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विभाग, जल शक्ति मंत्रालय

भारत सरकार

Central Ground Water Board

Department of Water Resources, River
Development and Ganga Rejuvenation,
Ministry of Jal Shakti
Government of India

AQUIFER MAPPING AND MANAGEMENT OF GROUND WATER RESOURCES

MANVI TALUK,

RAICHUR DISTRICT, KARNATAKA

दक्षिण पश्चिमी क्षेत्र, बैंगलोर

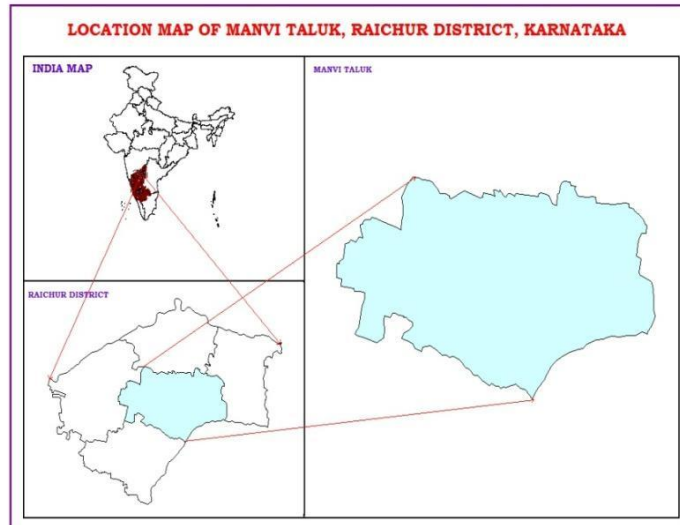
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**GOVERNMENT OF INDIA
MINISTRY OF JAL SHAKTI
DEPT. OF WATER RESOURCES, RD & GR
CENTRAL GROUND WATER BOARD**

AQUIFER MANAGEMENT PLAN OF MANVI TALUK, RAICHUR DISTRICT, KARNATAKA STATE



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MARCH 2020



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AQUIFER MANAGEMENT PLAN OF MANVI TALUK, RAICHUR DISTRICT, KARNATAKA STATE

1. SALIENT INFORMATION

Name of the taluk	:Manvi
District	:Raichur
State	:Karnataka
Area	:1793 sq.km.
Population	:3,70,670
Annual Normal Rainfall	:665mm

1.1 Aquifer management study area

Aquifer mapping studies were carried out in **Manvi** taluk, Raichur district covering an area of 1793 sq.kms under National Aquifer Mapping Project. Manvi taluk of Raichur district is located between north latitude $15^{\circ}50'58.0''$ and $16^{\circ}13'29.0''$ & east longitude $76^{\circ}38'31.0''$ and $77^{\circ}16'40.0''$, and is covered in parts of Survey of India Toposheet Nos.57D/12, 57D/16, 57A/9, 57A/13, 57E/1, 57E/5, 57H/4 and 57H/8. Manvi taluk is bounded by Deodurg taluk on north, Andhra Pradesh State on south, Raichur taluk on east and Sindhanur taluk on western side. Location map of Manvi taluk of Raichur district is presented in **Fig-1**.

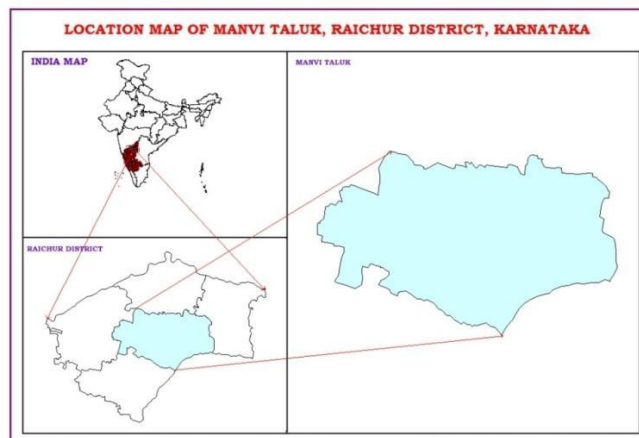


Fig 1.:Location Map of Manvi taluk, Raichur district

Manvi taluk has a population of about 3.70 lakh. Taluk administration of Manvi taluk is divided into 9 Hoblies and 36 gram panchayaths. Manvi is the largest town in taluk, which is

also the taluk headquarters. There are 165 inhabited and 6 uninhabited villages in the taluk. The entire taluk lies in the valley of the Tungabhadra river, with the Tungabhadra river flowing south of the taluk.

