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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 SRINIVASPUR 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 SRINIVASPUR TALUK, KOLAR DISTRICT, KARNATAKA

CONTENT

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

TALUK AT A GLANCE	
Taluk	**Srinivaspur**
District	Kolar
State	Karnataka
Taluk area	864.6 Sq km
Area Suitable for Artificial Recharge	603.03 Sq km
Latitude & Longitude	Longitude of 78° 11' 14" E - 78° 17' 41" E Latitude of 13° 12′ 54″ N - 13° 35′ 47″ N
Normal Rainfall	785 mm
Normal Monsoon Rainfall	447 mm
Normal Non- Monsoon Rainfall	338 mm
Geology	Granites, Gneisses and Laterites
WATER LEVEL	
Pre - Monsoon	>15 m bgl.
Post - Monsoon	>15 m bgl. * Almost all the representative OW are dry
GROUND WATER RESOURCES ESTIMATION	
Net ground water available	58.10 MCM
Ground water draft for irrigation	101.01 MCM
Groundwater draft for domestic & industrial water supply	1.48 MCM
Total ground water draft	102.49 MCM
Stage of ground water development (%)	171 %
Non committed monsoon runoff available for the taluk	11.6 MCM
Total volume of weathered zone available for Recharge	6030 MCM
Storage Potential Weathered/unsaturated zone available for Recharge	120.61 MCM
ARTIFICIAL RECHARGE /CONSERVATION MEASURES	
Structures Proposed (tentative)	Check Dam – 72 Percolation Tank – 5 Point Recharge structures – 8
Tentative total cost of the project	Rs.282.97 lakhs
Excepted recharge	1.40 MCM
Expected rise in water level by recharging 1.40 MCM of rain fall run off.	0.12 m

PLAN ON ARTIFICIAL RECHARGE TO GROUND WATER AND WATER CONSERVATION IN SRINIVASPUR 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 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 Srinivaspur Taluk, Kolar District, having an area of 864.6 sq km has been prepared in this report.

2. Objectives of the Scheme

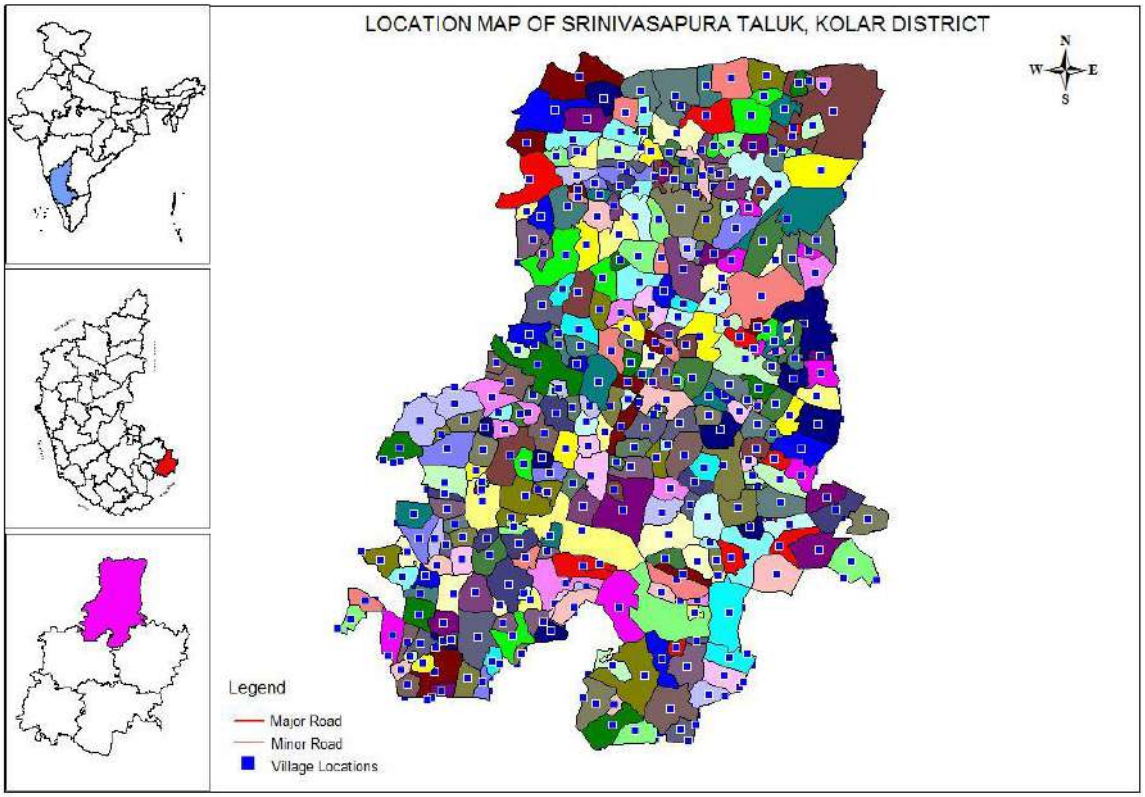
- To augment ground water resources by harvesting and conserving non committed surplus monsoon run off using artificial recharge measures.
- To overcome the inadequacy of surface water to meet the ever- increasing water demands.
- To arrest decline in ground water levels.
- To recover and transform this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

