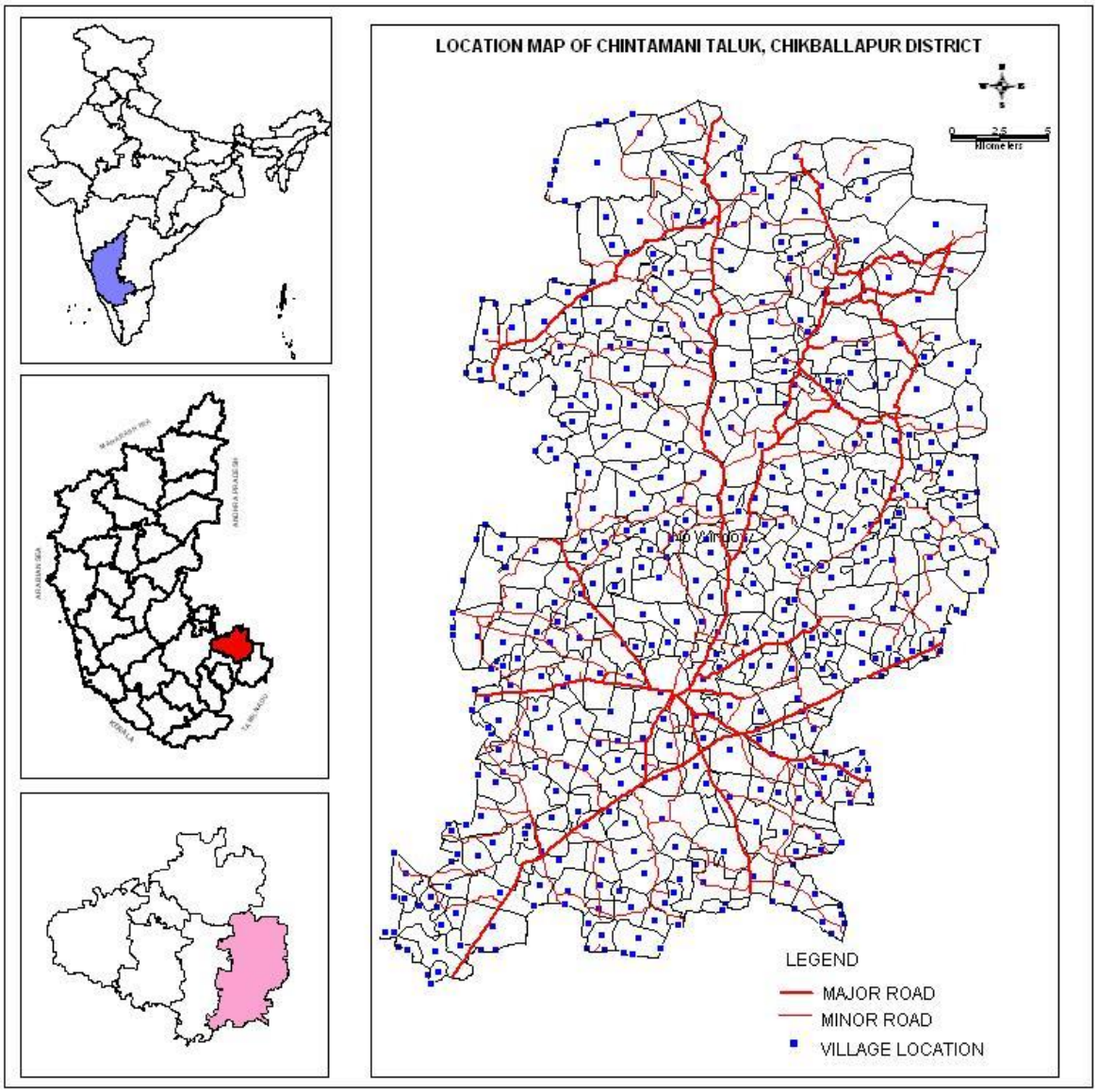
- To augment ground water resources by harvesting and conserving non-committed surplus monsoon runoff using artificial recharge measures.
- To overcome the inadequacy of surface water to meet the ever- increasing water demands.
- To arrest decline in ground water levels.
- To recover and transform this Over-Exploited (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 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.
- Ultimately implementing sustainable ground water resources management plan.

