



केंद्रीय भूमि जल बोर्ड

जल संसाधन, नदी विकास और गंगा संरक्षण मंत्रालय

भारत सरकार

Central Ground Water Board

Ministry of Water Resources, River Development and Ganga

Rejuvenation

Government of India

Report on

AQUIFER MAPPING AND MANAGEMENT PLAN

Srinivaspur Taluk, Kolar District, Karnataka

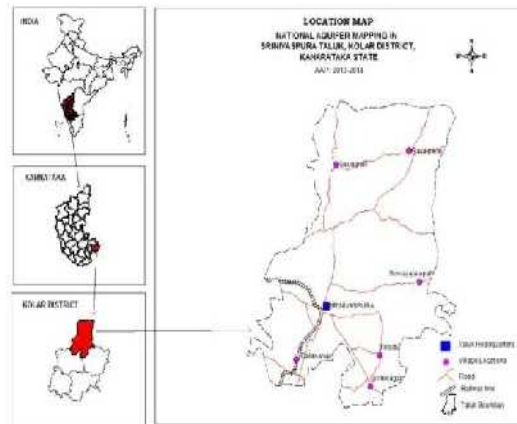
दक्षिण पश्चिमी क्षेत्र, बैंगलोर

South Western Region, Bengaluru



GOVERNMENT OF INDIA
MINISTRY OF WATER RESOURCES,
RIVER DEVELOPMENT AND GANGA REJUVENATION
CENTRAL GROUND WATER BOARD

SRINIVASPUR TALUK AQUIFER MAPS AND
MANAGEMENT PLANS, KOLAR DISTRICT,
KARNATAKA



By
T. Rajendran
SCIENTIST-D

CENTRAL GROUND WATER BOARD
SOUTH WESTERN REGION
BANGALORE
DECEMBER 2016

**SHRINIVASPUR TALUK AQUIFER MAPS AND MANAGEMENT
PLANS, KOLAR DISTRICT, KARNATAKA**

CONTENTS

Sl. No.	Chapter Title	Page No.
1	SALIENT INFORMATION	1- 8
2	AQUIFER DISPOSITION	9 - 11
3	GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION AND OTHER ISSUES	11 – 14
4	GROUND WATER RESOURCE ENHANCEMENT	15
5	DEMAND SIDE INTERVENTIONS	15 - 17

AQUIFER MANAGEMENT PLAN OF SRINIVASPUR TALUK, KOLAR DISTRICT, KARNATAKA STATE

1.0 SALIENT INFORMATION

Name of the taluk: **SRINIVASPUR**

District: Kolar; State: Karnataka

Area: 862 sq.km.

Population: 2,02,304

Annual Normal Rainfall: 745 mm

1.1 Aquifer management study area

Aquifer mapping studies was carried out in **Srinivaspur taluk**, Kolar district of Karnataka, covering an area of **862 sq.kms** under **National Aquifer Mapping Project**. Srinivaspur taluk of Kolar district is located between north latitude $13^{\circ} 13'$ and $13^{\circ} 36'$ & east longitude $78^{\circ} 06'$ and $78^{\circ} 25'$, and is covered in parts of Survey of India Toposheet Nos. 57 K/2, 57K/3, 57K/6, 57 K/7 and 57K/8. Srinivaspur taluk is bounded by the State of Andhra Pradesh on east and north, Chintamani taluk on west, Kolar and Mulbagal taluks in the south and the location map of Srinivaspur taluk of Kolar District is presented in Fig. 1.

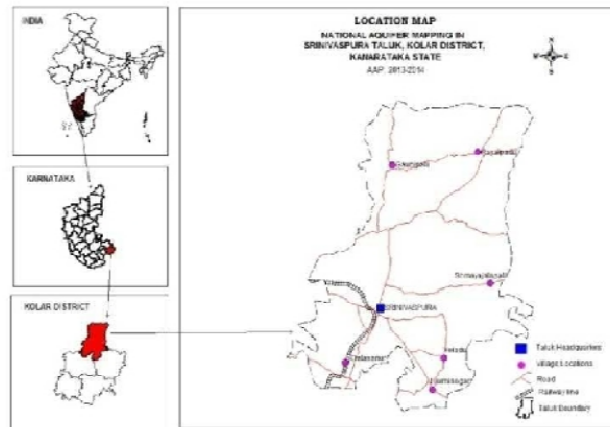


Fig. 1: Location Map of Srinivaspur taluk, Kolar district

1.2 Taluk administration

Srinivaspur taluk is divided into 5 Hoblies and Srinivaspur is the only one town, which is also the taluk head quarter. There are 296 inhabited and 51 uninhabited villages in Srinivaspur taluk. The taluk is well connected by good network of roads. Bangarpet – Kolar –Chickballapur railway line is the only railway line passing through the taluk.

1.3 Population

According to 2011 census, the population in Srinivaspur taluk is 2,02,304, comprises 1,02,075 males and 1,00,229 females. Out of the total population of 2,02,304, nearly 1,75,511 constitute the rural population and 26,793 is the urban population, which works out to 86.7 % (rural) and 13.3 % (urban) of the total population of taluk. The study area has an overall population density of 235 persons per sq.km. The decadal variation in population from 1991-2001 is 9.78 % in Srinivaspur taluk.

1.4 Hydrometeorology

Srinivaspura taluk has semi-arid to arid climate. Dryness and hot weather prevails during major part of the year. The area falls under Eastern Dry agro-climatic zone of Karnataka state and is categorized as drought prone.

The climate of the study area is quite agreeable and free from extremes. The year is usually divided into four seasons: summer from March to May; rainy season or south-west monsoon season from June to September; post-monsoon season covering the months of October and November and dry or winter Season from December to February.

There is one rain gauge station located in Srinivaspura taluk (Table 1). The data in respect of this station from the year 1981 to 2010 is analysed and presented in the Table 2. The data pertaining to this gauge is of long term nature and are well maintained. It is presumed that they are representative of the taluk and the same is used for analysis. Normal annual rainfall in Srinivaspura taluk for the period 1981 to 2010 is 804 mm.

Table 1: Raingauge and its location in Srinivaspura taluk

Sl. No.	Station	Latitude	Longitude	Altitude
1	Srinivasapura	13°20'	78°13'	805

Statistical analysis

Computations were carried out for the 30 year block of 1981- 2010 for Mean, Standard deviation and coefficient of variation of pre-monsoon, monsoon, post-monsoon and annual and are shown in Table 2. Mean monthly rainfall at Srinivaspur station is ranging between 2 mm during January to 170 mm during September. The CV percent for winter, pre-monsoon, monsoon and post monsoon season is 54, 31 & 51 percent respectively. Annual CV at this station works out to be 24 percent.