3. Study area details

3.1 Location

Srinivaspur taluk is located in the northern part of Kolar district of Karnataka. The taluk covers a geographic area of 864.6 sq.km and lies between Longitude of 78° 11' 14" E and 78° 17' 41" E and Latitude of 13° 12′ 54″ N and 13° 35′ 47″ N. There are 400 villages falling in the taluk. The taluk comprises 13 Minor Irrigation tanks. Location of the taluk is shown in Fig-1.

Fig-1



3.2 Physiography and Drainage

Geomorphologically, Srinivaspur taluk is undulating to plain area with elevation varying from 849 to 1130 m above mean sea level. (Average elevation 819 metres). There are no perennial rivers in the taluk and it falls in Pennar Basin. The drainage pattern is dendritic. Maps showing geomorphology and drainage pattern are presented in Fig-2 and 3.

Fig-2

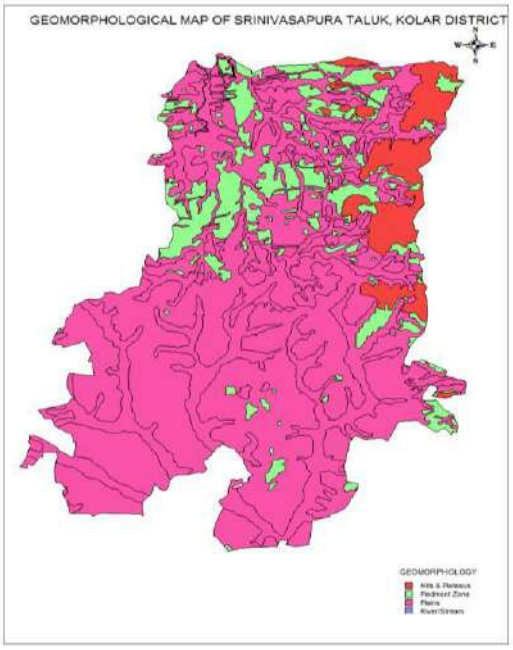
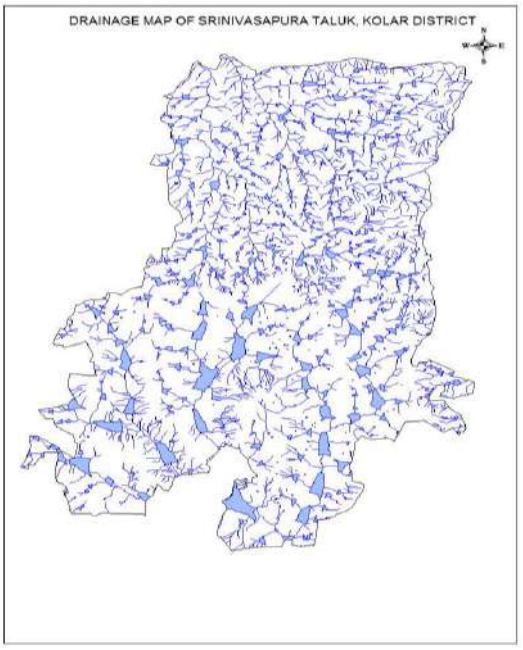