3. Study Area Details

3.1 Location

Chintamani taluk is located in the South eastern part of Chikballapur district of Karnataka. It lies between Longitude of 77°54'57" E and 78°12'44" E and Latitude of 13°40′27″ N and 13°16′00″ N. Spread over a geographical area of 892.6 sq.km, the taluk covers 466 villages. Location map of the taluk is presented in Fig-1.

Fig-1: Location map of the Chintamani taluk, Chikballapur district, Karnataka



3.2 Physiography and Drainage:

Geomorphologically, Chintamani taluk comprises undulating terrain intersected by low rocky ridges. Lateritic masses are seen as irregularly distributed patches in the form of flat hills. Elevation in the taluk ranges from 720 m to 937 m a msl. Taluk is part of Ponnaiyar and Pennar basins. Drainage pattern in the taluk is dendritic. Geomorphology and drainage maps are presented in Fig- 2 and 3.

Fig-2

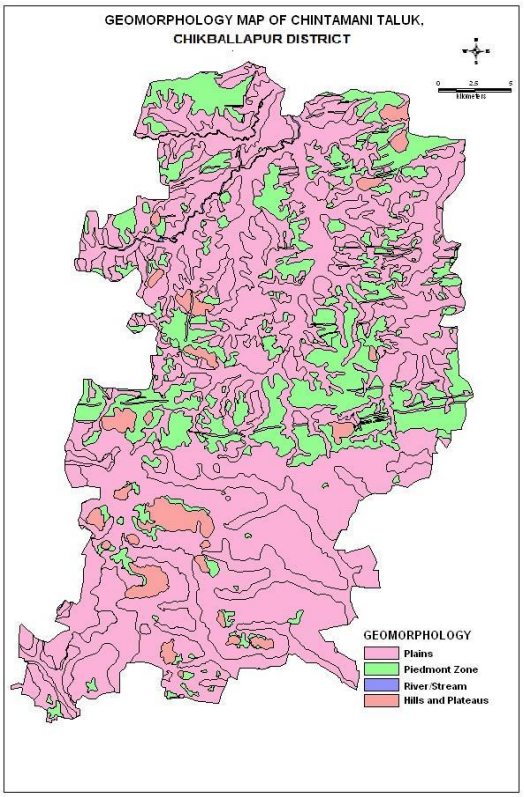
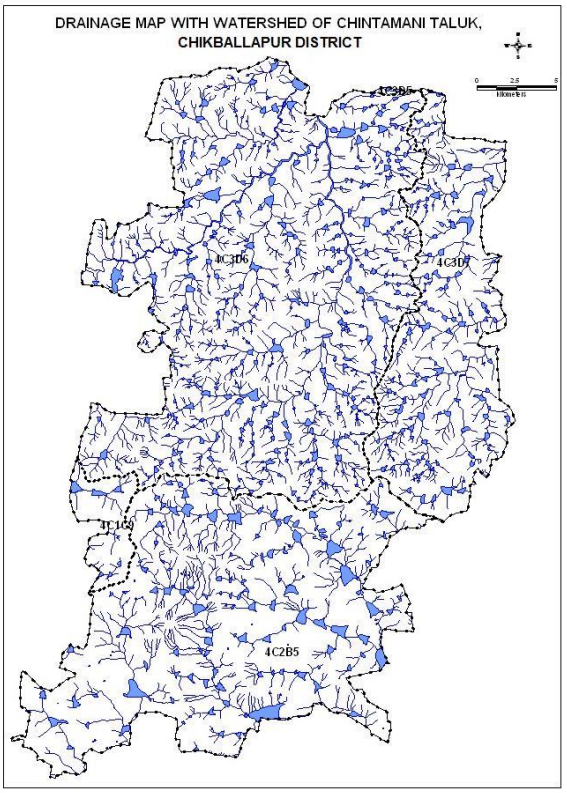