1.2 Population

According to 2011 census, the population in Manvi taluk is 3,70,670 of which rural population is 3,24,205 constituting about 87.46%, and the urban population is 46,465, constituting about 12.54% of the total population, basically due to Manvi town. The taluk has an overall population density of 205 persons per sq.km and showed a decadal increase of about 12.08% during 2001-2011.

1.3 Rainfall

Manvi taluk enjoys semi-arid climate. Dryness and hot weather prevails in major part of the year. The area falls under Northern 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 Manvi taluk (**Table 1**). The data in respect of this station from the year 1981 to 2010 is analysed and presented in **Table 2**. The data pertaining to this gauge is of long term nature and are well maintained. It is presumed that it is representative of the taluk and the same is used for analysis. Normal annual rainfall in Manvi taluk for the period 1981 to 2010 is 665 mm.

Table 1: Raingauge and its location in Manvi taluk

Station	Latitude	Longitude	Altitude
Manvi	15.97	77.07	611.5

Statistical analysis

Computations were carried out for the 30 year blocks of 1981- 2010 on Mean, Standard deviation and coefficient of variation of each month premonsoon, monsoon, post monsoon and annual and are shown in **Table 2**.

The mean monthly rainfall at Manvi taluk is ranging between 3 mm during January to 149mm during September. The CV percent for pre monsoon, monsoon and post monsoon season is 86, 39 & 60 percent respectively. Annual CV at this station works out to be 26 percent.

Table 2: Statistical Analysis of Rainfall Data of Manvi Taluk, Raichur District 1981 to 2010

STATION		JAN	FEB	MAR	APR	MAY	PRE MONSOON	JUN	JUL	AUG	SEP	SW MONSOON	OCT	NOV	DEC	NE MONSOON	ANNUAL RAINFALL
RAICHUR TALUK	Normal Rainfall (mm)	5	1	16	17	33	72	108	93	117	135	453	112	23	4	139	665
	STDEV	10	3	42	26	36	62	86	54	80	90	175	77	35	10	83	173
	CV%	228	292	261	152	108	86	80	58	68	67	39	69	150	248	60	26

Assessment of Drought

Rainfall data analysed for 45years using IMD method to assess the drought condition in Manvi taluk. The results of the classification are listed in the **Table.3**. It is observed that the the taluk has experienced alternating no drought to severe drought conditions over the years.

% Deviation (Di)		>0	0 to -25	-25 to -50	50 to 75	<-75	Probability of drought occurrences
Category		No drought	Mild (Normal)	Moderate	Severe	Acute	
		Years					
Taluk	Manvi	10	25	10	0	0	Once in 5 years

The details of the drought assessment are discussed as herein under. Out of 45 years of analysis in Manvi taluk, “No Drought” condition was experienced in 10 years, “Mild Drought” condition was experienced in 25 years and “Moderate Drought” condition experienced in 10 years. 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 5 years** in Manvi taluk.

1.4 Agriculture and Irrigation

Agriculture is the main occupation in Manvi taluk. Paddy is the major crop and is grown in 33% of the total crop area followed by Jowar, Cotton, Tur and oilseeds covering about 17%, 16%, 4% and 4% of the total crop area respectively. Bajra, Vegetables and Fruits are some other crops grown in the taluk. (**Table 4**) Sugarcane is not grown in the taluk now. Irrigation details are given in **Tale 5**.