Fig-3



3.3 Land Use and Soil

The area is underlain by loamy soil having fine sand as major constituent. Agriculture is practiced in major part of the watershed area. There are 13 Major Irrigation tanks in the taluk. An area of 695.63 sq. km in the taluk is covered by plain topography; 107.46 sq. km by piedmont zone, 60.94 sq km by hills and plateaus. Major part of the taluk (76%) is covered by Alfisol Soil, 2% by Entisol and 14% by Inceptisol Soils. Maps showing soil distribution and land use are presented in Fig-4 and 5.

Fig-4

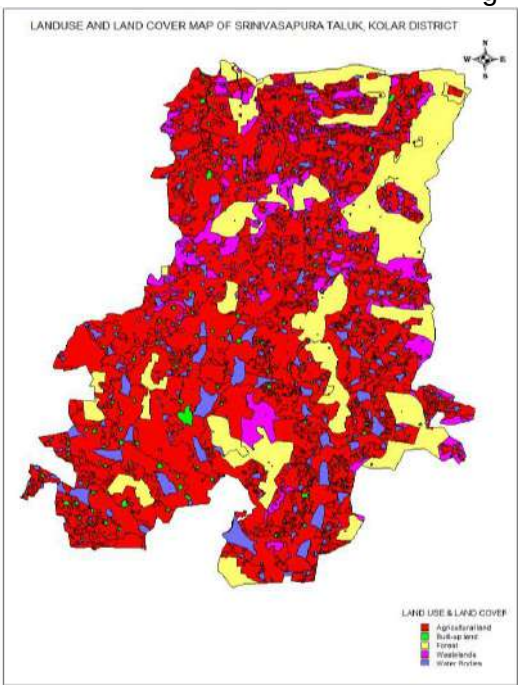
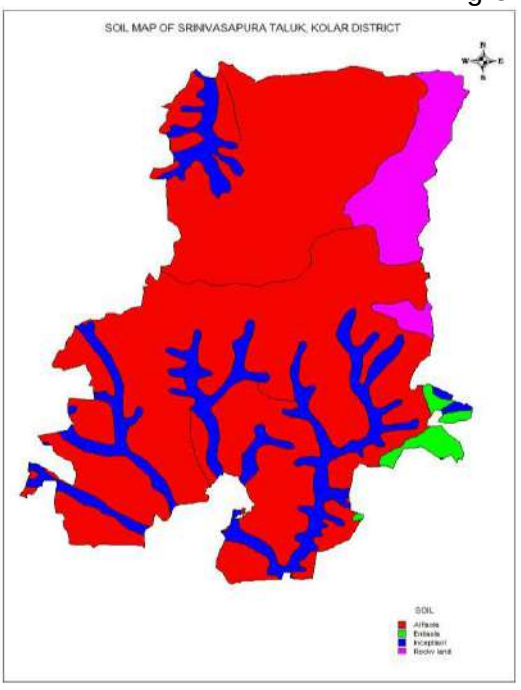


Fig-5



3.4 Hydrometeorology

Normal rainfall in Taluk is 785 mm and majority of the precipitation is from South – West monsoon. The taluk falls in the Eastern dry agro climatic zone. It experiences a semi-arid climate, winter temperature varies from 18° to 33 °C whereas, and in summer it varies from 25° to 46 °C. The details of rainfall are given in **Table 1.**