Fig-3



3.3 Land Use and Soil:

Agriculture is practiced in major part of the taluk. As per 2012 data available, while forest covers 3243 ha, net area sown is 35622 ha. An area of 685.9 sq. km in the taluk is covered by plain topography; 107.60 sq.km by piedmont zone, 34.01 sq km by hills and plateaus;

Major part of the taluk (87.10%) is covered by Alfisol Soil, 12.6% by Inceptisol Soils. Maps showing soil distribution and land use are presented in Fig-4 and 5.

Fig-4

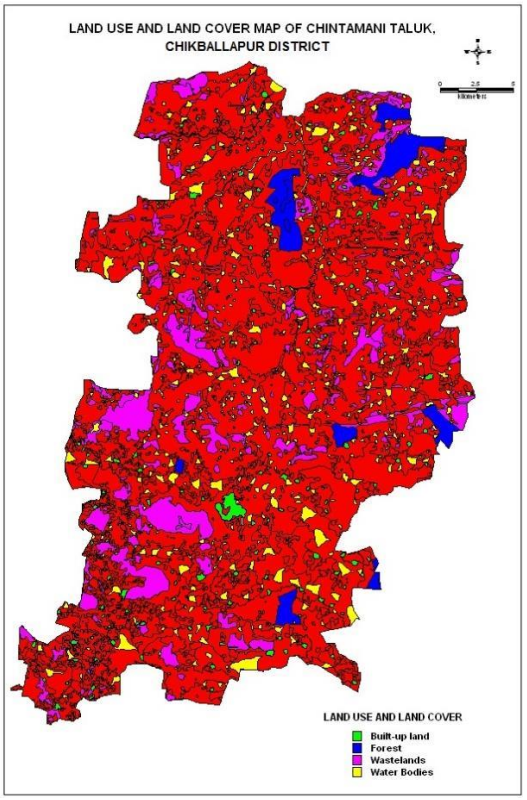
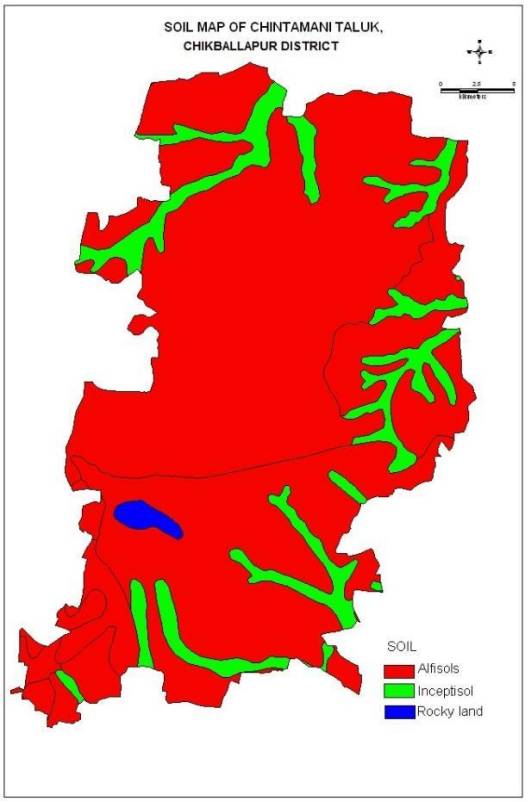


Fig-5



3.4 Hydrometeorology:

Normal rainfall in the taluk is 726 mm and major part of the precipitation comes from South -west monsoon. The taluk falls in the semi-arid tracts of Karnataka. The temperature ranges from 12 to 39^{O}C. The details of rainfall are given in Table 1.

