केन्द्रीय भूमि जल बोर्ड

जल शक्ति मंत्रालय, जल संसाधन, नदी विकास और गंगा संरक्षण विभाग
भारत सरकार

Central Ground Water Board

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

Report on

AQUIFER MAPPING AND MANAGEMENT PLAN

Bangalore East Taluk

Bangalore Urban District, Karnataka

दक्षिण पश्चिमी क्षेत्र, बेंगलुरु
South Western Region, Bengaluru

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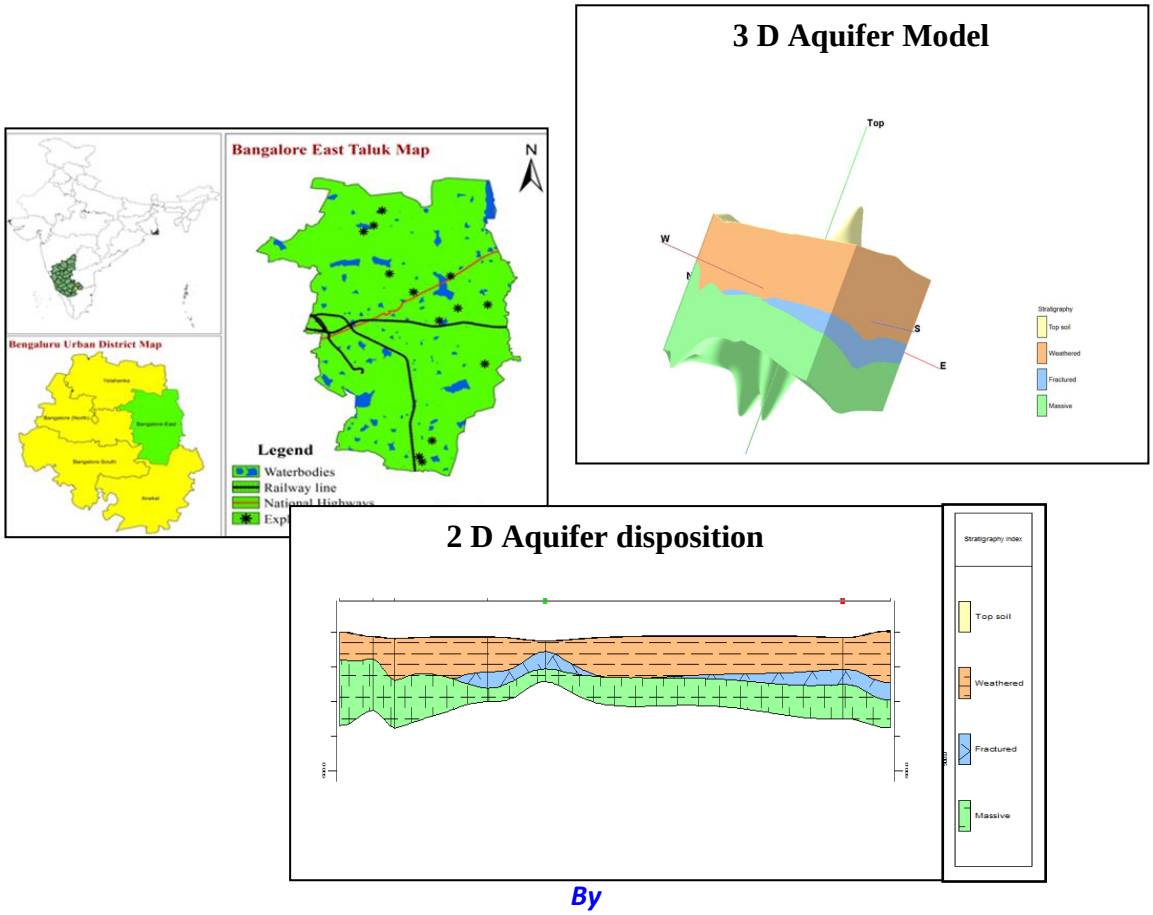
AQUIFER MAPS AND MANAGEMENT PLAN, BANGALORE EAST TALUK, BANGALORE URBAN DISTRICT, KARNATAKA STATE

(AAP – 2020-2021)



By

Saritha S., Scientist 'B', CGWB, SWR, Benagaluru

JULY 2022

AQUIFER MAPS AND MANAGEMENT PLAN, BANGALORE EAST TALUK, BANGALORE URBAN DISTRICT, KARNATAKA STATE

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AQUIFER MAPS AND MANAGEMENT PLAN, BANGALORE EAST TALUK, BANGALORE URBAN DISTRICT, KARNATAKA STATE

1 SALIENT INFORMATION

Name of the taluk: **Bangalore East**

District: **Bangalore Urban**

State: Karnataka

Area: 336 sq.km.

Population: 102607 (2011 census)

Annual Normal Rainfall: 1008 mm

1.1 Aquifer management study area

Aquifer mapping studies were carried out in Bangalore East taluk, Bangalore Urban district of Karnataka, covering an area of 336 sq.km under National Aquifer Mapping Project during AAP 2020-21. Bangalore East taluk of Bangalore Urban district is located between north latitude 12o52'31" & 13o06'54", and East longitudes 77o36'10" & 77o47'11"and is covered in parts of Survey of India Toposheet Nos.57H/13,57H/9 &57G/12& 57G/16.

The new taluk Bangalore East was created after 2001 Census, bifurcating Bangalore South taluk. Bangalore East taluk is bounded by the Bangalore South and North taluks in the west, Hoskote & Devanahalli taluks of Bangalore rural district in the east, Bangalore North taluk in northern side and Anekal taluk in south. Administratively Bangalore East taluk is divided 5Hoblies (Biderahalli, KR Puram, Mahadevapura, Marthahalli & Varthur) and 173 villages (source: Bangalore Urban district, Wikipedia).Location map of Bangalore East taluk of Bangalore Urban district is presented in Fig.1.

1.2 Population

According to 2011 census, the population in Bangalore East taluk is 102607 in which 53699 are males and 48908 are females. 94464 constitute the rural population and 8143 is the urban population. Literacy rate of the taluk is 79.36%.

1.3 Rainfall

The rainfall of the Bangalore East is accounted by the Pre-monsoon (PRE) months, SW monsoon (SWM) months and NE monsoon (NEM) months. Bulk of the rainfall is contributed by SW Monsoon i.e., during June to September. In general, humid to semi-arid climatic conditions prevail in the area. The average temperature is around 23.1˚C. The seasonal and annual average rainfall of the taluk from the year 2001 to 2015 is considered for studying the rainfall pattern. The average annual rainfall is lowest for Bangalore East taluk (786 mm) **(Table 1)** with compared to other taluks in the district.