Table 1: Details of rainfall in Srinivaspur Taluk

Normal Monsoon Rainfall (mm)	Normal Non- monsoon Rainfall (mm)	Total Normal Annual Rainfall (mm)
447	338	785

3.5 Geology:

Major water bearing formations occurring in the taluk are granites and gneisses. Laterites occupy small portion of the taluk. Alluvium is confined to river courses. The thickness of weathered zone in the taluk varies from 10 – 27 m in northern part and between 70 - 80 m in southern part of the taluk. Average thickness of weathered section is 36 m. Lineaments are trending generally in NW - SE and NE - SW directions. Geological map showing lineament and thickness of weathered zone are presented in Fig-6 and 7

Fig-6

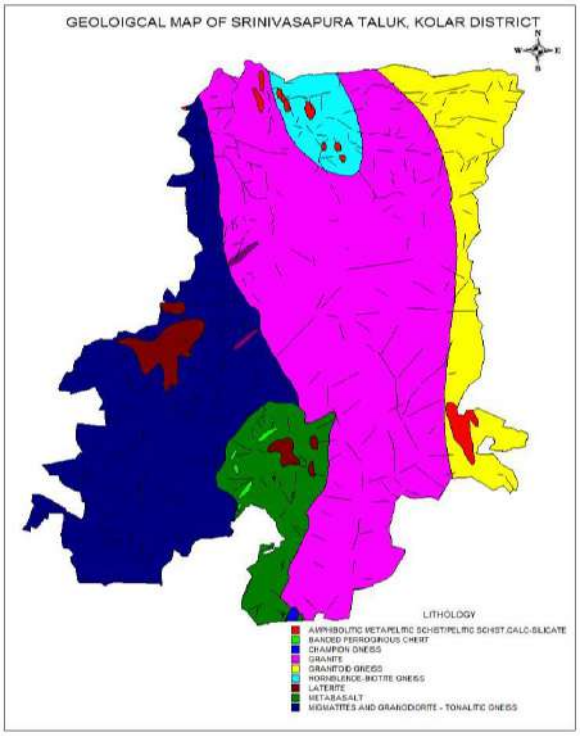
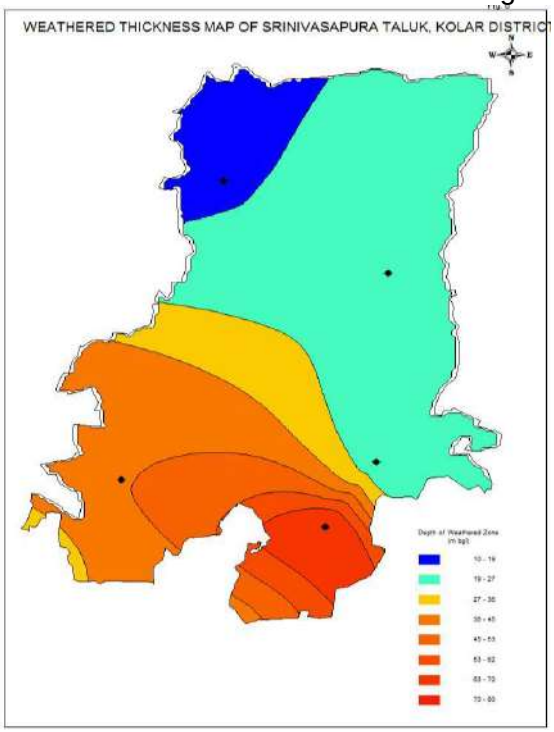