Table-1: Details of Rainfall in Chintamani Taluk

Normal Monsoon Rainfall (mm)	Normal Non-monsoon Rainfall (mm)	Total Normal Rainfall (mm)
389	337	726

3.5 Geology:

Major Geological formations occurring in the Chintamani taluk are Granites and Gneisses with small patches of laterites. Distribution of Geological formations and lineament in the taluk are shown in Fig- 6 and 7.

Fig-6

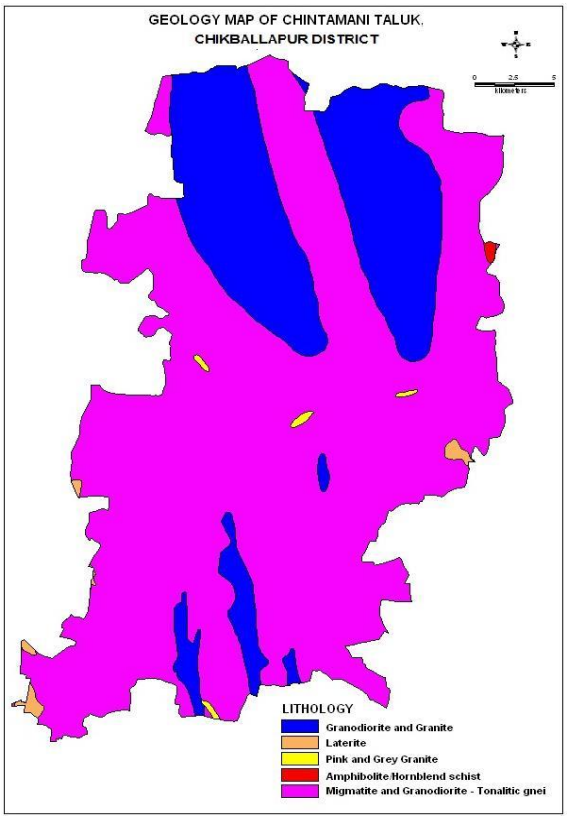
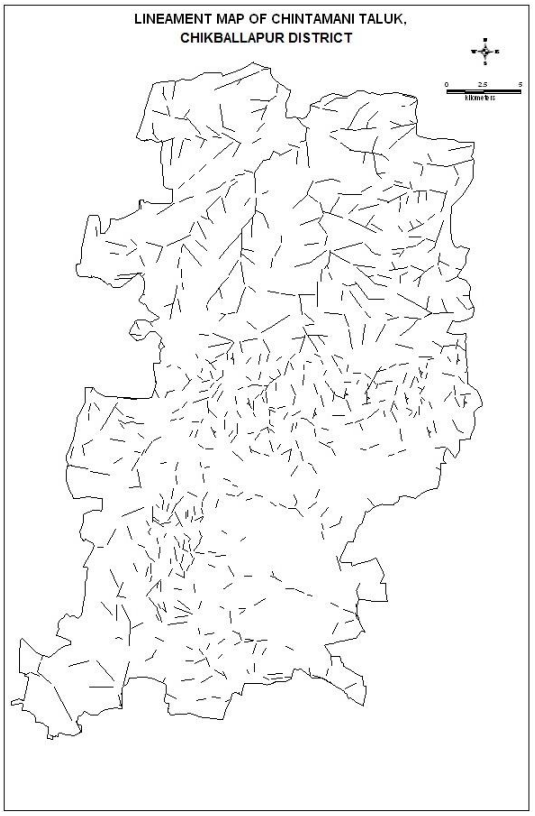