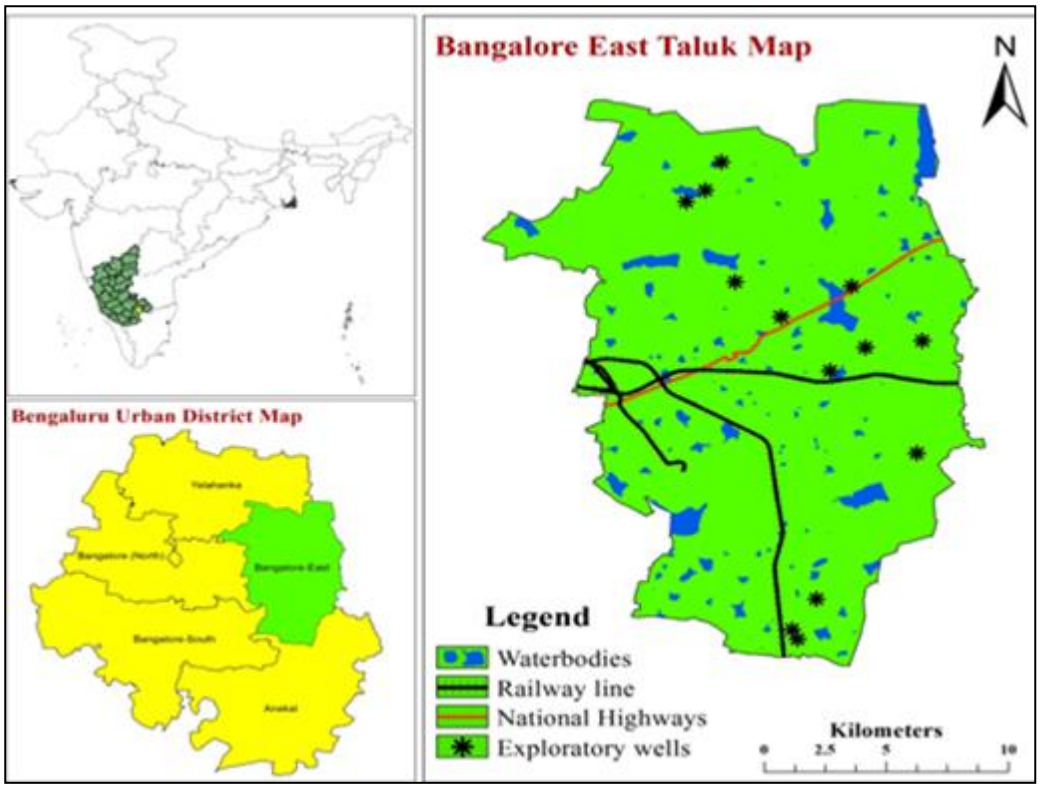


Fig.1: Location map of Bangalore East Taluk, Bangalore urban District

Table 1: Seasonal & Annual Average Rainfall of Bangalore East Taluk

2001-2015 Rainfall (mm)				
Station	**Pre-Monsoon**	**Monsoon**	**Post-Monsoon**	**Annual**
Bangalore East	**202**	**395**	**189**	**786**

During 2020, the taluk received 815 mm Normal rainfall and 1019 mm Actual rainfall **(Table 2).**

Table 2: Rainfall (mm) of Bangalore East Taluk during 2020

Pre-monsoon (Jan-May)			**SW (Jun-Sep)**			**NE(Oct-Dec)**			**Annual (Jan-Dec)**		
Normal	**Actual**	**% of Departur**	**Normal**	**Actual**	**% of Departur**	**Normal**	**Actual**	**% of Departur**	**Normal**	**Actual**	**% of Departur**
119	**220**	**85**	**479**	**544**	**14**	**217**	**254**	**18**	**815**	**1019**	**25**

1.4 Agriculture & Irrigation

As this taluka lies in the vicinity of developed urban area and the city of Bengaluru is fast expanding, agriculture activities is carried out to limited extent. 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 to October) and Rabi season (Mid October to Mid-February). Major Kharif crops are paddy and vegetables. Main crops of Rabi season are pulses

and oilseeds which together constitute 811 ha of cropped area. fruits and vegetables are the other crops grown (Table 3).

Table 3: Area wise crops grown in Bangalore East Taluk

Sl. No	Name of Crop	Area in Ha(2016-17)
1	Paddy	38
2	Jowar	0
3	Ragi	570
4	Maize	92
6	Pulses	155
7	Oilseeds	0
8	Total Fruits &Vegetables	750

Source: Bangalore Urban District at a glance 2016 - 17, Govt. of Karnataka

During the year 2016 – 17, percentage of gross cropped area of total geographical area was 6.5 % and net cropped area was 5.6% in the taluk (Table 4). Land use map of Bangalore East Taluk is shown in Fig.2.

Table 4: Land use pattern in Bangalore East Taluk

Area under Forest (ha)	Land not available for cultivation and other uncultivated land (ha)	Fallow land (ha)	Net sown area (ha)	Area sown more than once (ha)
350	4412	6895	1880	305

Source: Bangalore Urban District at a glance 2016 - 17, Govt. of Karnataka

Bangalore East taluk are marked by a series of tanks varying in size from small ponds to considerably large tanks. Irrigation in the taluk is only from the borewells. Gross irrigated area by borewells is 1032 ha and net irrigated area is 728 ha.(**Table 5**).

Table 5: Irrigation sources in Bangalore East Taluk

Sl. No.	Irrigation source	Gross Area (Ha)
1	Canal	0
2	Tanks	0
3	Dug wells	0
4	Bore Well	1032
5	Lift Irrigation	0
6	Other Sources	0
	Total	**1032**

Source: Bangalore Urban District at a glance 2016 - 17, Govt. of Karnataka

1.5 Geomorphology, Physiography & Drainage

Bangalore East taluk represents an uneven landscape with intermingling of hills and valleys. The highest and lowest area of Bangalore East taluk lies between 860 to 928 m above mean sea level **(Fig.3).** The Bangalore East taluk comes under south Pinakini river basin. Drainage map of the study area is presented in **Fig.4**.