Table 2: Statistical Analysis of Rainfall Data of Eastern Dry Agro climatic Zone, Karnataka for the Period 1981 to 2010

Station	Kolar																	
	CV (%)	NRF (mm)	JAN	FEB	MARCH	APRIL	MAY	PRE	JUNE	JULY	AUG	SEP	SW	OCT	NOV	DEC	NE	ANNUAL
	323	2	2	5	13	26	73	119	78	94	105	170	447	142	58	18	219	785
	0	1	2	3	9	15	10	12	13	22	57	18	7	2	28	100		

Assessment of Drought

Rainfall data of Srinivaspura taluk has been analysed for 114 years using IMD method to assess the drought conditions in Srinivaspura taluk. The results of the classification are listed in the Table 3. It is observed that the Srinivaspura taluk has experienced alternating from no drought to severe drought conditions over the years.

% Deviation (Di)		>0	0 to -25	-25 to -50	< -50	Probability of drought occurrences
Category		No drought	Mild (Normal)	Moderate	Severe	
		Years				
Taluk	Srinivaspur	49	47	15	3	Once in 6 years

The details of the drought assessment are discussed as herein under. Out of 114 years of analysis in Srinivaspura taluk “No Drought” condition in the taluk is 49 years, “Mild Drought” condition 47 years, “Moderate Drought” condition experienced is 15 years. Further it is observed that “Severe Drought” condition is experienced in 3 years i.e., during the years 1918, 1923 and 1980. Based on occurrence and frequency of past drought events, the probability of occurrence of various intensities of drought at each station has been studied. It has been observed that the frequency of occurrence of drought is once in 6 years in Srinivaspura taluk.

1.5 Agriculture & Irrigation

Agriculture is the main occupation in Srinivaspur taluk. The amount of rainfall and its distribution throughout the season contributes to the cropping pattern in the area. There are two

agricultural seasons namely Kharif (June - October) and Rabi season (Mid October - Mid February). Major Kharif crops are paddy, maize, ragi, tur dal and vegetables (Table 4a). Main crops of Rabi season are Ragi, Maize, horse gram, groundnut, and sunflower. Mango plantations are the major perennial crop grown in the area (table 4a).

Table 4a: Details of Cropping pattern in Srinivaspur taluk 2013-2014 (ha)

Year	Paddy	Maize	Ragi	Tur dal	Horse Gram	Other pulses	Fruit trees	Vegetables	Groundnut	other oil seeds	Sugarcane
Area under cultivation (in ha)											
2013-2014	228	150	8620	269	3208	1758	22713	1168	1399	10	0

Table 4b: Details of land use in Srinivaspur taluk 2013-2014 (ha)

Sl. No.	Item Taluk	Year	Total Geographical Area	Area under Forest	Area not available for cultivation	Fallow land	Net sown area	Area sown more than once
1.	Srinivaspur	2013-14	85824	9547	17855	3252	42572	975

Source: District at a glance 2013-14, Govt. of Karnataka.

It is observed from table 4b that during the year 2013-14 percentage of gross cropped area of total geographical area was 49.60 % in Srinivaspur taluk (table 4b).

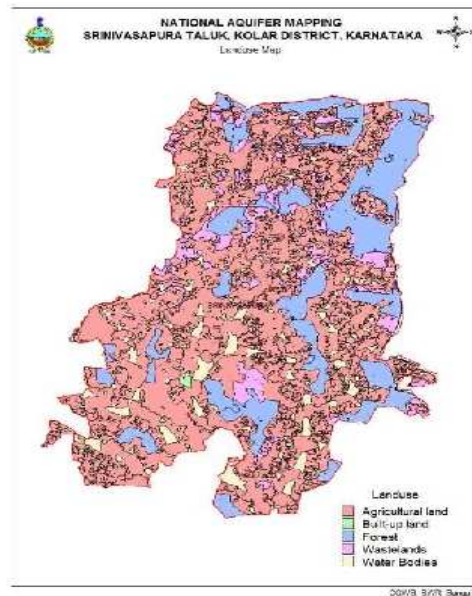


Fig 2: Land use map, Srinivaspur taluk

Table 5: Irrigation details in study area (in ha)

Net Area Irrigated From	Srinivaspur Taluk
Canals	Nil
Tanks	344
Wells	Nil
Bore wells	3224
Lift Irrigation	Nil
Other Sources	Nil
Total	3568

Source: District at a glance Govt. of Karnataka 2013-14

1.6 Geomorphology, Physiography & Drainage

Geomorphologically, the taluk area is covered with uplands on Gneisses and Granites, which are ideal for agriculture. Physiography of the entire area is in southern maidan region, characterized by undulating landscape with broad valleys, where the elevation ranges from 700m to 1376 m amsl with good degree of slope. Prominent hill ranges in the taluk are Pedda Konda 1376 m amsl, Kukkamuti Betta 1283 m amsl etc. Overall the topographic features in the area are formed by topographic divides between north Palar and south Pennar catchments.

In Srinivaspur taluk, there are no perennial rivers. There are few streams that rise in the hills and feed number of tanks. These tributaries are ephemeral. The drainage pattern of the area can be described as semi-dendritic to dendritic type (Fig. 4). The drainage patterns are described as sub-rectangular due to marked influence of geologic structures and more or less similar lithological characters.