Fig-7



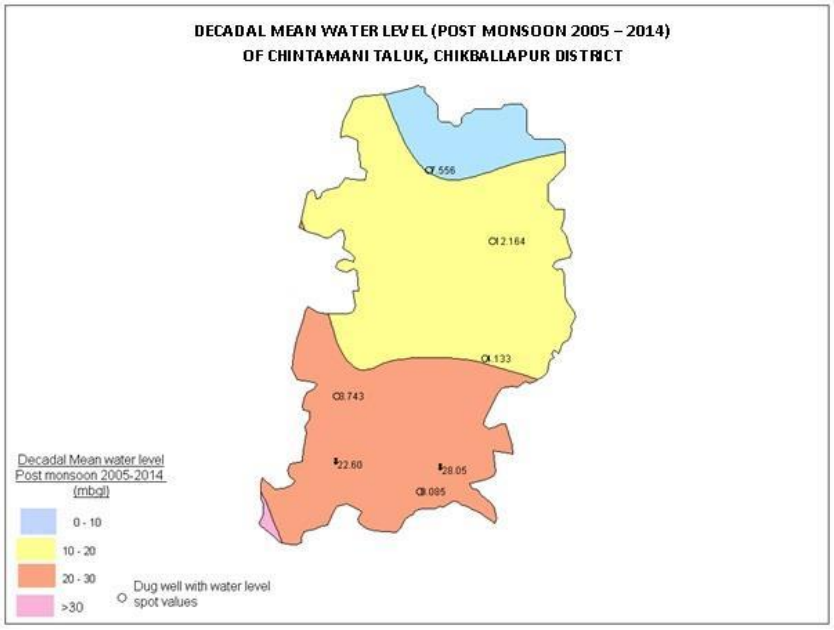
4. Hydrogeology:

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. Thickness of weathered zone varies from 8 to 44 mbgl.

4.1 Decadal Post monsoon Mean Depth to Water Level:

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 levels. 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 Peizometers (PZ) water level data is used for map preparation. It is observed that major area of the taluk has water levels in the range of 10-30 m bgl. Only a small portion of the taluk in northern part has decadal mean post-monsoon water level less than 10 m bgl. A map showing decadal mean post-monsoon water level is given in Fig-8.

Fig-8



4.2 Decadal Water Level Trend (2005-2014):

Decadal water level trend for pre-monsoon was analysed for 16 wells. It is observed that 10 wells have dried up, 4 have recorded rise in the range of 0.05 to 0.40 m/year. 2 wells have recoded falling trend in the range of 0.13 to 0.64 m/year. In general there is a declining trend.

4.3 Dynamic Ground Water Resource:

The taluk is categorized as “Over-Exploited” as on March 2011. The net annual ground water availability in 5916 HAM, Ground water draft for irrigation is 9701 HAM and the ground water draft for drinking and industrial purposes is 255 HAM. Further, the stage of ground water development is estimated as 168%. The data are given in Table-2.

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

Sl. No.	Item	Resources as on 2011
1.	Net Annual Ground water Availability (HAM)	5916
2.	Existing Ground water draft for irrigation (HAM)	9701
3.	Existing ground water draft for drinking & industrial purposes (HAM)	255
4.	Existing ground water draft for all uses (HAM)	9956
5.	Stage of ground water development (HAM)	168%
6.	Categorisation	Over-Exploited

5. Planning for Ground water Recharge / Conservation

5.1 Justification for Artificial Recharge

- Stage of development of ground water is 168% and the area falls in Over - Exploited category.
- Phreatic zone is totally dried up due to over-exploitation of ground water resource. Availability of sufficient unsaturated thickness in weathered zone provides sufficient scope and space for artificial recharge in the project area.
- Farmers are losing their livelihood and labourers 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.
- 10.50 MCM of non-committed surplus monsoon run off is available for recharge.
- There are some Major Irrigation 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 zone, decadal mean depth to water level, decadal water level trend and source water availability. Based upon these parameters, an area of 856.50 sq km was delineated for artificial recharge.

5.3 Availability of Surplus Surface water for Artificial Recharge:

Monsoon rainfall run off is the only source water for the artificial recharge in the area. Source water availability is 10.5 MCM. The details of source water availability are presented in Table-3.