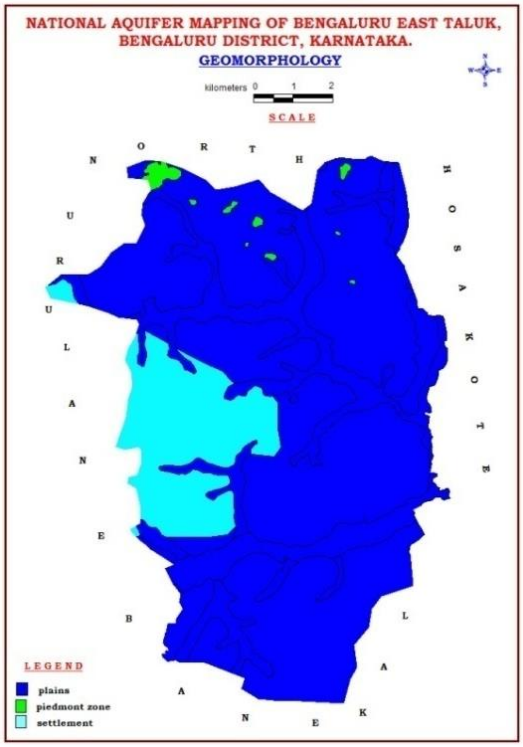


Fig.2: Geomorphology map

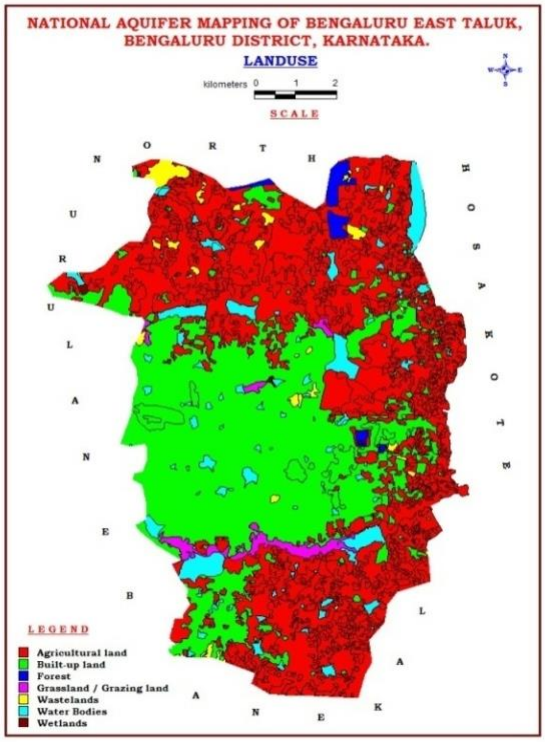


Fig.3: Land use map

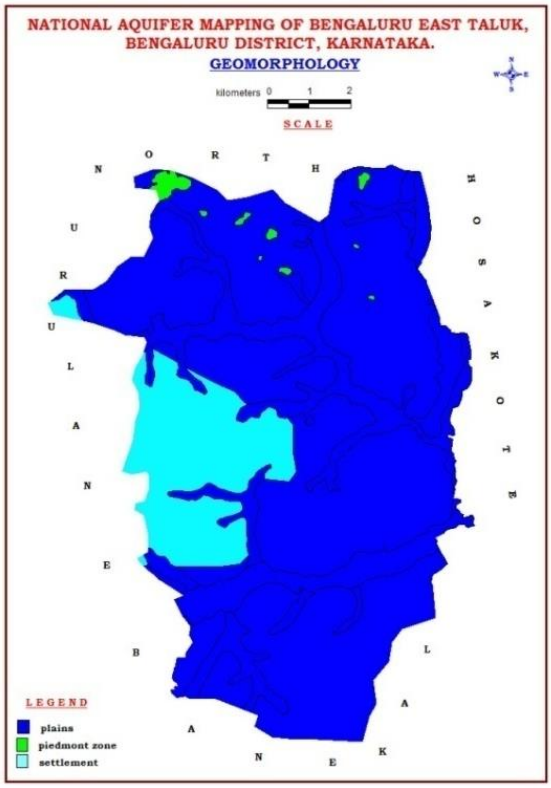


Fig 3: Geomorphology Map

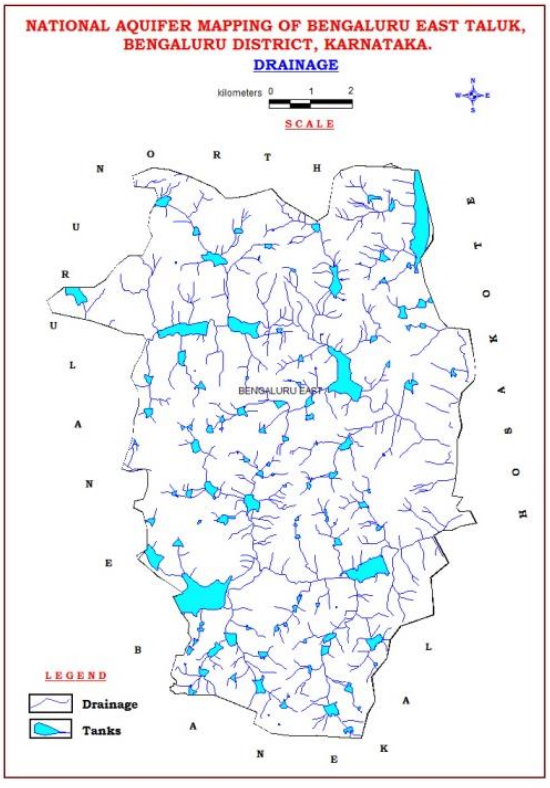


Fig 4: Drainage Map

1.6 Soil

The soils of the Bangalore East taluk are mostly clayey in nature. The soils can be broadly grouped into red clayey soil and clayey skeletal soil. Red loamy and sandy soils generally occur on hilly to undulating land slope on granite and gneissic terrain.

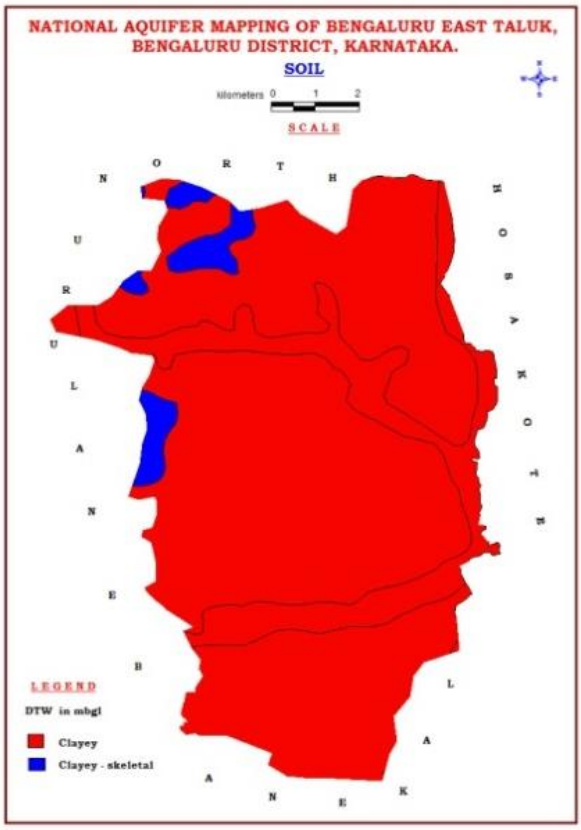


Fig 5: Soil Map

1.7 Groundwater resource availability and extraction

Aquifer wise total ground water resources up to 200 m depth are given in **Table-5** below.

Table 5: Total GW Resources (2017) (Ham)

Taluk	Annual Extractable GW resources	Fresh In-storage GW resources		Total availability of fresh GW resources
		Phreatic	Fractured (Down to 200m)	Dynamic +phreatic in-storage
Bangalore East	2433	8441	1229	9670

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

- Net groundwater availability for future irrigation development: 0
- Domestic (Industrial sector) demand for next 25 years:334 HAM

1.9 Hydrogeology

Aquifer I - The weathered thickness ranges from 2 m to 52 m. The pre-monsoon depth to water level ranges from 2 to 5 mbgl (GWD wells). CGWB is not having NHS dug wells in this taluk. Aquifers not sustainable for longer duration pumping and becomes desaturated.

Aquifer II- The major formations are fractured Granites and Gneisses. The pre-monsoon piezometric head ranges from 15 to 45 mbgl. The yield of the fractured aquifer ranges from 0.5 to 1.2 m^3/hr and sustainability is less than 1 hour. The Hydrogeology map of the Bangalore East taluk is shown in **Fig.6.**

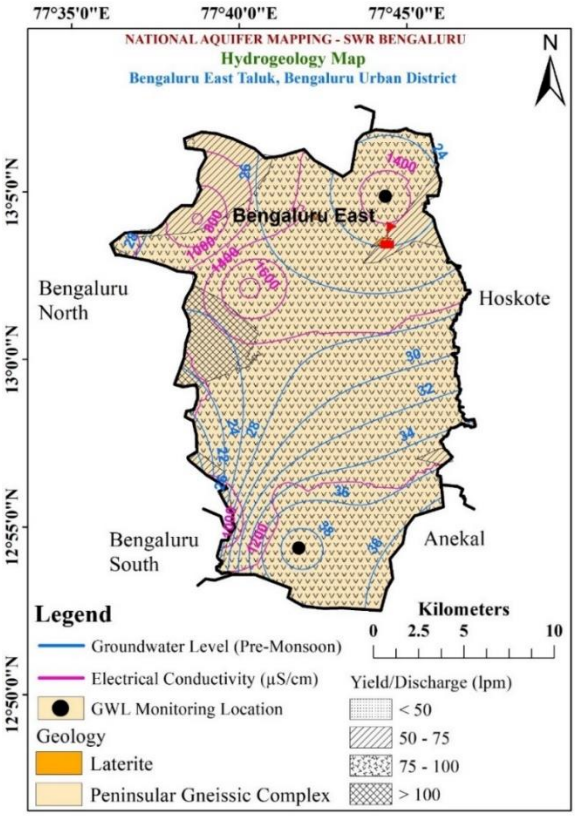


Fig 6: Hydrogeology map

1.9.1 Water level behavior

(a) Depth to water level 2018 - Aquifer – I (Phreatic)