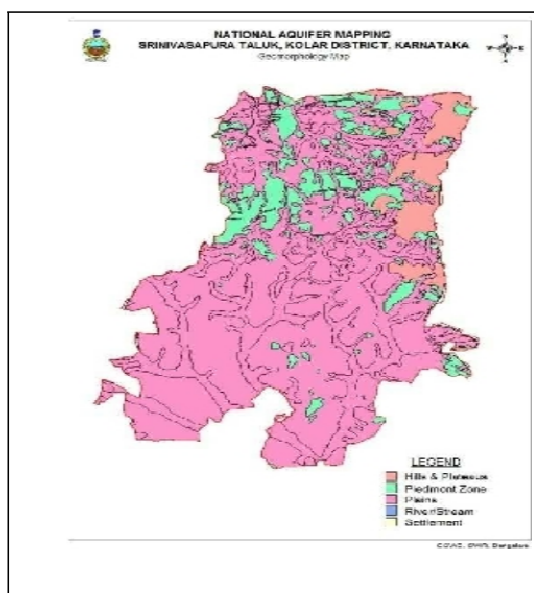


Fig. 3: Geomorphology, Srinivaspur taluk

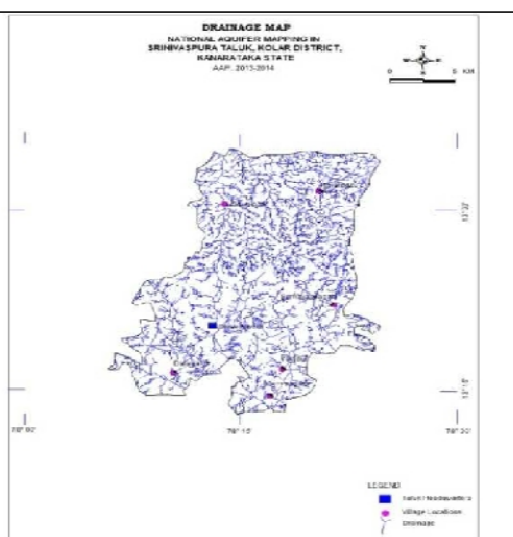


Fig. 4: Drainage, Srinivaspur taluk

1.6 Soil

Five classes of soils are found in Srinivaspur taluk. They are clayey, clayey, mixed clayey skeletal, Loamy skeletal and Rocky land.

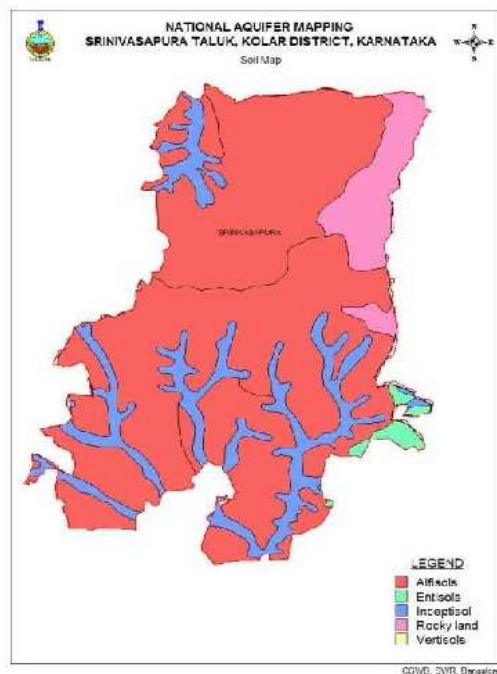


Fig 5: Soil map, Srinivasapur taluk

1.7 Ground water resource availability and extraction

(Aquifer wise up to 200 m depth)

Total GE Resources (2009), (Ha m)

Taluk	Annual replenisable GW resources	Fresh In-storage GW resources		Total availability of fresh GW resources
		Phreatic	Fractured (Down to 200 m)	Dynamic + phreatic in-storage + fractured
Srinivasapur	4740	7496	2077	14,313

1.8 Existing and future water demands

No scope for further Irrigation from ground water.

Domestic (Industrial sector) demand: 292.05 MCM (GWRE-2011)

1.9 Water level behavior

(a) Depth to water level

Aquifer - I

Pre-monsoon: 1.2 – 12.56 mbgl

Post-monsoon: 1.2 – 12.54 mbgl

Aquifer - II

Pre-monsoon: 6.0 – 188 mbgl

Post-monsoon: 7.02 – 213 mbgl

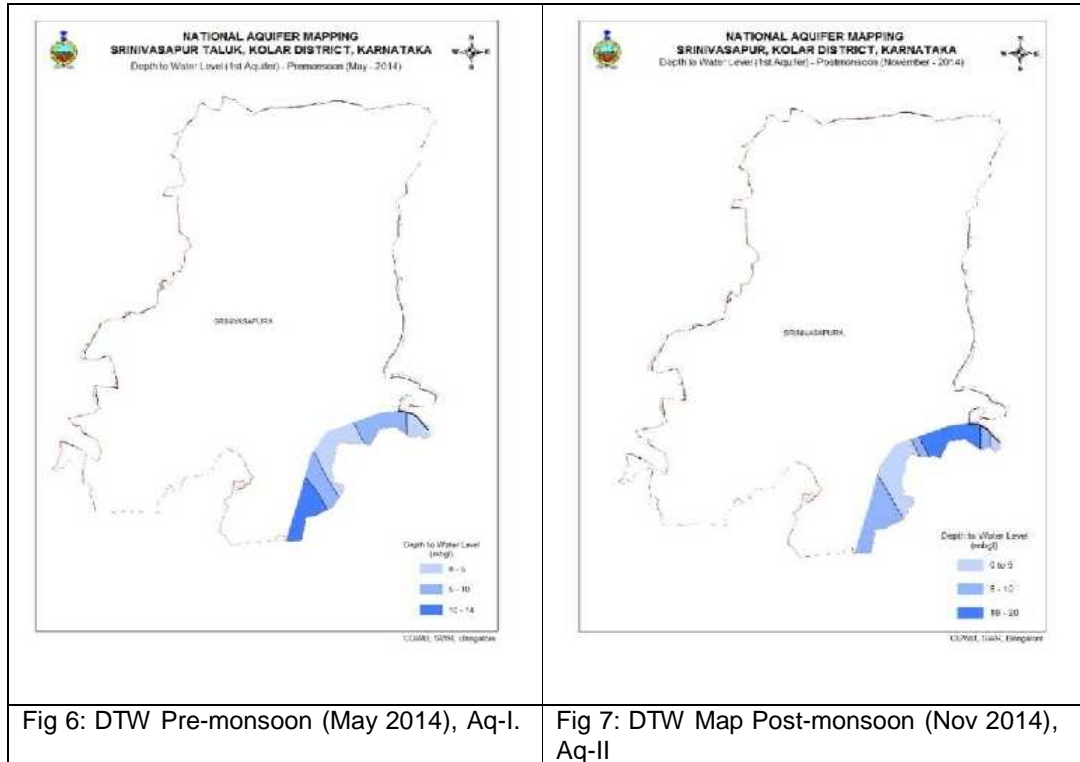


Fig 6: DTW Pre-monsoon (May 2014), Aq-I.