Table-3: Details of Source Water Availability in Chintamani Taluk

Normal Monsoon Rainfall	389 mm
Area of identified for Artificial Recharge	856.50 sq km
Run off Coefficient (Strange's Method)	7%
Monsoon Run off	23.3 MCM
Utilisable Monsoon Run off (50%)	11.7
Committed Monsoon Run off (10% of utilisable run off)	1.2 MCM
Non-committed surplus monsoon run off	10.5 MCM

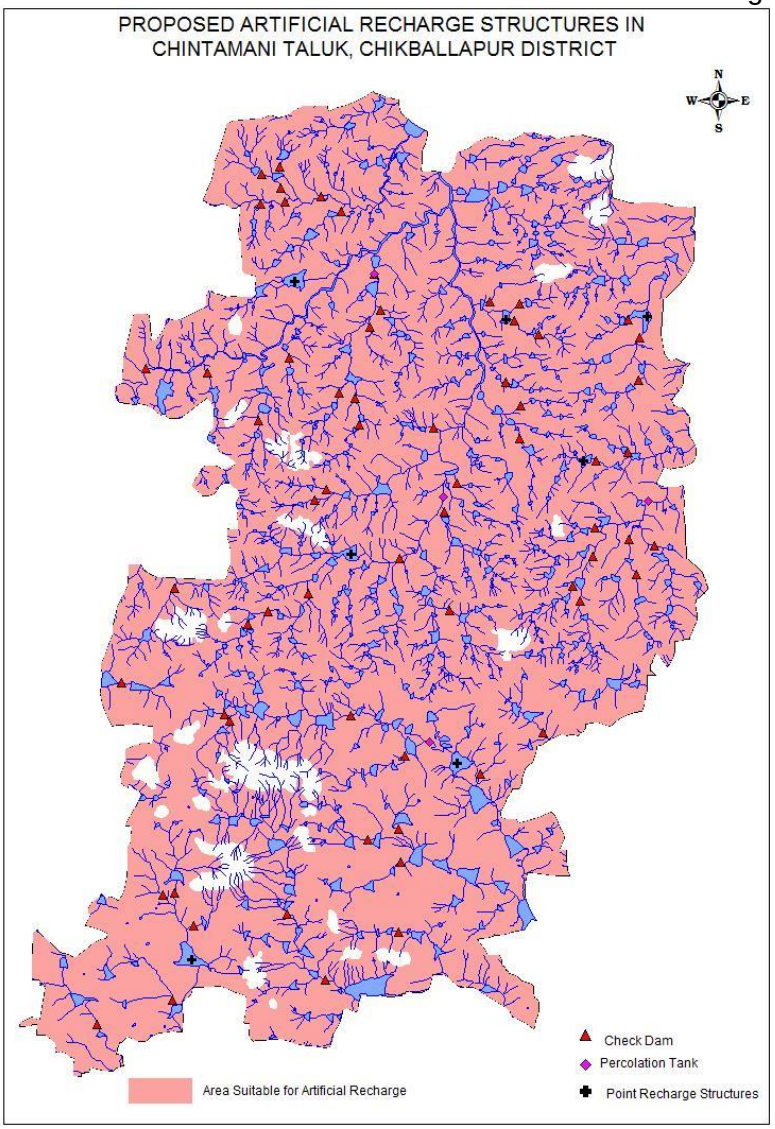
6. Proposed interventions including Tentative Locations of Artificial Recharge/Conservation Structures

The feasible artificial recharge structures proposed in the taluk are Check dams, Percolation Tanks and Point Recharge Structures. In addition to this, de-silting of tanks and micro-irrigation 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 Chintamani Taluk

Type of Structure Proposed	Number of Structures Proposed
Check Dam	65
Percolation Tank	04
Point Recharge Structure	07
Total	**76**

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 65 check dams are feasible in the Taluk. Location details with coordinates are given in the Table-5. The cost of 65 Check dams is estimated at 195 lakhs. The total storage capacity of check dams is estimated at 0.858 MCM. The volume of ground water likely to be recharged through these check dams is estimated to be 0.60 MCM.