- Pre-monsoon: 2.05- 4.9 mbgl **(Fig.7)**
- Post-monsoon: 1.80 - 9.80 mbgl **(Fig.8)**

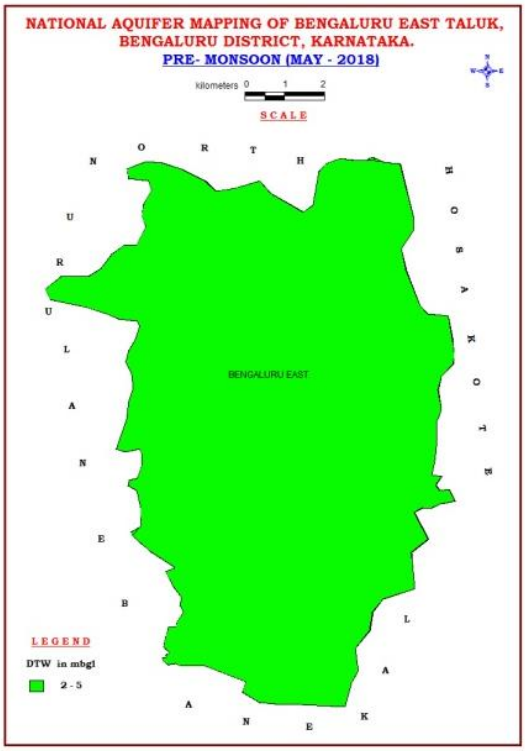


Fig. 7: Pre-monsoon DTW (May 2018)

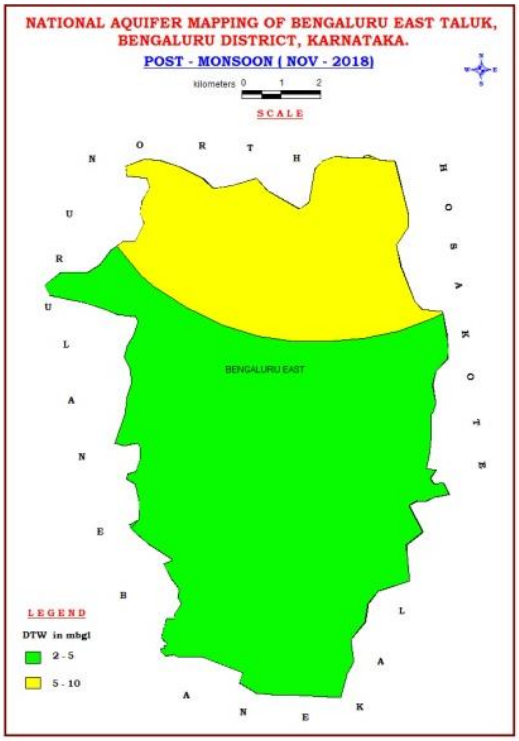
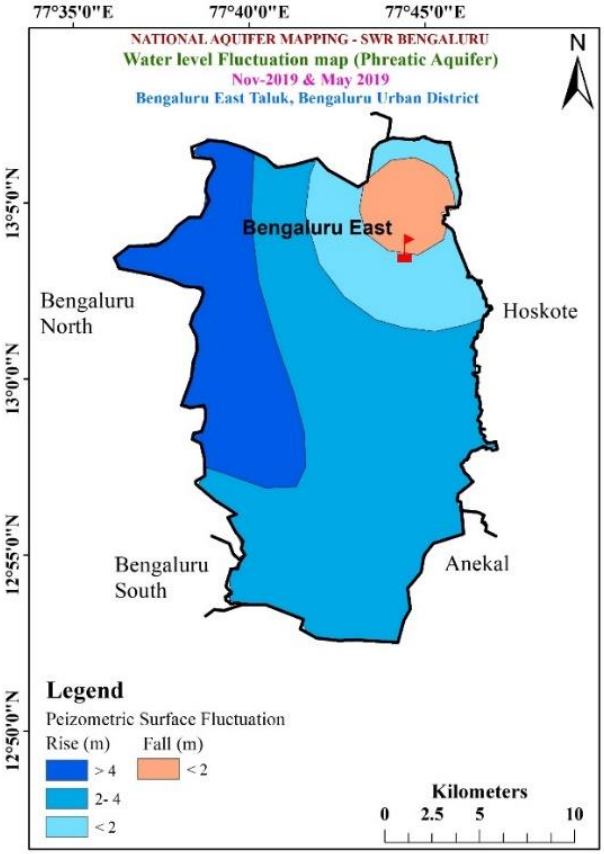


Fig. 8: Post-monsoon DTW (Nov 2018)

Seasonal water level fluctuation map of phreatic aquifer during May & November 2019 is shown in **Fig. 9.** The Decadal Fluctuation Map of Phreatic aquifer (Aquifer-1) from 2010 to 2019 is shown in **Fig. 10.**



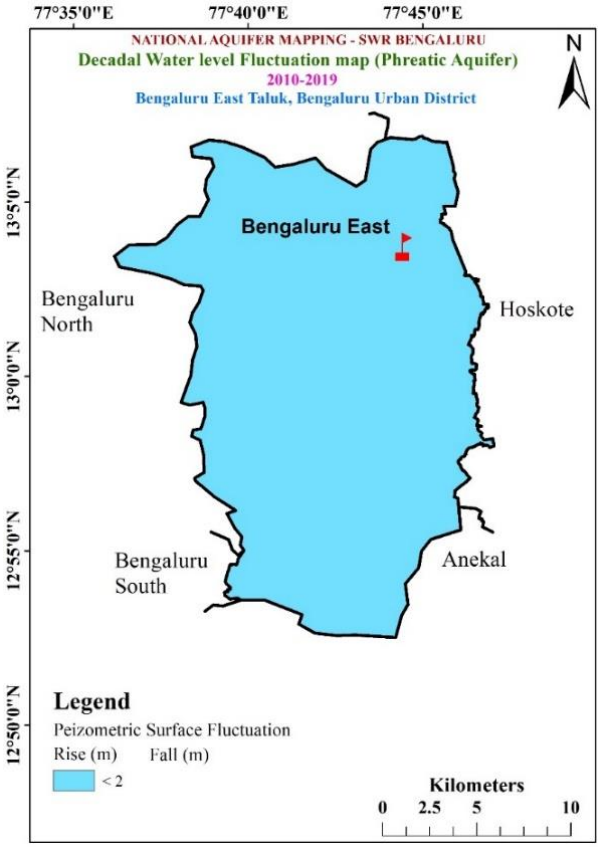


Fig. 9: Seasonal Water level fluctuation (Nov 2019- May 2019) Fig. 10: Decadal water level fluctuation map

2 AQUIFER DISPOSITION

2.1 Number of aquifers:

In Bangalore East taluk, there are two types of aquifer systems

i. Aquifer-I (Phreatic aquifer) comprising weathered granite and banded gneissic complex

ii. Aquifer-II (Fractured aquifer) comprising Fractured Granite and banded gneissic complex

Geologically, Bangalore East taluk is predominantly underlain by granites and gneisses of Archaean age popularly designated as hard rocks. These gneisses are often found to be intruded by basic dykes. The dominant strike direction is northwest – southeast with a subsidiary east-north-east strike. These hard rocks are fractured and fissured, and have undergone extensive and chemical decomposition in the plains and valleys. The resulting weathered mantle ranges in thickness generally from 10 to 50 meters.