Fig 7: DTW Map Post-monsoon (Nov 2014), Aq-II

(b) Water level fluctuation

Aquifer-I

Seasonal Fluctuation: Rise ranges between 1.1 to 7.22 m;

Fall ranges between 0 to 12.10m

Aquifer-II

Seasonal Fluctuation: Rise ranges between 0.25 to 33.1m;

Fall ranges between 0.33 to 19.4m

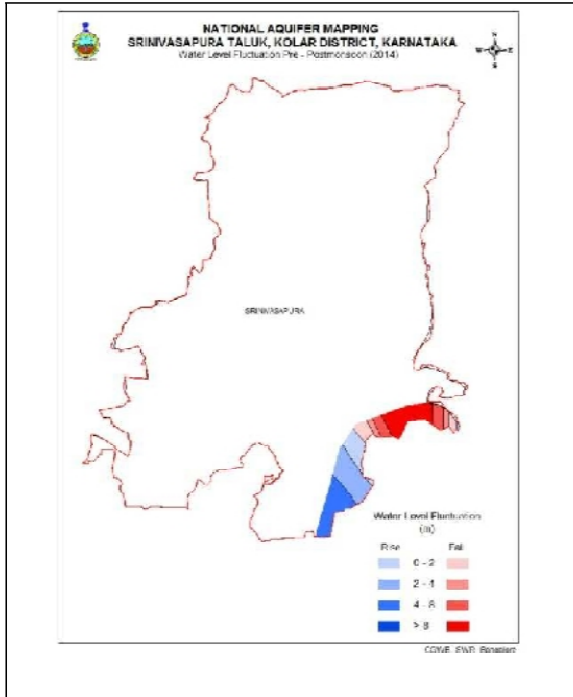


Fig 8: Water level fluctuation map (Aq – I)

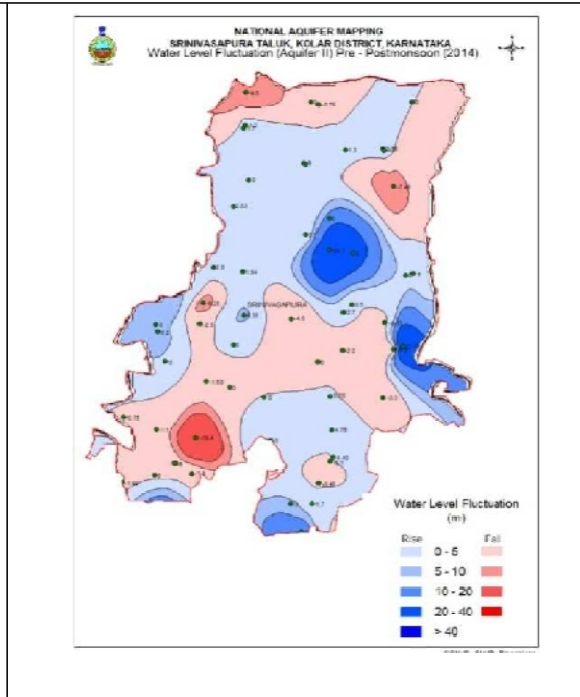


Fig 9: Water level fluctuation map (Aq – II)

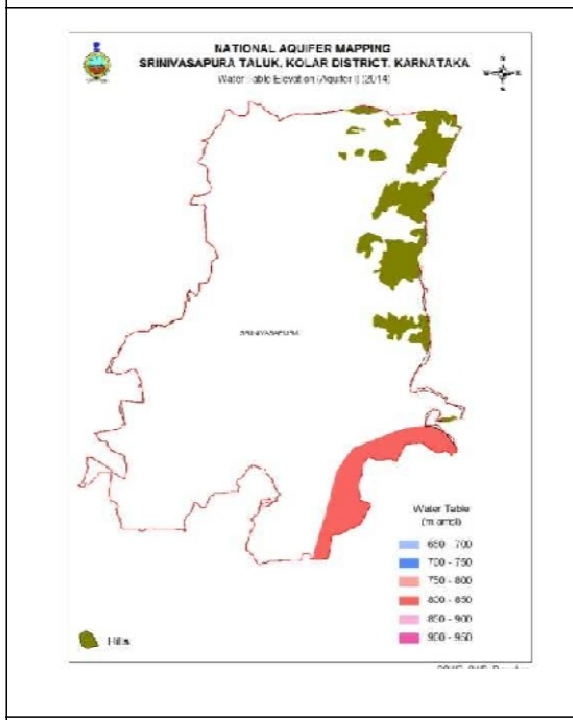


Fig 10: Water table elevation map (Aq – I)

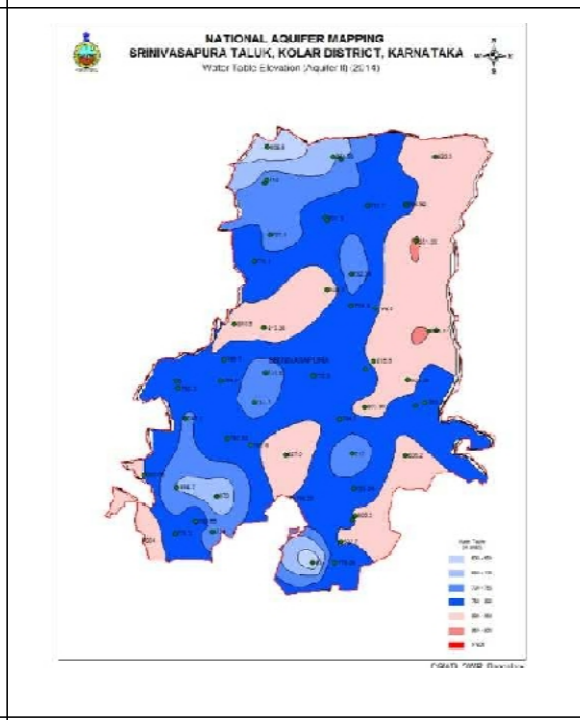


Fig 11: Water table elevation map (Aq - II)

2. AQUIFER DISPOSITION

2.1 Number of aquifers: In Srinivaspur taluk, there are mainly two types of aquifer systems;

- i. **Aquifer-I (Phreatic aquifer) comprising** Weathered Gneiss / Granite / Schist
- ii. **Aquifer-II, (Fractured multi-aquifer system) comprising** Fractured Gneiss / Granite /Schist