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

Sl. No.	Longitude	Latitude
1	77.9494	13.2880
2	77.9816	13.2982
3	77.9777	13.3419
4	77.9828	13.3428
5	77.9909	13.3289
6	78.0307	13.3341
7	78.0469	13.3067
8	78.0782	13.3266
9	78.0653	13.3647
10	78.0783	13.3690
11	78.0791	13.3553
12	77.9599	13.4300
13	78.0139	13.4543
14	78.0227	13.4594
15	78.0577	13.4165
16	78.0813	13.3994
17	78.1132	13.3922
18	78.1402	13.4094
19	78.0040	13.4167
20	78.0063	13.4140
21	78.1629	13.5222

22	78.0476	13.5101
23	78.0424	13.5060
24	77.9826	13.4692
25	78.0298	13.6297
26	78.0279	13.6356
27	78.0598	13.5485
28	78.0530	13.5505
29	78.0315	13.5649
30	78.0187	13.5389
31	77.9967	13.5587
32	77.9702	13.5606
33	78.0935	13.5359
34	78.1031	13.5130
35	78.1301	13.5314
36	78.1277	13.5804
37	78.1298	13.5875
38	78.1174	13.5882
39	78.1763	13.5807
40	78.1384	13.5747
41	78.0453	13.6322
42	78.0537	13.6259
43	78.0614	13.5372
44	78.0661	13.5779
45	78.1243	13.5546
46	78.1306	13.5450
47	78.1809	13.5558
48	78.1811	13.5734
49	78.1761	13.5259
50	78.0677	13.6000
51	78.0194	13.6287
52	78.0276	13.6443
53	78.0199	13.6412
54	78.0706	13.5850
55	78.1614	13.4827
56	78.1768	13.4898
57	78.0790	13.4816
58	78.1876	13.4869
59	78.0396	13.4671
60	78.1559	13.4638
61	78.1003	13.4601
62	78.0979	13.5010
63	78.1621	13.4945
64	78.1801	13.4749
65	78.1526	13.4700

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 4 numbers of percolation tanks are feasible in the project area. Location details with coordinates are given in the Table-6. The estimated cost of 4 percolation tanks is estimated at 30.0 lakhs. The annual storage capacity of tanks is estimated at 0.72 MCM. The volume of ground water recharged through these Percolation Tanks is estimated to be 0.50 MCM.

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

Sl. No.	Longitude	Latitude
1	78.0972	13.5072
2	78.1851	13.5056
3	78.0677	13.6000
4	78.0916	13.4052

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 7 numbers of Point Recharge Structures are feasible in the taluk. Location details with coordinates are given in the Table-7. The cost of 7 PRS is estimated at 14 lakhs. The annual storage capacity of PRS is estimated at 0.105 MCM. The volume of ground water likely to be recharged through PRS is estimated to be 0.09 MCM.

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

Sl. No.	Longitude	Latitude
1	77.9899	13.3151
2	78.1034	13.3966
3	78.0581	13.4834
4	78.0338	13.5967
5	78.1243	13.5807
6	78.1843	13.5822
7	78.1574	13.5222

7. Tentative Cost Estimates

Tentative cost estimates of structures/interventions proposed in the area 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 1.20 MCM of water will be recharged to ground water system which may create an additional irrigation potential of 144 hectares.

Table-8: Tentative cost Estimates of Structures Proposed in Chintamani taluk.

Type of Structure	Number	Unit Cost (Rs. Lakhs)	Estimated Cost (Rs. Lakhs)	Annual Storage Capacity (MCM)	Volume of water likely to be recharged (MCM)	Additional Irrigation Potential Likely to be created (Hectares)
Check Dam	65	3.0	195.00	0.858	0.60	144
Percolation Tank	4	7.5	30.00	0.72	0.50	
Point Recharge Structure	7	2.0	14.00	0.105	0.09	
Total	76		239.00	**1.683**	**1.20**	
Impact Assessment (5% of estimate)	11.95					
Grand Total	**250.95**					

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.