Table 4: Cropping pattern in Manvi taluk 2014-2015 (Ha)

Year	Paddy	Jowar	Bajra	Pulses	Fruits	Vegetables	Oilseeds	Sugarcane	Cotton
Area under cultivation (in ha)									
2014-2015	37730	19290	4349	28195	841	749	4780	00	17962

It is observed that net sown area accounts for about 62% of total geographical area, while area sown more than once is 4% of total geographical area in the taluk. 52493 hectares is the gross irrigated area in the taluk. 90% of the gross irrigated area is irrigated through canals from Tungabhadra dam and the balance 10% gross irrigated area is catered through bore wells (Table 5.) and Fig.2.

Table 5: Details of land use in Manvi taluk 2014-2015 (Ha)

Taluk	Total Geographical Area	Area under Forest	Area not available for cultivation	Fallow land	Net sown area	Area sown more than once
Manvi	1,79,273	2313	612	54904	1,11,760	7988

Source: District at a glance 2014-15, Govt. of Karnataka

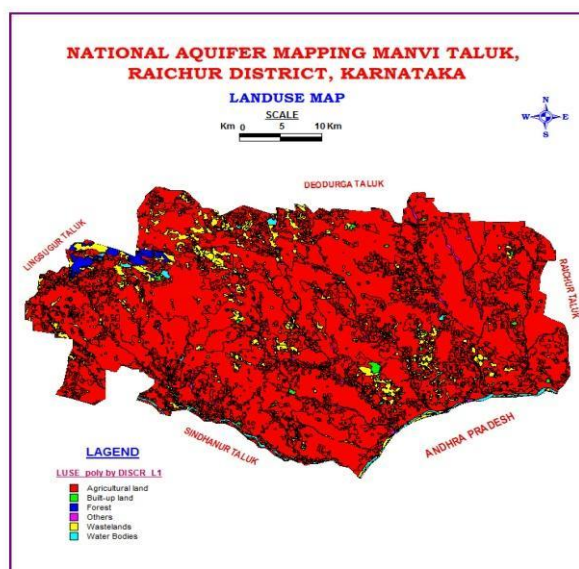


Fig. 2 : Land use Map

Table 6: Irrigation details in Manvi taluk (Ha)

Source of Irrigation	Net area irrigated (Ha)	% of area
Canals	37981	88.0
Tanks	96	0.2
Wells	84	0.2
Borewells	4494	10.4
Lift Irrigation	380	0.9
Other Sources	0	0
Total	43035	

Source: District at a Glance 2014-15, Government of Karnataka

1.5 Geomorphology, Physiography and Drainage

The geomorphology of the taluk is characterized by vast stretches of undulated plains interspersed with sporadic ranges or isolated clusters of low ranges of rocky hills dotting the south central and southern parts (**Fig-3**). The entire taluk lies in the Krishna basin with the Tungabhadra River flowing in the south. The important river of the taluk is Tungabhadra, which is a tributary of Krishna River. Drainage pattern in the taluk is dendritic to sub-dendritic (**Fig. 4**).