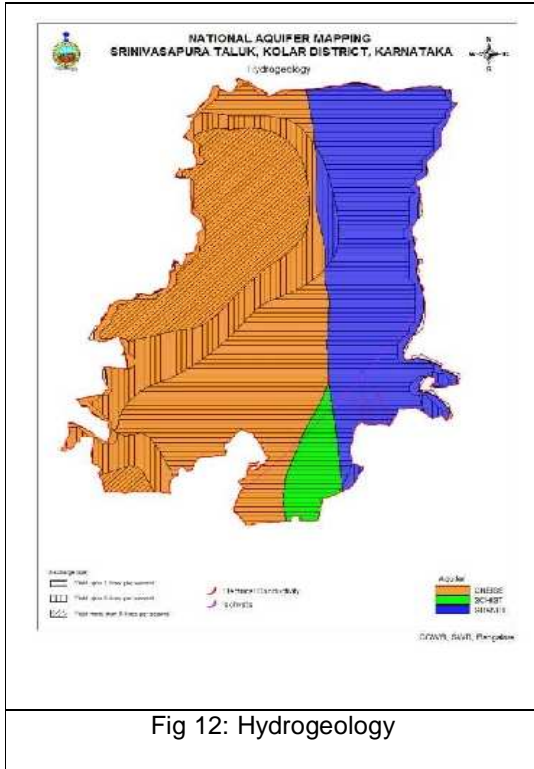


Fig 12: Hydrogeology

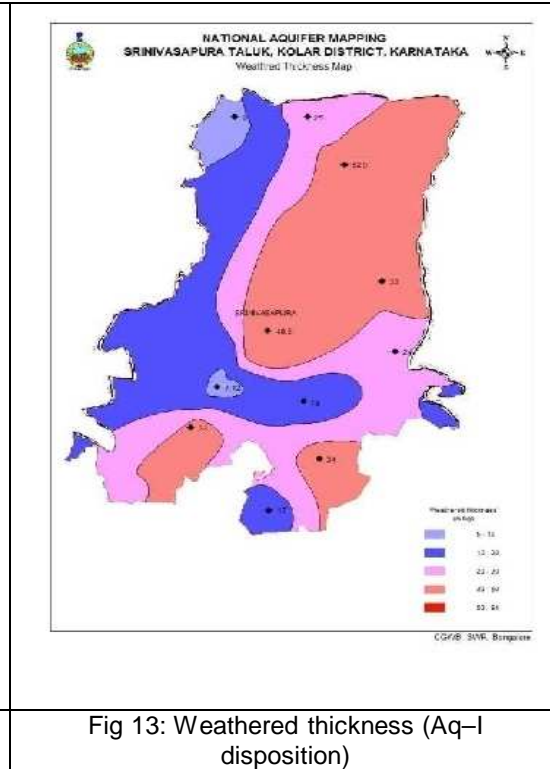


Fig 13: Weathered thickness (Aq-I disposition)

2.2 3 D aquifer disposition and basic characteristics of each aquifer

(A) Aquifer disposition – Rockworks output

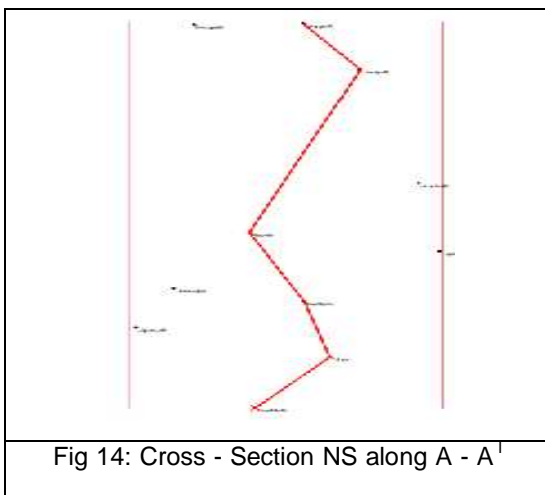


Fig 14: Cross - Section NS along A - A¹

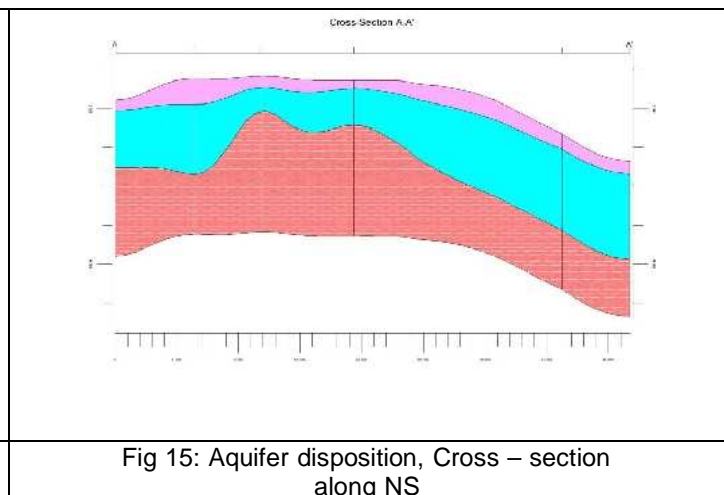


Fig 15: Aquifer disposition, Cross – section along NS

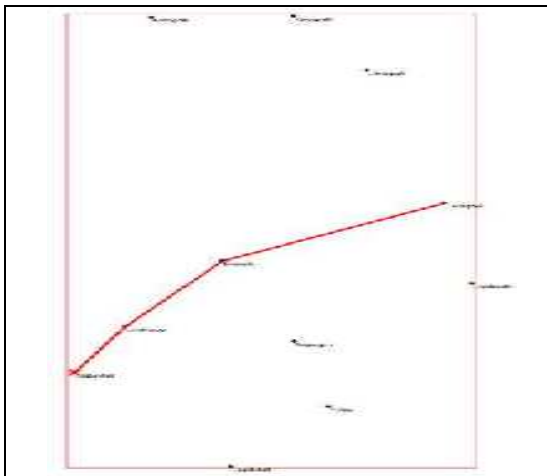


Fig 16: Cross - Section NE-SW, along A - A'

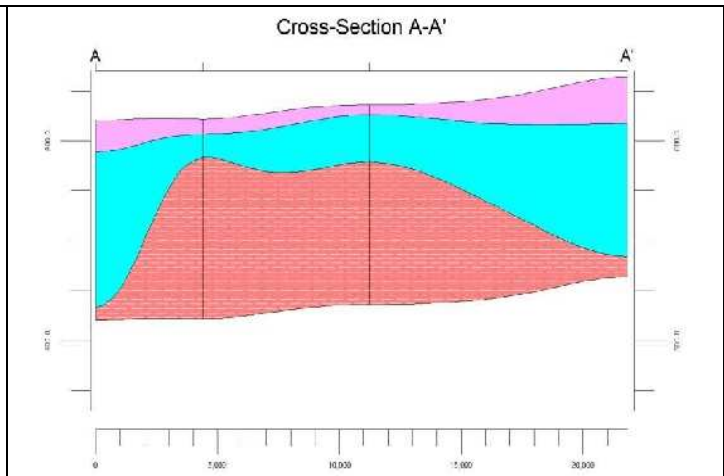


Fig 17: Aquifer disposition, Cross section along NE-SW, Rockworks output



Fig 18: Cross - Section NE - SE, along A - A'