Fig-7



4. Hydrogeology

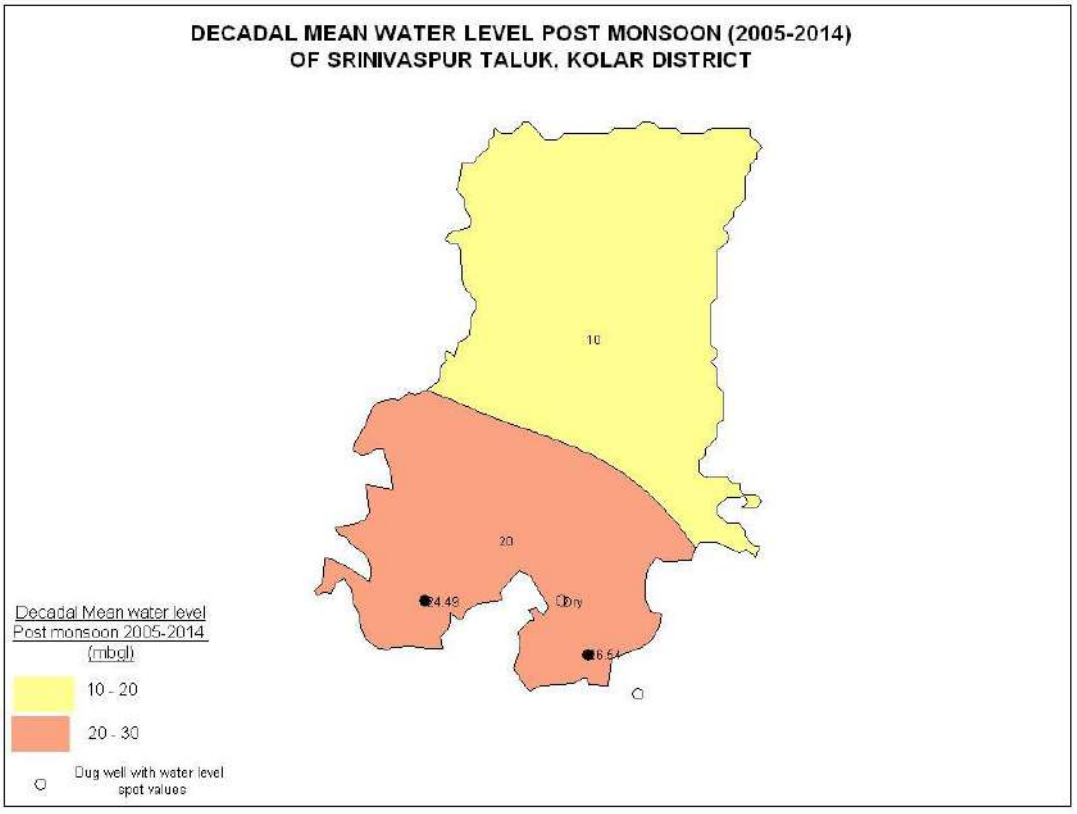
Ground water occurs in weathered formations under phreatic conditions (in small isolated and highly localized patches) at shallow level and in semi-confined to confined conditions in fractured formations at deeper level. High density of lineaments is observed in the taluk trending in NW - SE and NE - SW directions.

4.1 Decadal Mean depth to water level (2014)

Most of the dug wells in the taluk have dried up. Hence, water level data is not available for analysis. Piezometer located at Laxmipura is having pre monsoon depth to water level of 27.80 mbgl. During post monsoon water level of the same station is 24.62 mbgl. Seasonal Fluctuation in the area is more than 3.20 m m.

Post-monsoon Decadal mean water level map has been prepared using piezometer water level data. It is observed that mean water level varies in the range of 10 – 20 m bgl in the northern part of the taluk, whereas in the southern part it is in the range of 20 - 30 m bgl. In general, average post-monsoon water level in the taluk is more than 15mbgl. Post-monsoon Depth to Water map is shown in Fig-8.

Fig-8



4.2 Decadal Water Level Trend (2005-2014)

Most of the observation wells in the taluk have dried up due to declining water level trend. Decadal water level trend available for one station was analysed for pre monsoon and it recorded fall of 0.4377m/Year.