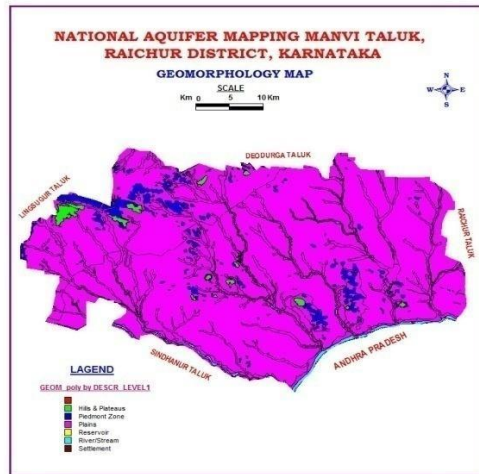


Fig. 3: Geomorphology Map

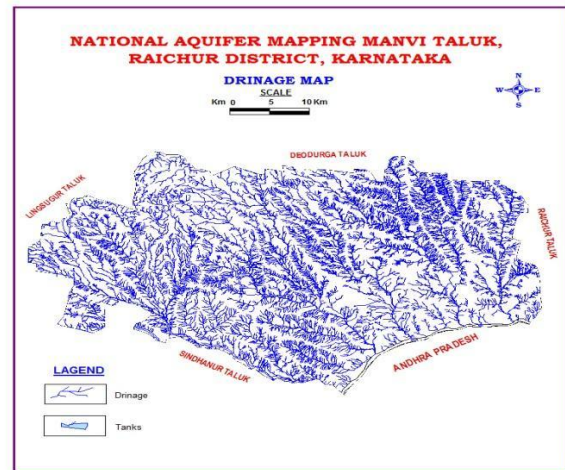


Fig. 4: Drainage Map

1.6 Soil

The taluk is having predominantly fertile black soil with varying clayey and sandy mixtures. Loamy soil cover is also seen in some parts of the taluk (**Fig .5**).

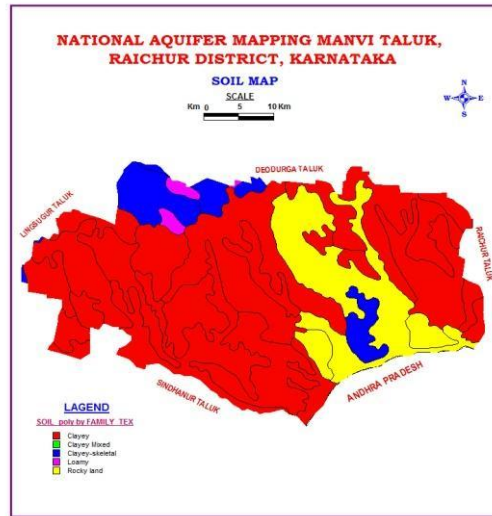


Fig. 5: Soil map

1.7 Ground water resource availability and extraction

Aquifer wise total ground water resources up to 200m depth is given in **Table 7**.

Table 7: Total GW Resources 2017 (Ham)

Taluk	Annual Replenishable GW resources	Fresh In-storage GW resources		Total availability of fresh GW resources
		Phreatic	Fractured (downto200m)	Dynamic+ Phreatic in-storage+ fractured
Manvi	26992	13668	4644	45304

1.8 Existing and future water demands (as per GEC-2017)

Net ground water availability for future irrigation development : 172.95MCM

Domestic and Industrial sector demand for next 25 years : 11.39MCM

1.9 Water level behaviour

(a)Depth to water level Aquifer-I **

Pre-monsoon:3.13-18.10 mbgl (**Fig. 6**)

Post-monsoon:3.24 -18.10 mbgl (**Fig. 7**)

**This aquifer-I is totally de-saturated due to over-exploitation and has become totally dry. However, isolated patches in topographical lows are seen yielding for very short durations.

(b)Depth to water level Aquifer-II

Pre-monsoon:3.60- 27.60 mbgl (**Fig. 8**)

Post-monsoon:4.30- 39.80 mbgl (**Fig. 9**)

Water level fluctuation Aquifer-II

Seasonal Fluctuation: (**Fig.10**) Fall ranges between 0.70 -12.20 m

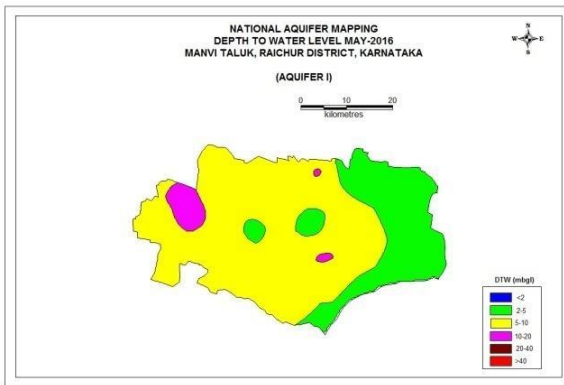


Fig.6: Pre-monsoon Depth to WL (Aquifer I)