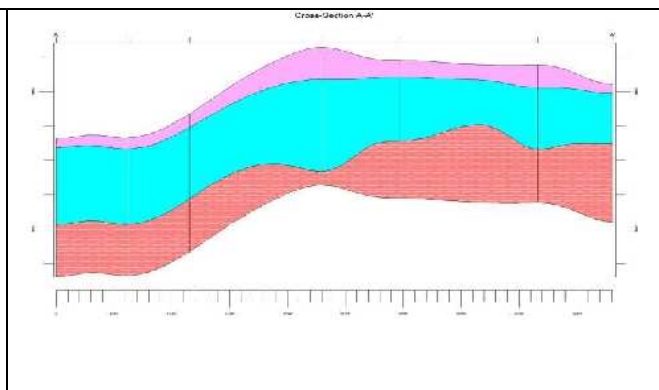


Fig 19: Aquifer disposition, Cross-section NW-SE, Rockworks output

(B) Aquifer & Fracture occurrence - Rockworks output;

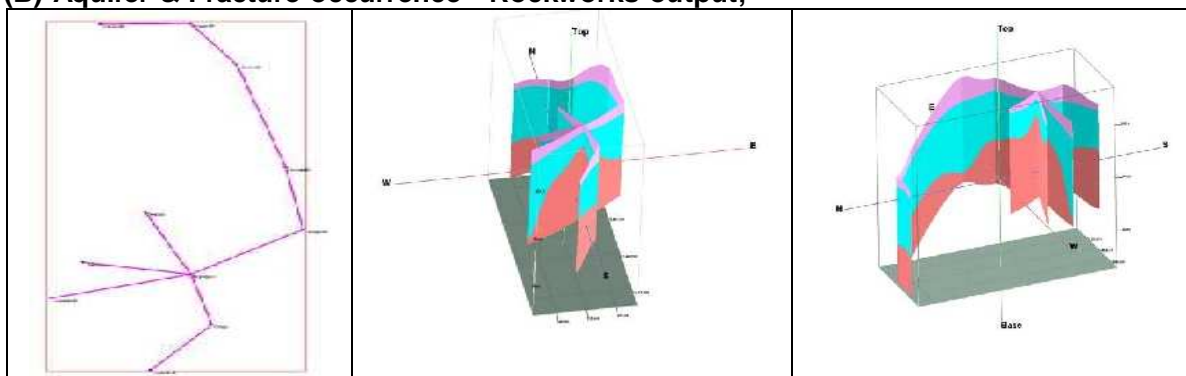


Fig 20: Fence diagrams along different sections

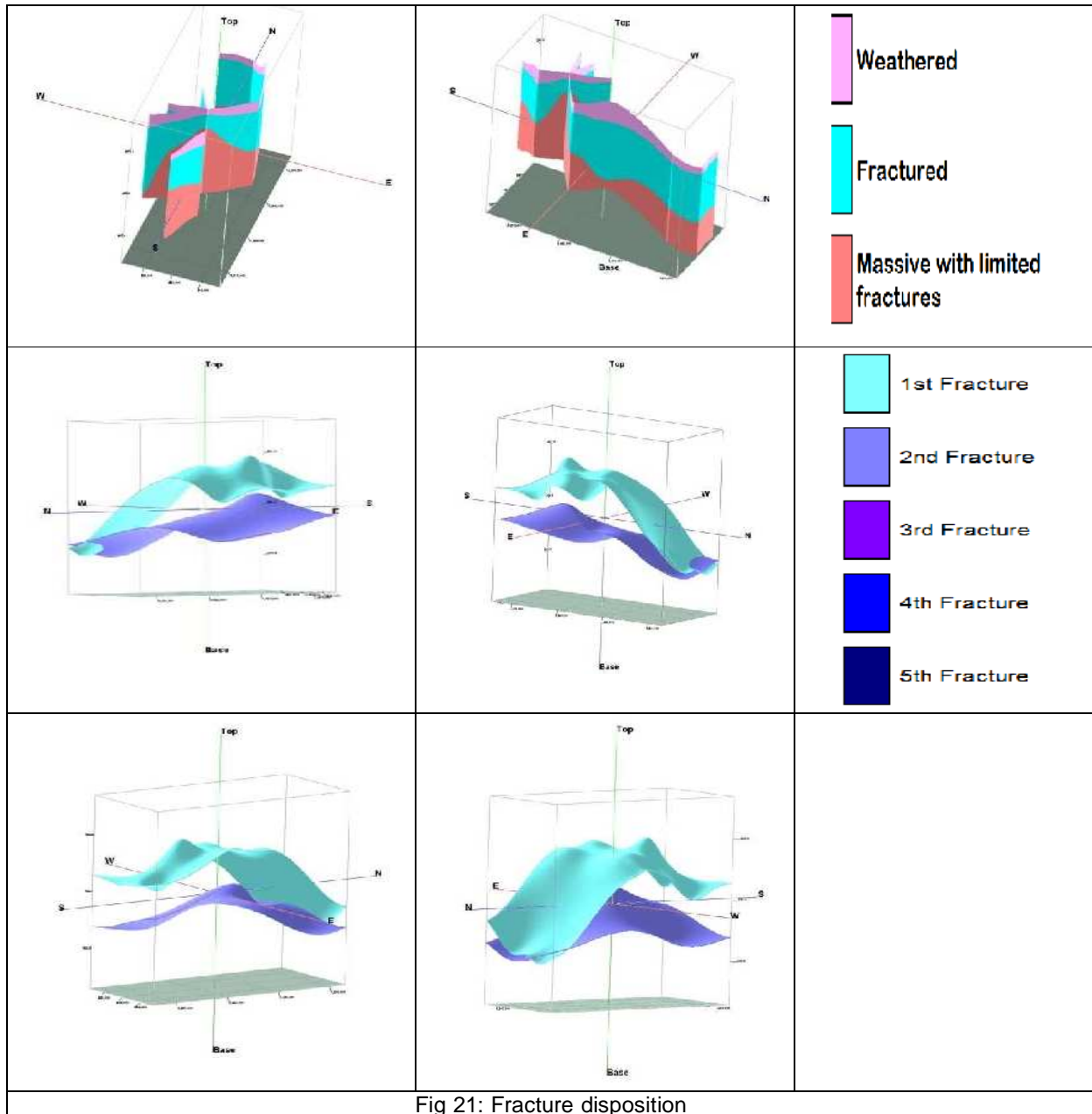


Fig 21: Fracture disposition

3. GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION AND OTHER ISSUES

3.1 Aquifer wise resource availability and extraction

(a) Present Dynamic Ground Water Resource (2011)

Taluk	Net annual GW availability, (ham)	Total draft for all uses, (ham)	Stage of GW development, %	Category
Srinivaspur	5810	10249	176	Over Exploited

(b) Present total Ground Water Resource (in ham)

Taluk	Annual replenishable GW resources (in ham)	Fresh In-storage GW resources (in ham)		Total availability of GW resource (in ham)
		Phreatic	Fractured	Dynamic + phreatic in-storage + fractured in-storage
Srinivaspur	4740	153587	3826	17413

(c) Present ground water availability and draft scenario (2011) in Srinivaspur taluk of Kolar district and expected improvement in Stage of Ground Water Development in future.