Decadal water level trend for post- monsoon was analysed for 1 well and it is recorded falling trend of 1.7 m/year. In general, there is falling trend in the post-monsoon period. It 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

The taluk is categorized as **Over Exploited** as on March 2011. The net annual ground water availability in 5810 HAM, ground water draft for irrigation is 10101 HAM and the ground water draft for drinking and industrial purposes is 148 HAM. Further, the stage of ground water development is estimated as 171%. The data are given in **Table 2.**

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

Sl. No.	Item	Resources as on 2011
1.	Net Annual Ground water Availability (HAM)	5810
2.	Existing Ground water draft for irrigation (HAM)	10101
3.	Existing ground water draft for drinking & industrial purposes (HAM)	148
4.	Existing ground water draft for all uses (HAM)	10249
5.	Stage of ground water development (HAM)	171%
6.	Categorization	Over-Exploited

5. Planning for Ground water Recharge / Conservation

5.1 Justification for Artificial Recharge

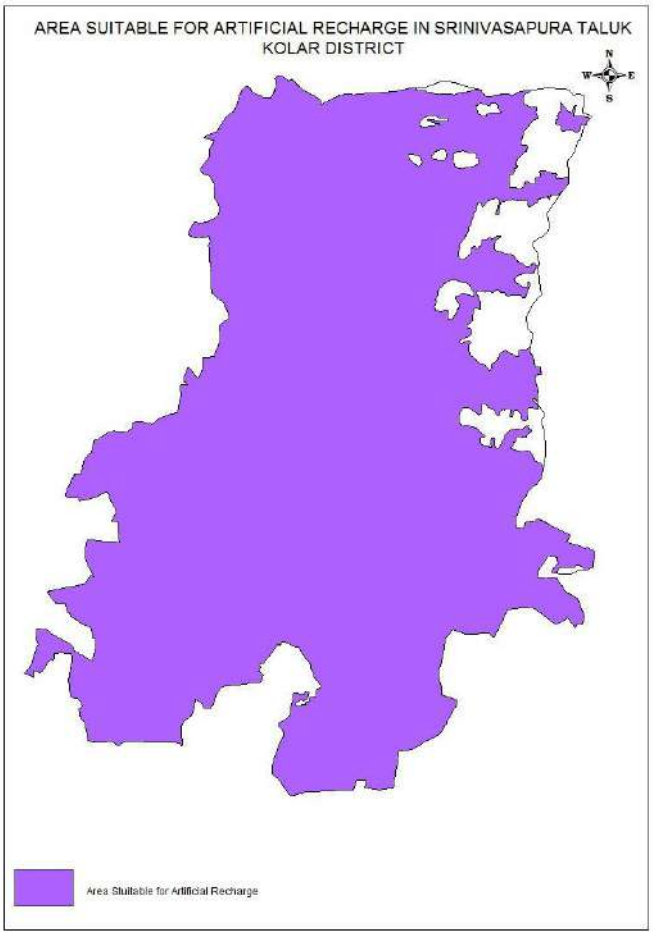
- Stage of development of ground water is 171% and the area falls in Over -Exploited category.
- Phreatic zone is totally dried up due over exploitation of ground water resource. Availability of sufficient unsaturated thickness in weathered zone provides sufficient space for artificial recharge in the project area.
- Farmers are losing their livelihood and labourers 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.
- 11.6 MCM of non-committed surplus monsoon run off is available for recharge.
- 13 Major Irrigation tanks are existing 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 603.03 sq km was delineated for artificial recharge as shown in Fig-9.

Fig-9



5.3 Availability of Surplus Surface water for Artificial Recharge

Monsoon rainfall run off is the only source water for artificial recharge in the area. Source water availability is 11.60 MCM. The details of source water availability are presented in Table 3.