In Bangalore East taluk, fractured Granite and Gneiss are the major water bearing formations **(Fig.11)**. Ground water occurs within the jointed and fractured Granite and Gneiss under semi-confined to confined conditions. 4 Exploratory bore wells were drilled in this taluk during 2021 from a minimum depth of 93 mbgl to a maximum of 200mbgl.Depth of weathered zone (Aquifer-I) ranges from 10mbgl to 58mbgl **(Fig.12)**.Ground water exploration reveals that

aquifer-II fractured formation was encountered between the depth of 26 to 170m bgl. Yield is very low and ranges from 0.4 to 1.18lps. The details of the Exploratory wells drilled by CGWB are given in **Table 6** and details of Exploratory wells drilled by State Rural drinking water supply dept, Karnataka is given in Annexure-I.

The 3D Aquifer disposition models, 2D aquifer sections and 3D aquifer fence diagrams have been prepared and presented in **Fig. 13.**

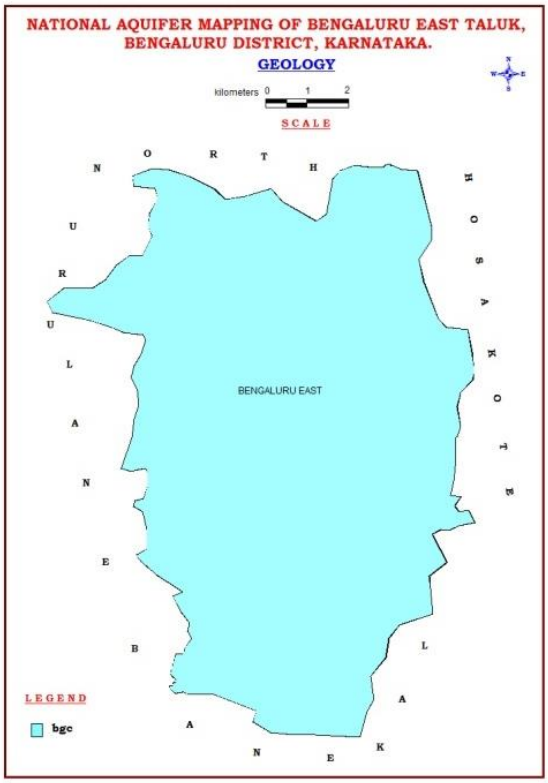


Fig.11: Geology Map

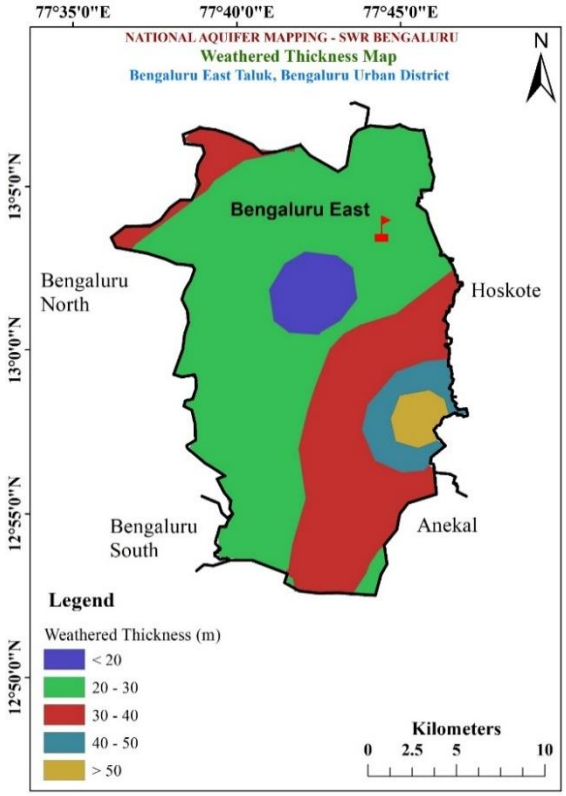
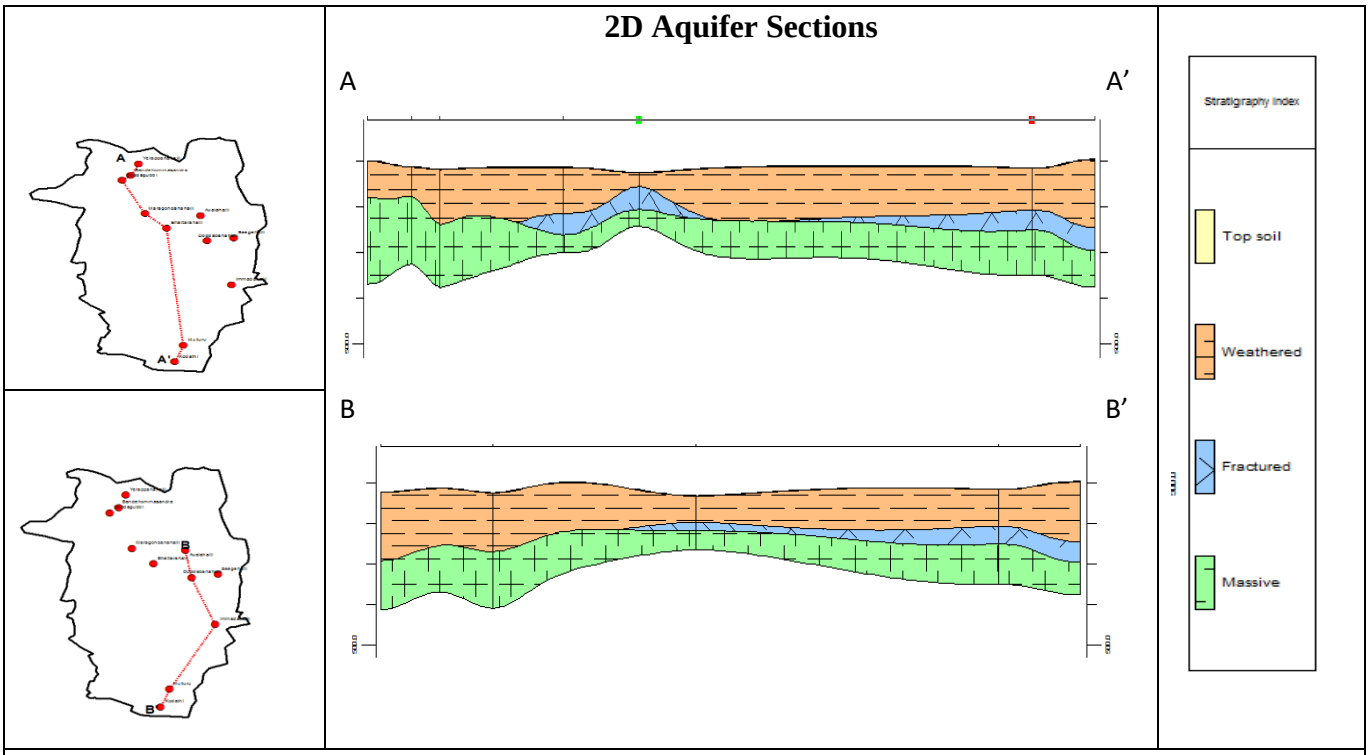


Fig 12: Weathered Thickness Map

Table 6: Details of Ground water Exploration in Bangalore East Taluk

S. No.	Location	Latitude	Longitude	Depth Drilled (m bgl)	Casing Depth (m bgl)	Fracture Zones (mbgl)	SWL (mbgl)	Q (lps)
1.	Immadahalli EW	12.9645	77.7591	200	58	65.68-66.68, 112.52-114.52	60	0.5
2.	Bhattarahalli EW	13.0227	77.7096	200.2	10.50	26.48 to 28.48, 81.96 -83.96 145.08-146.72	8.50	0.5
3	Kalkere EW	13.0136	77.6578	93.24	21	32.34-34.12, 61.04-62.68, 83.96-85.6	10.82	1.18