TALUK	GW Availability (in ham)	GW DRAFT (in ham)	Net Balance	Stage of GW Development (%)	Expected Additional Recharge from non committed monsoon runoff available (in ham)	Expected Increase in GW Availability (in ham)	Expected Reduction in Stage of GW Development (%)	Expected Difference in Stage of GW Development (%)
Srinivaspur	5810	10249	-4439	176	1160	6970	147	29

(d) Comparison of ground water availability and draft scenario in Srinivaspur taluk

Taluk	GW availability (in ham)	GW draft (in ham)	Net Balance	Stage of GW development	GW availability (in ham)	GW draft (in ham)	Net Balance	Stage of GW development	GW availability (in ham)	GW draft (in ham)	Net Balance	Stage of GW development
	2004				2009				2011			
Srinivaspur	4192	5522	- 1330	132	5103	8495	- 3392	166	5810	10249	- 4429	176

3.2 Chemical quality of ground water and contamination

During Aquifer Mapping Studies in Srinivaspur taluk, 57 key wells were established for Aquifer II which are all bore wells. In order to study the chemical quality of ground water one acidified and one normal representative water samples were collected from each of the key wells during pre-

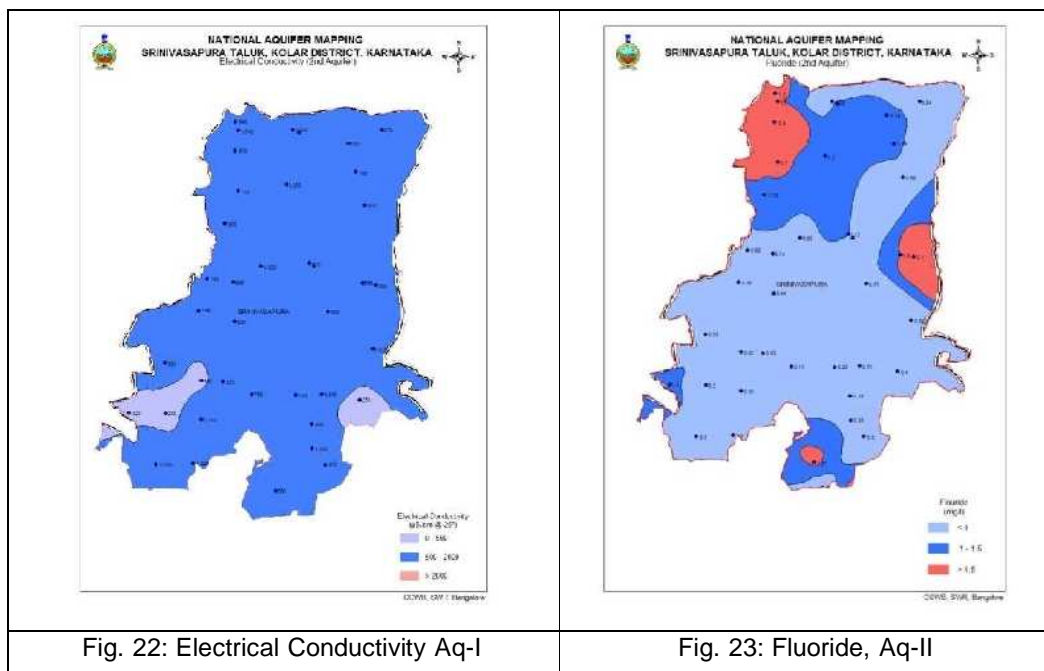
monsoon and were analyzed at Chemical Laboratory, C.G.W.B, S.W.R, Bangalore. Interpretation of Chemical Analysis results are mentioned as under:

Electrical conductivity

Aquifer- II - Out of 41 samples collected from bore wells representing Aq – II only, no sample indicates EC greater than the permissible limit of 2000 m/mhos/cm. Fig 22 illustrates electrical conductivity of water samples representing Aq- II, which indicates ground water in larger extent has EC value within the permissible limit. EC values of Aq- II ranges between 780 to 1790 m/mhos/cm at 25°C.

Fluoride: Fluoride concentration in ground water is of geogenic origin in areas underlain by younger granites/ gneisses containing minerals like Fluorspar & fluoroapatite

Aquifer – II - Out of 41 samples collected from bore wells representing Aq – II, 5 samples indicate fluoride greater than the permissible limit of 1.5 mg/l, which constitutes 12% of the samples collected. Fig 23 illustrates fluoride concentration and its spatial occurrence in water samples representing Aq- II. Ground water in northwest and east of taluk has fluoride greater than the permissible limit. Fluoride ranges between 0.7 to 2.9 mg/l (Bairaganapalli).



Nitrate: Aquifer II: Out of 41 samples collected from bore wells representing Aq – II, 3 samples indicate nitrate greater than the permissible limit of 45 mg/l, which constitutes 7% of the

samples collected. Fig 24 illustrates nitrate concentration and its spatial occurrence in water samples representing Aq- II. Ground water in isolated pockets of the taluk have nitrate greater than the permissible limit. Nitrate ranges between 16 to 120 mg/l (Avaganapalli village). Nitrate contamination is due to extensive use of fertilizers, hence is anthropogenic in origin.

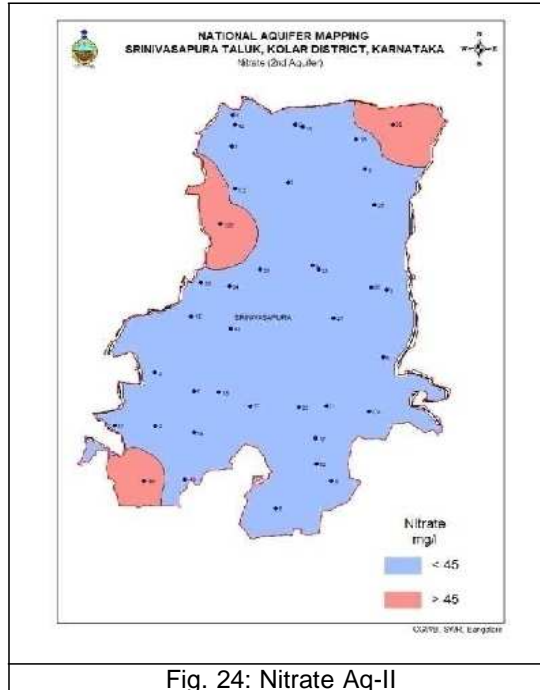


Fig. 24: Nitrate Aq-II

Arsenic: Arsenic concentration in water samples is much less than the permissible limit of 0.05mg/l.