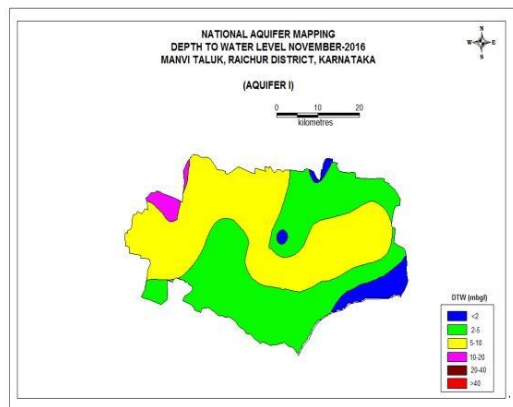


Fig.7: Post-monsoon Depth to WL(Aquifer I)

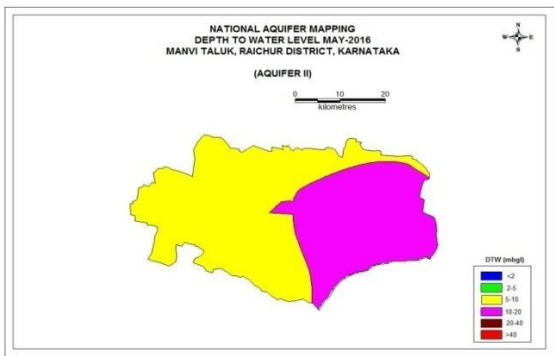


Fig. 8: Pre-monsoon Depth to WL (Aquifer II)

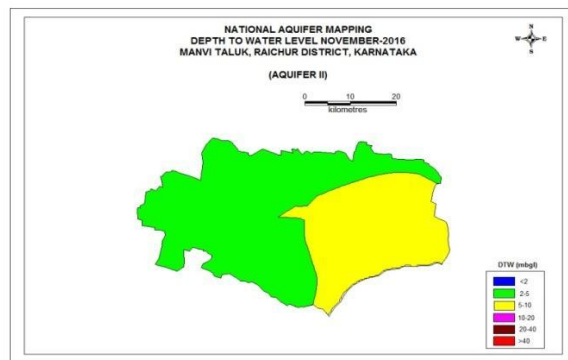


Fig. 9: Post-monsoon Depth to WL(Aquifer II)

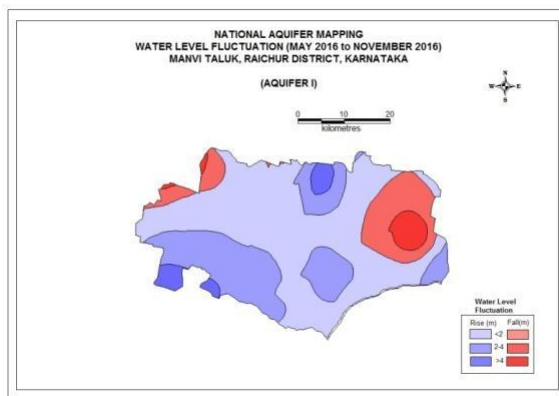


Fig.10: Water level fluctuation (Aq II)

2. AQUIFER DISPOSITION

2.1 Number of aquifers: In Manvi taluk, there are mainly two types of aquifer Systems;

- i. Aquifer-I (Phreatic aquifer)** comprising Weathered Granite Gneiss and schist
- ii. Aquifer-II (Fractured aquifer)** comprising Fractured Granitic-gneiss, Gneiss and Schist

In Manvi taluk, fractured granitic-gneiss, and hornblende-schist are the main water bearing formations (**Fig-11**). Ground water occurs within the jointed and fractured granitic-gneisses under semi-confined to confined conditions. In Manvi taluk, generally the bore wells drilled upto a maximum depth of of 200mbgl.

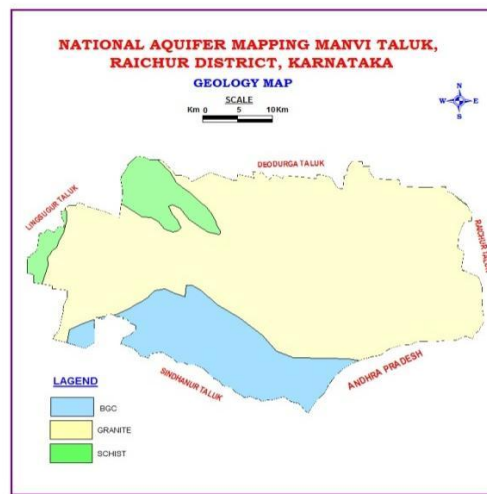


Fig.11: Geology Map

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

a. Aquifer wise resource availability and extraction

(a) Present Dynamic Ground Water Resource (2017)