6	Kodathi EW	12.8891	77.7134	200.2	32	24.22-25.22, 62.68-63.68	18.65	0.75
7	Sadaramangala	12.9994	77.7275	200.2	33.10	51.4-53.4, 102.88-104.88, 146.72-148.72, 168-169.64	7.52	0.4



3 D Fence diagrams

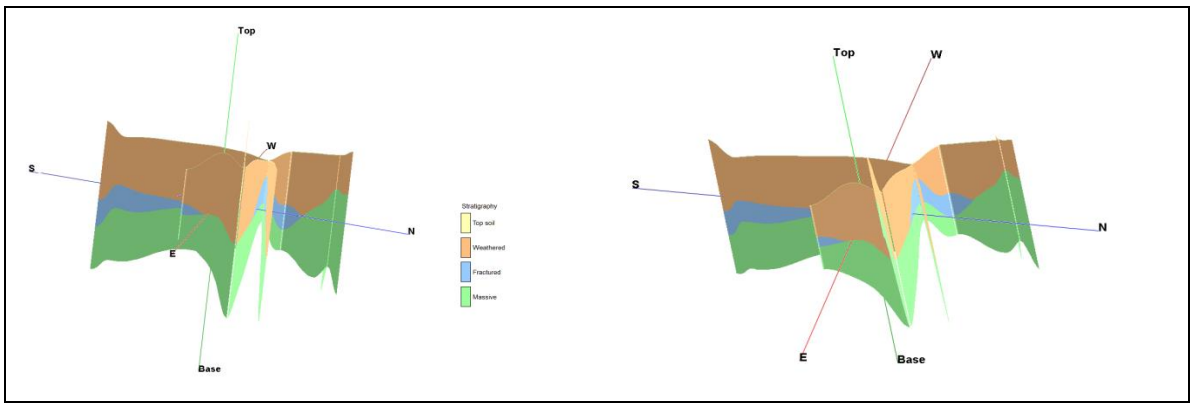


Fig.13: 3D Aquifer dispositions and cross sections

3 GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION AND OTHER ISSUES

The main ground water issues are urbanisation, less recharge worthy areas, over exploitation, limited Ground Water Potential / Limited Aquifer Thickness / Sustainability, declining water level trend which are all inter-related or inter dependent and Inferior ground water quality due to nitrate contamination in major part of the area.

3.1 Aquifer wise groundwater resource availability and extraction

The Dynamic Ground Water Resource 2017 and 2020 had been summarised above and are shown in Table 7. The comparison of the resource as on 2013, 2017 and 2020 are summarised below in Table – 8. It is observed that the ground water availability, extraction/draft and stage of development is increasingly continuously since 2013.

Table 7: Present Dynamic Ground Water Resource (ham) in Bangalore East taluk

Assessment year	Net annual ground water Availability	Existing gross ground Water draft for irrigation	Existing gross ground Water draft for domestic And industrial water supply	Existing gross ground Water draft for all uses	Allocation for domestic And industrial use for next 25 years	Net ground water Availability for future Irrigation development	Existing stage of ground Water development %	Category
As on March 2017	2433	3443	334	3776	334	0	155	Over Exploited
As on March 2020	2727	4005	388	4393	449	0	161	Over Exploited

Table 8: Comparison of groundwater availability and draft scenario (in ham)

2013			2017			2020		
GW availability	GW Extraction	Stage of GW development	GW availability	GW Extraction	Stage of GW development	GW availability	GW Extraction	Stage of GW development
2333	3125	134%	2433	3776	155%	2727	4393	161%

3.2 Chemical quality of ground water and contamination

To evaluate the quality of ground water, two water samples have been collected during drilling at Sadaramangala EW and was analysed for major chemical constituents at chemical laboratory in CGWB, SWR, Bangalore. Suitability of ground water for domestic purposes was evaluated with the concentration ranges recommended by IS: 10400, BIS, 2012 and ICMR drinking water standards and presented in Table-9.

Table 9: Hydro chemical data of Sadaramangala Exploratory well

Sl. No	Constituents	Concentration Exploratory well		BIS		ICMR
		Zone I	Zone II	Desirable	Permissible	
1	pH	7.88	7.79	6.5-8.5	6.5-8.5	7-8.5
2	TH (as $CaCO_3$)	235	255	300	600	300
3	Calcium mg/l	30	16	75	200	75
4	Magnesium mg/l	39	52	30	100	50
5	Chloride mg/l	199	195	250	1000	200
6	Sulphate mg/l	102	130	200	400	200
7	Nitrate mg/l	12	13	45	100	20
8	Sodium mg/l	151	150	-	-	-
9	Potassium mg/l	3	3	-	-	-
10	Carbonate mg/l	0	0	-	-	-
11	Bicarbonate mg/l	281	262	-	-	-
12	EC μmhos/cm	1252	1280	-	--	-
13	Fluoride mg/l	0.59	0.63	1.0	1.5	1.0

Chemical analytical data of dugwells/borewells samples collected by Ground Water Directorate; Govt. of Karnataka during 2018-19 from Bangalore East Taluk is presented in Table 10. The perusal of the data indicates that the distribution of electrical conductivity in the taluk shows wide variations (172-820 μS/cm at 25˚ C). The BIS has recommended a drinking water standard for total dissolved solids a limit of 500mg/l (corresponding to about EC of 750 μS/cm at 25^0C) can be extended to a TDS of 2000mg/l (corresponding to about 3000 μS/cm at 25^0C) in case of absence of an alternate source. Water samples having TDS more than 2000mg/l are not suitable for drinking purpose**.**

One of the essential elements for maintaining normal development of healthy teeth and bones is Fluoride. Lower concentrations of fluoride usually below 0.6mg/l may contribute to dental caries. However, continuing consumption of higher concentrations, above 1.2mg/l may cause dental fluorosis and in extreme cases even skeletal fluorosis. Most of the fluoride found in groundwater is of geogenic origin. Distribution of fluoride in the taluk ranges from 0.13 mg/l to 0.44 mg/l. Thus, majority of samples in the taluk shows fluoride concentration below 1.5 mg/l rendering them suitable for drinking purpose**.**

Nitrate is a problem as a contaminant in drinking water (primarily from groundwater and wells) due to its harmful biological effects. High concentrations can cause methemoglobinemia, and have been cited as a risk factor in developing gastric and intestinal cancer. The distribution of nitrate in the taluk indicated that the values are in the range of 7 mg/l to 57 mg/l. Nitrate in drinking water should not exceed 45 mg/l as per BIS (ISO: 10500: 2012) standard**.**

Table 10: Hydro chemical data of dugwells/borewells wells in Bangalore East taluk

Village	Concentration in mg/L			Latitude	Longitude
	F mg/L	NO_3 mg/L	TH (as $CaCO_3$) mg/L		
Doddakannahalli	0.31	40	364	12.9042	77.7028
Devarabeesanahalli	0.44	42	172	12.9311	77.6856
Mahadevapura	0.43	**54**	576	12.9903	77.6961
K.Narayapura	0.13	07	180	13 5 54	77 3831
Avalahalli	0.24	**47**	820	13.0356	77.7372
Manduru	0.23	**57**	392	13.0811	77.7394

Source: GWD. Govt. of Karnataka

4 GROUND WATER RESOURCE ENHANCEMENT

4.1 Resource Enhancement by Supply Side Interventions

The overall stage of ground water development is 161% as per GEC 2020. Considering the ever increasing demand for groundwater resource and erratic annual rainfall pattern, it is proposed to construct artificial recharge (AR) structures to recharge phreatic aquifer and enhance the ground water resources. The area feasible for recharge in Bangalore East taluk is worked out as 108 sq.km. and the surface surplus non-committed runoff availability is 2.9 MCM, which is considered for planning of AR structures. For this, a total of 3 percolation tanks and 15 check dams are proposed. The volume of water expected to be conserved/recharged @75% efficiency is 2.18 MCM through these AR structures. The approximate cost estimate for construction of these AR structures is Rs. 210 Lakhs. However, the figures given are tentative and pre-field studies / DPR are recommended prior to implementation of these recharge structures.