Table 3: Details of Source Water Availability in Srinivaspur Taluk

Normal Monsoon Rainfall	447 mm
Area of identified for AR	603.03 Sq km
Run off Coefficient (Strange's Method)	9.6%
Monsoon Run off	25.9 MCM
Utilisable Monsoon Run off (50%)	12.9 MCM
Committed Monsoon Run off (10% of utilisable run off)	1.3 MCM
Non committed monsoon run off	11.60 MCM

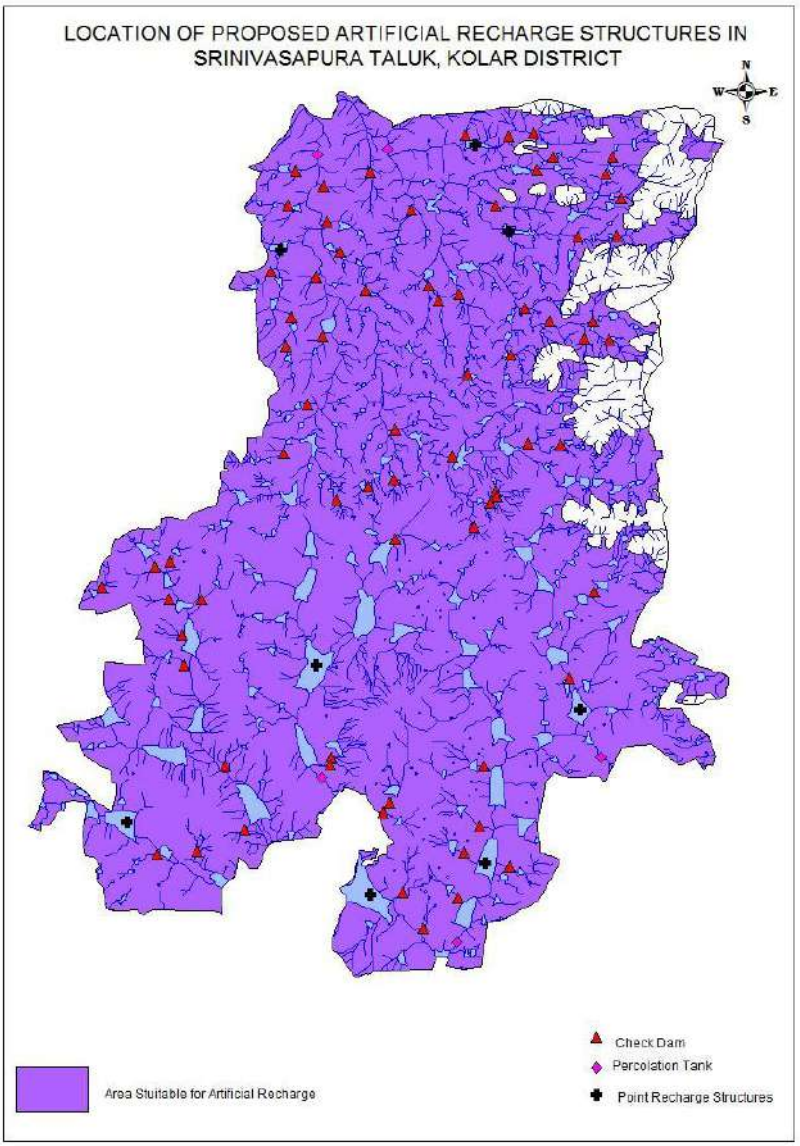
6. Proposed interventions including Tentative Locations of Artificial Recharge/ Conservation Structures

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 be taken up for water conservation purpose. The proposed structures are as given in Table 4 and locations are shown in Fig-10.