Magnesium: Magnesium concentration in 21 water samples was found to be greater than the permissible limit of 30 mg/l, which constitutes 51% of samples.

In general, ground water quality in Srinivaspur taluk is good for drinking purpose except in some areas as depicted in above illustrated maps, where nitrate, fluoride and EC is found to be greater than the permissible limit as per “Indian Standard Drinking Water Specification 2009”. Ground water samples have also been tested and found suitable for agriculture & irrigation purposes.

3.3 Other issues

Radon concentration in water samples from bore wells indicate greater concentration than the permissible limit of 11.1 Bq/l. it may be due to presence of radioactive minerals in the host rock. However, the concentration of dissolved radon gas can be reduced by agitation, boiling or spraying.

4.0 GROUND WATER RESOURCE ENHANCEMENT

4.1 Aquifer wise space available for recharge and proposed interventions

Quantity of water available through non-committed surface runoff:

Artificial Recharge Structures Proposed	Srinivasapur Taluk
Non committed monsoon runoff available (Ham)	1160
Number of Check Dams	72
Number of Percolation Tanks	5
Number of Point Recharge structures	6
Tentative total cost of the project (Rs. in lakhs)	282.97
Excepted recharge (MCM)	6.59
Expected rise in water level (m)	0.5
Cost Benefit Ratio (Rupees/ cu.m. of water harvested)	4.29

4.2 Improvement in GW availability due to Recharge, Srinivasapur taluk. (Ham)

Taluk	GW availability	Stage of GW dev %	Expected Additional Recharge from non committed monsoon runoff	Expected Increase in GW Availability	Expected Stage of GW Development after recharge (%)
Srinivasapur	5810	176	1160	6970	147

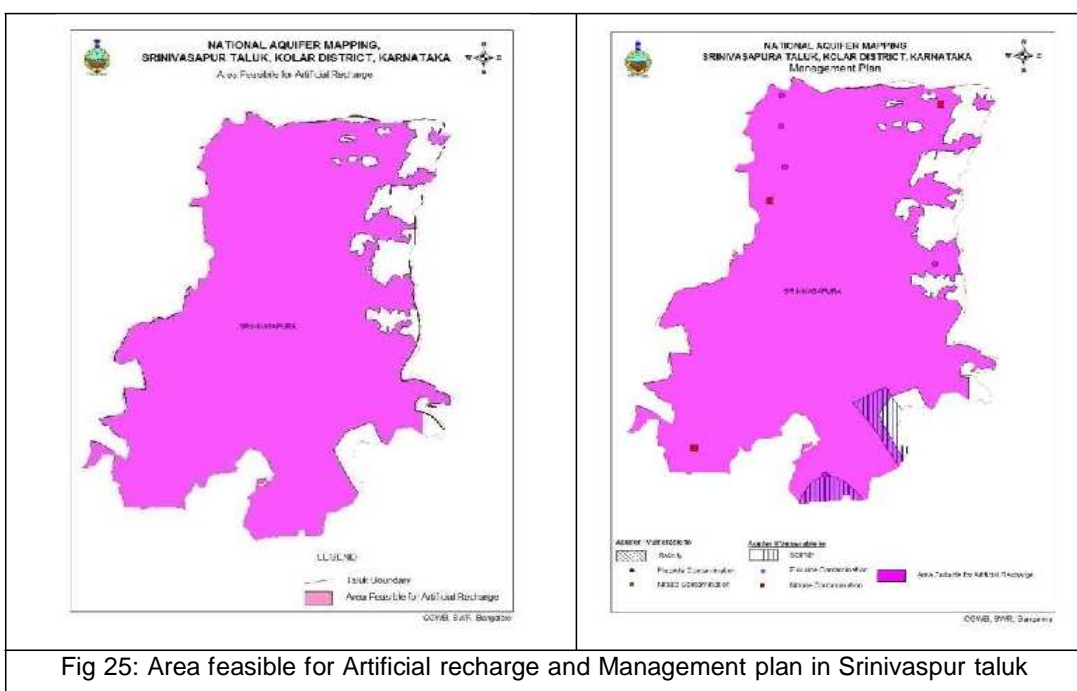


Fig 25: Area feasible for Artificial recharge and Management plan in Srinivasapur taluk

5. DEMAND SIDE INTERVENTIONS

5.1 Advanced irrigation practices

It is observed that bore well is the prevalent source for irrigation in the taluk. Thus, by adopting the below mentioned techniques will contribute in ground water resource enhancement in the long run.

Efficient irrigation practices like Drip irrigation & sprinkler needs to be adopted by the farmers in the existing 3224 ha of gross irrigated area.

Efficient irrigation techniques will contribute in saving ground water and thus will reduce the irrigation draft.



5.2 Change in cropping pattern

Not necessary as due to water scarcity, water intensive crops are not grown in the taluk. Cereals, fruits, vegetables, pulses and oil seeds constitute major crops of the taluk.

Alternate water sources

Inter-basin transfer from west-flowing river Yettinahole project is considered for Srinivaspur taluk also. Under Yettinahole Project it is proposed to fill 35 Minor Irrigation tanks with 0.210 TMC of water.

Transporting tertiary treated water from Bangalore city and filling MI tanks, is also considered as an alternate water source.

5.3 Regulation and Control

Srinivaspur taluk has been categorized as **OVER EXPLOITED**, since the Stage of ground water development has reached **176%** (GE March 2011).

Ground water recharge component needs to be made mandatory in State Govt. Project related to further development of ground water, viz; Irrigation Projects or Public Water Supply Projects.

5.4 Other interventions proposed

Recharge already dry **phreatic aquifer (Aq-I)** in the taluk, through construction of artificial recharge structures, viz; sub-surface dams, check dams, step bunds & percolation tanks. The choice of recharge structures should be site specific and such structures need to be constructed in areas already identified as feasible for artificial recharge.

Periodical maintenance of artificial recharge structures should also be incorporated in the Recharge Plan.

Excess nitrate & fluoride concentration is found in ground water samples from Aq-II, as shown in the Figures given above & requires remedial measures viz.

- Dilution of nitrate rich ground water through artificial recharge & water conservation.
- Roof top rain water harvesting.
- Micro irrigation.