Taluk	Net Annual Ground Water Availability (Ham)	Existing Gross Ground Water Draft for Irrigation(Ham)	Existing Gross Ground Water Draft For Domestic and Industrial Water Supply (Ham)	Existing Gross Ground Water Draft for all Uses (Ham)	Allocation For Domestic and industrial Use for Next 25 Years (Ham)	Net Ground Water Availability for Future Irrigation Development (Ham)	Existing Stage Of Ground Water Development (%)	Category
Manvi	26992	8557	582	9139	1139	17295	34	SAFE

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

Taluk	Annual Replenishable GW Resources	Fresh In-storage GW Resources		Total availability of GW Resource
		Phreatic	Fractured	Dynamic+ Phreatic in-storage+ Fractured in-
Manvi	26992	13668	4644	45304

(c) Comparison of Ground Water Availability and Draft Scenario in Manvi taluk

Taluk	GW Availability (Ham)	GW Draft (Ham)	Stage of GW Development %	GW Availability (Ham)	GW Draft (Ham)	Stage of GW Development %	GW Availability (Ham)	GW Draft (Ham)	Stage of GW Development %
	2011			2013			2017		
Manvi	34579	6229	18%	34832	6601	19	26992	8557	34

b. Chemical Quality of Ground Water and Contamination

In general, ground water quality in Manvi taluk is good for drinking purpose as per "Indian Standard Drinking Water Specification 2009". However, some parts in the north and north east of the taluk are affected by chloride contamination in groundwater which is > 3000 mg/l. Many parts of the taluk are affected by nitrate contamination of groundwater which is due to application of fertilizers to crops during cultivation. Distribution of Fluoride, EC and Nitrate are shown in **Fig. 12,13 & 14**.