Table 4: Artificial Recharge Structures Proposed in Srinivaspur Taluk

Structures Proposed	Number of Structures Proposed
Check Dam	72
Percolation Tank	05
Point Recharge Structure	08
Total	85

Fig-10



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 72 check dams are feasible in the taluk. Location details with coordinates are given in the Table-5. The cost of these 72 Check dams is estimated at 216 lakhs. The total storage capacity of check dams is estimated at 0.95 MCM. The volume of ground water likely to be recharged through these check dams is estimated to be 0.67 MCM.

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

Sl. No.	Longitude	Latitude
1	78.1674	13.3628
2	78.1682	13.3496
3	78.1317	13.3834
4	78.1551	13.3922
5	78.1621	13.3943
6	78.1617	13.3778
7	78.1761	13.3778
8	78.2123	13.4411
9	78.2358	13.4208
10	78.2232	13.4623
11	78.2299	13.4917
12	78.2133	13.4875
13	78.2156	13.4997
14	78.2068	13.5196
15	78.2145	13.5481
16	78.2177	13.5631
17	78.2300	13.5562
18	78.2318	13.5409
19	78.2741	13.2361
20	78.2654	13.2513
21	78.2924	13.2686
22	78.2898	13.2493
23	78.3129	13.2627
24	78.2992	13.2801
25	78.2566	13.2862
26	78.2594	13.2904
27	78.3012	13.3061
28	78.2335	13.3098
29	78.2333	13.3066
30	78.1866	13.3060
31	78.1953	13.2783
32	78.1742	13.2694
33	78.1563	13.2678
34	78.3428	13.5343
35	78.2620	13.4512
36	78.2497	13.4267
37	78.2616	13.4301
38	78.2619	13.4043
39	78.2969	13.4093
40	78.3066	13.4245
41	78.3070	13.4224

42	78.3042	13.4197
43	78.2871	13.4396
44	78.3352	13.4446
45	78.3209	13.4451
46	78.2491	13.5117
47	78.2811	13.5069
48	78.2768	13.5135
49	78.2900	13.5096
50	78.3193	13.5038
51	78.3131	13.4834
52	78.3603	13.5347
53	78.3064	13.5480
54	78.3555	13.5617
55	78.3622	13.5514
56	78.3498	13.4979
57	78.3567	13.4903
58	78.3461	13.4908
59	78.3304	13.4979
60	78.2941	13.4751
61	78.2269	13.5173
62	78.2372	13.5280
63	78.2511	13.5623
64	78.2690	13.5461
65	78.3319	13.5688
66	78.3248	13.5634
67	78.3232	13.5794
68	78.3125	13.5781
69	78.3584	13.5688
70	78.2933	13.5782
71	78.3502	13.3814
72	78.3393	13.3441

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 5 numbers of percolation tanks are feasible in the project area. Location details with coordinates are given in the Table-6. The cost of these 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: Tentative Location of proposed Percolation Tanks in Srinivasapura Taluk

Sl. No.	Longitude	Latitude
1	78.2294	13.3008
2	78.2893	13.2299
3	78.3532	13.3098
4	78.2273	13.5700
5	78.2587	13.5724

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 Location of Proposed Point Recharge Structures in Srinivasapura Taluk

Sl. No.	Longitude	Latitude
1	78.2509	13.2504
2	78.2269	13.3494
3	78.1430	13.2817
4	78.3018	13.2642
5	78.3438	13.3305
6	78.2112	13.5287
7	78.2973	13.5743
8	78.3123	13.5367

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 1.40 MCM of water will be recharged to ground water system which may create an additional irrigation potential of 169 hectares.

Table 8: Tentative Cost Estimates of structures proposed in Srinivaspur 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	72	**3.0**	216.00	0.9504	0.67	169
Percolation Tank	5	**7.5**	37.50	0.9	0.63	
Point Recharge Structure	8	**2.0**	16.00	0.12	0.11	
TOTAL	**85**		**269.50**	**1.9704**	**1.40**	
Impact Assessment (5% of estimate)			13.47			
Grand Total			**282.97**			

. 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 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 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.