The details pertaining to proposed recharge structures, cost estimates and likely Recharge benefits for Bangalore East taluk, Bangalore Urban district have been carried out and given in below Tables 11. The tentative locations of proposed AR structures and area feasible for recharge is shown in **Fig.-14**, whereas the location details of check dams and percolation tanks are presented in **Annexure-II and III** respectively.

Table 11: Quantity of non-committed surface runoff and expected recharge through AR structures proposed

Bangalore East Taluk	
Area Feasible for Artificial Recharge	108 sq km
Non committed monsoon runoff available (MCM)	2.9
Number of Check Dams	15
Number of Point Recharge Structures	0
Number of Percolation Tanks	3
Number of Sub Surface Dyke	0
Tentative total cost of the project (Rs.in lakhs)	210

4.2 Resource Savings by Demand Side Interventions

4.2.1 Water Use Efficiency by Micro Irrigation Practices

It is observed that 1234 bore wells are the source for 728 ha of net irrigation in the taluk constituting about 100% of the irrigated area. Adoption of water use efficiency (WUE) techniques will contribute in ground water resource enhancement in the long run by way of saving of water.

Efficient irrigation practices like drip irrigation & sprinkler needs to be adopted by the farmers in the existing 728 ha of net irrigated area by bore wells.

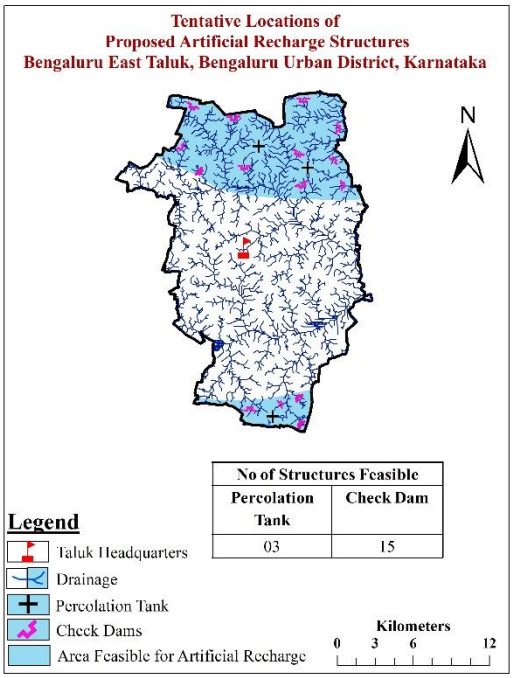


Fig.14: Area feasible for Artificial Recharge Structures

The water efficient methodology may be applied for growing food grains, fruits and vegetables which is largely ground water dependent. In long run the practice of efficient irrigation techniques will add to the ground water resource in large extent. (Table-13). Implementation of efficient irrigation techniques will contribute in saving ground water by 153 ham. Being an urban area, sewage water to the tune of 796 ham, which can be subjected to tertiary/secondary treatment and the treated water can be reused. However, almost entire treated water is being transferred to Kolar and Chikballapur talukas for ground water recharge, thus this quantum cannot be used for reuse in the taluk. (Table 12).

Table 12: Details of Resource Enhancement after proposed supply side and demand side interventions

Sl. No.	**Resource Details**	**As per 2020 Estimation**
1	Net Ground Water Availability in Ham	2726.97
2	Existing ground water draft for all uses in Ham	4393.98
3	Existing Stage of Ground Water Development in percentage %	161
4	Expected Recharge from Artificial Recharge sources Ham	218
5	Cumulative Ground water availability in Ham	2944.97
6	Expected improvement in stage of ground water development %	12
7	Saving due to adopting water Use Efficiency measures in Ham	153
8	Saving due to adopting grey water in Ham	Nil as treated water is transferred to other taluks for AR
9	Cumulative ground water availability after adopting WUE and AR in Ham	3098
10	Expected improved stage of ground water development after implementation of WUE and Grey water %	113 from 142
11	Total water likely to be saved after all implementations Ham	371

4.2.2 Change in cropping pattern

In Bangalore East taluk, the water intensive paddy crop is grown only in 38 ha area, hence change in cropping is not suggested.

4.2.3 Additional area of irrigation

Urbanisation is one of the major problems. Irrigation areas are converted to buildup areas for households. Hence bringing additional area under irrigation may not be practical with a long-term resource management point of view.

4.3 Regulation and Control

The taluk has been categorized as Over-exploited, since the Stage of ground water development has reached 161% (GEC 2020). Hence, strict regulation has to be enforced by KGWA like protecting/notifying the deeper aquifers below 100 m depth for future drinking and domestic use so as to control the over exploitation of ground water in the Taluk. Ground water recharge component needs to be made mandatory in the taluk to save the situation from deteriorating further.

4.4 Other interventions proposed:

- Periodical maintenance of artificial recharge structures should also be incorporated in the Recharge Plan.
- Excess nitrate concentration is found in ground water samples which require remedial measures viz. dilution of nitrate rich ground water through artificial recharge & water conservation.
- Build up awareness among local village community about proper disposal of sewage/runoff from chemical fertilizers contributing to nitrate
- Mandatory roof top rain water harvesting in urban and semi-urban areas.
- All upcoming, large residential apartment complexes and industries should build two water supply systems for daily use, one for normal water and another for treated grey water.

5 SUMMARY AND RECOMMENDATIONS

The main ground water issues are urbanisation, less recharge worthy areas, over exploitation, limited Ground Water Potential / Limited Aquifer Thickness / Sustainability, declining water level trend which are all inter-related or inter dependent and Inferior ground water quality due to nitrate contamination in major part of the area. The summary of ground water management plan of Bangalore East taluk is given in Table-13.

Table 13: Summary of Management plan of Bangalore East taluk

Stage of GW Extraction and Category (2020)	161 %, Over Exploited
Annual Extractable GW Resource (Ham)	2726.97
Total Extraction (Ham)	4393.38
Ground Water Draft for Irrigation (Ham)	4004.96
Ground Water Resource Enhancement by Supply side Interventions	
No of Proposed AR structures SSD PT	 0 3

CD Filter Beds	15 0
Expected Additional Recharge to GW due to AR (Ham)	218
Additional Irrigation Potential that can be created (Ha)	Not suggested
Total Estimated Expenditure (Rs. in lakhs)	210
Ground Water Resource Savings by Demand side Interventions	
Expected Saving due to adopting WUE (Ham)	153
Expected Saving due to adopting grey water use (Ham)	Nil
Change in Stage of GW development (%)	161 to 142
Change in Cropping Pattern	Not Suggested

Ground Water Quality – Nitrate contamination	Improving quality by proper drainage of sewage and Limited usage of Nitrogenous fertilizers
Ground Water Regulation	Strict regulation has to be enforced by KGWA like protecting/notifying the deeper aquifers below 100 m depth for drinking and domestic use.