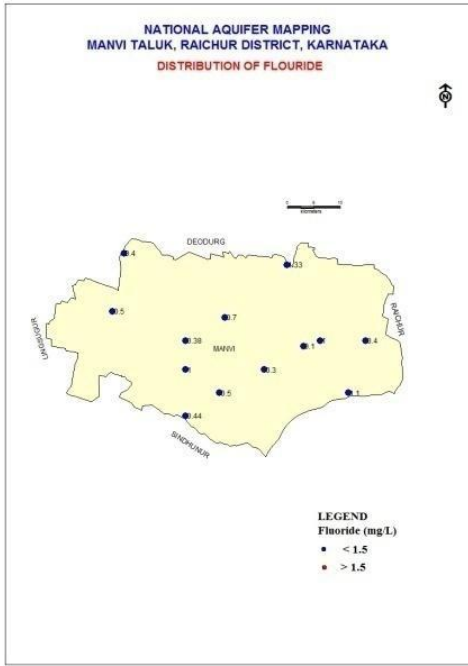


Fig.12: Distribution of Fluoride

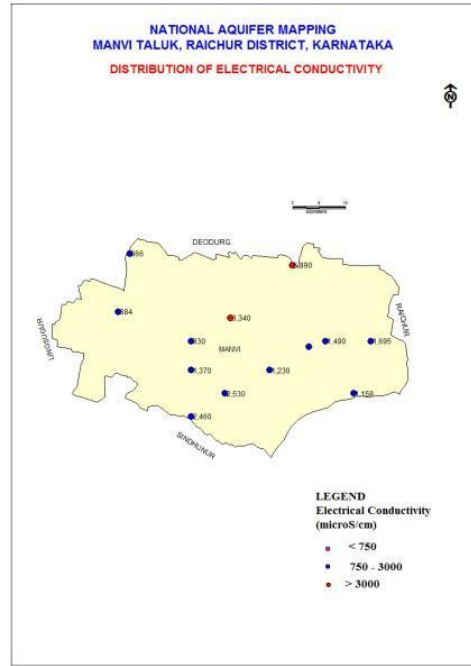


Fig 13: Distribution of Electrical Conductivity

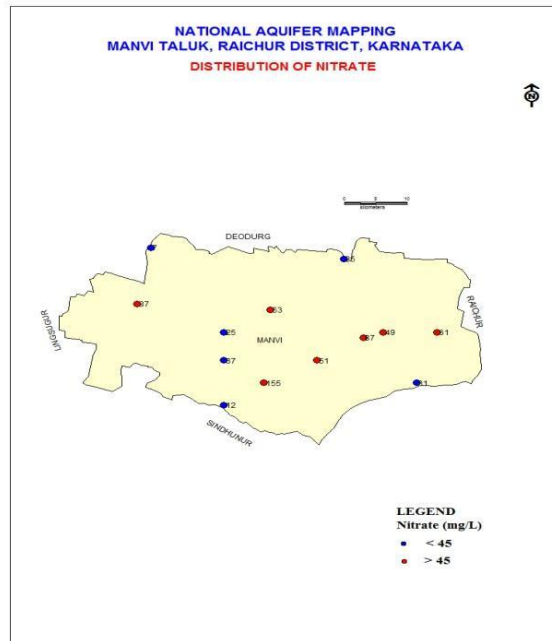


Fig.14 : Distribution of Nitrate

4. GROUND WATER RESOURCE ENHANCEMENT

4.1 Aquifer wise space available for recharge and proposed interventions

Recharge dry phreatic aquifer (Aq-I) in the taluk (in non command areas), through construction of artificial recharge structures, viz. Check dams, percolation tanks & point recharge structures (**Table 8**).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.

Table 8: Quantity of non-committed surface runoff and expected recharge through AR structures

Artificial Recharge Structures Proposed	Manvi taluk
Non committed monsoon runoff available(Ham)	11312
Number of Check Dams	558
Number of Percolation Tanks	102
Number of Point Recharge structures	25
Tentative total cost of the project(Rs in lakhs)	7619
Excepted recharge(MCM)	84.843

4.2 Improvement in GW availability due to Recharge, Manvi taluk

Taluk	Net annual ground water availability	Existing gross ground water draft for all uses	Existing stage of groundwater development	Expected recharge from proposed artificial recharge structures	Additional potential from proposed irrigation development schemes through inter-basin transfer	Cumulative annual groundwater availability	Expected i improvement in stage of groundwater development after the implementation of the project	Expected improvement in overall stage of groundwater
	HAM	HAM	%	HAM	HAM	HAM	%	%
Manvi	26992	9139	34	8484	-	35476	9	25

After implementation of Artificial Recharge structures for GW recharge, the annual groundwater availability will increase from 26992 to 35476 ham and the expected improvement in stage of development is 9 % i.e., from 34% to 25%.

5. DEMAND SIDE INTERVENTIONS

5.1 Advanced irrigation practices

It is observed that presently canal water is being used for irrigation of paddy in 90% of the irrigated area. Bore wells are used for irrigation only in non command areas. It is recommended that conjunctive use of both surface and ground water should be practised in command areas in order to avoid the ill effects of salinity and water logging conditions.

5.2 Change in cropping pattern

In Manvi taluk, water intensive crop Paddy is being grown in major part of the canal command area. It may not be of any consequence to apply any modifications in cropping pattern. Hence, change in cropping pattern is not suggested.

5.3 Regulation and Control

Conjunctive use of both surface and ground water should be made mandatory since the major parts of the taluk are irrigated through canal water.

5.4 Other interventions proposed:

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

5.5 Summary

The summary of Management plan of Manvi taluk is given in **Table 9**.

Table 9 : Summary of Management plan of Manvi taluk

Manvi taluk is Safe and present stage of GW Development (2017)	34%
Net Annual Ground Water Availability(MCM)	26.99
Existing Gross Ground Water Draft for all uses(MCM)	91.39
Total GW Resources(Dynamic&Staticuptothedepthof200mbgl) (MCM)	453.04
Expected additional recharge from monsoon surplus runoff(MCM)	84.84
Change in Stage of GW development, %	34 to 25