As per the resource estimation – 2020, Bangalore East taluk falls under Over-exploited category with the stage of ground water extraction is 161 %. Thus, there is need to formulate management strategy to tackle the urbanisation, over-exploitation, water scarcity related issues in the taluk in the coming days to avoid water crisis in the future. It is suggested to adopt a scientific and multi-pronged ground water management strategy covering supply side interventions, demand side interventions, ground water regulation interventions and ground water quality protection aspects as mentioned in the management plan suggested above

Ground water resource enhancement by supply side interventions: Quantity of surface water available through non-committed surface run-off is estimated to be 290 ham. This can be used to recharge the aquifer mainly through percolation tanks (3) and check dams (15).The volume of water expected to be conserved/recharged @ 75% efficiency is 218 ham through these AR structures. The approximate cost estimate for construction of these AR structures is Rs. 210lakhs. However, the figures given are tentative and pre-field studies / DPR are recommended prior to implementation of these recharge structures. Since this taluk falls in the vicinity of the rapidly growing Bangalore city, it is not possible to bring additional area under irrigation. Roof top rain water harvesting should be made mandatory in urban and semi-urban areas.

Ground water resource enhancement by demand side interventions: At present maximum irrigation is by bore wells (ground water). The micro irrigation practices like drip and sprinkler irrigation are practiced to less extent in comparison with traditional mode of irrigation. Implementation of efficient irrigation techniques will contribute in saving ground water by 153 ham.

Ground Water Regulation: The taluk has been categorized as Over-exploited, since the Stage of ground water development has reached 161% (GEC 2020). Hence, strict regulation has to be enforced by KGWA like protecting/notifying the deeper aquifers below 100 m depth for future drinking and domestic use so as to control the over exploitation of ground water in the Taluk.

The change in stage of ground water extraction after effective implementation of above proposed interventions will be reduced from 161% to 142%.

Annexure-I: Details of Borewells in Bangalore East Taluk drilled by Rural Water Supply dept, Govt. of Karnataka

S. No.	Village	Water level if available	Total Depth	Depth of casing (mbgl)	Depth of water yielding	Yield l/hr
1	Bandebommasandra	300	320	13	90	1600
2	Yarappanahalli Colony	120	423.5	36	125	1000
3	Chikkagubbi	220	428	31	130	1200
4	Bandehosur	120	411	38	120	1500
5	Anagalapura	280	380	38	130	1200
6	Bandaapura	310	429	24	310	1000
7	Doddabanahalli Colony	243	376	50	200	1500
8	Bidareagrahaara	182	277	32	137	1000
9	Kannamangala Colony	274	335.5	25	152	1300
10	Khajeesonnenahallui-1	115	128	44	128	1000
11	Khajeesonnenahallui-2	119	256	39	100	1100
12	Veerenahalli Colony	400	426.5	12	400	800
13	Halehalli	200	252	14	106	1300
14	Vaalepura Colony	140	411	47	140	1000
15	Mulluru	220	377	48	90	1000
16	Kaachamaaranahalli	335	385	32	200	1500
17	Kodathi	355	411	46	150	1500
18	Haalanayakanahalli Colony	130	420	29	130	1000
19	A.Krishnappanagara	310	407	33	180	1500
20	Chikkanayakanahalli	350	391	46	90	1000
21	Aadusiddapura	340	399	40	340	1000
22	Doddagubbi Colony-1	240	317	13	210	1200
23	Doddagubbi Colony-2	235	318	54	230	1200
24	Doddagubbi Colony-3	240	320	36	215	1200
25	Doddagubbi Colony-4	235	320	30	220	1100
26	Doddagubbi Colony-5	230	322	24	225	1000
27	N.G.Gollahalli-2	350	384	39	235	1200
28	Maaragondanahalli-1	275	340	44	90	1500
29	Maaragondanahalli-2	250	272	48	100	1600
30	Maaragondanahalli-3	280	316	42	105	1800
31	Maaragondanahalli-4	290	321	39	110	1700
32	Kannuru-1	300	350	15	200	1600
33	Kannuru-2	280	370	62	180	1500

34	Heerandehalli Colony-1	240	350	39	150	1400
35	Heerandehalli Colony-2	250	350	15	140	1500
36	Heerandehalli Colony-3	245	325	45	145	1200
37	Gundooru Colony-2	330	365	42	200	1500
38	Kurudusonnenahalli-1	320	356	15	300	1800
39	Kurudusonnenahalli-2	360	411	18	350	1400
40	Cheemasandra-1	360	457	61	300	1000
41	Cheemasandra-2	297	331	42	280	1000
42	Seegehalli Colony-1	150	228	30	100	1800
43	Seegehalli Colony-2	260	307	36	118	1600
44	Aavalahalli GHC-1	310	335	32	250	1800
45	Aavalahalli GHC-2	400	426	37	300	1700
46	Aavalahalli GHC-3	428	426	13	310	1500
47	Konadaasapura-1	350	380	42	270	1300
48	Konadaasapura-2	361	380	30	265	1200
49	Kithaganooru Colony-2	389	411	12	350	1400
50	Kithaganooru Colony-3	352	396	18	300	1400
51	Kithaganooru Colony-4	311	365	21	280	1500
52	Mulluru Colony-2	300	380	29	150	1500
53	Khaajisonnenahalli	303	353	40	250	1200
54	Kannamangala	320	376	24	300	1800
55	Thirumenahalli	170	435	33	170	1000
56	Kannuru(Daalappa Layout)	250	358	50	200	1800
57	Sulikunte Colony	300	389	35	170	1800
58	Sulikunte	350	395	44	150	1500
59	Kodathigate	300	397	36	90	1800
60	Chikkanayakanahalli	350	392	36	115	1500
61	Goravigere	305	343	53	280	1300
62	Veerenahalli	315	377	30	275	2000
63	Avalahalli	320	374	32	270	1800
64	Avalahalli	302	335	30	200	2000
65	Chikkabanahalli	295	323	39	210	2000
66	Mulluru	240	383	19	75	1500
67	Kurudusonnenahalli	350	400	7	300	1200
68	Vaalapura	380	372	30	250	2000
69	Yarappanahalli	350	401	9	90	1500
70	Baiyappanahalli	290	333	56	130	1800

Annexure-II: Tentative Location Details of Proposed Check Dams.

S. No.	Longitude	Latitude	Village	Gram Panchayath	Taluk
1	77.7309	12.8794	Sulakunte	Kodathi	Bangalore-East
2	77.6946	12.8909	Chikkanayakanahalli	Halanayakanahalli	Bangalore-East
3	77.7176	12.8932	Kodathi	Kodathi	Bangalore-East
4	77.7294	12.8983	Sulakunte	Kodathi	Bangalore-East
5	77.7350	13.0480	Cheemasandra	Avalahalli	Bangalore-East
6	77.7643	13.0485	Katamnaluru	Doddabanahalli	Bangalore-East
7	77.6600	13.0593	Kyalsanahalli	Bangalore-East	Bangalore-East
8	77.6917	13.0611	Vaderahalli	Doddagubbi	Bangalore-East
9	77.7576	13.0676	J.I.Bendiganahalli	Manduru	Bangalore-East
10	77.7313	13.0710	Manduru	Manduru	Bangalore-East
11	77.6468	13.0778	Nagareshwara Nagenahalli	Bangalore-East	Bangalore-East
12	77.7620	13.0895	Hancharahalli	Manduru	Bangalore-East
13	77.6850	13.0961	Yarappanahalli	Kannuru	Bangalore-East
14	77.6546	13.1052	Kannuru	Kannuru	Bangalore-East
15	77.7358	13.1094	Jyothipura	Manduru	Bangalore-East

Annexure-III: Tentative Location Details of Proposed Percolation Tanks.

S. No.	Longitude	Latitude	Village	Gram Panchayath	Taluk
1	77.7112	12.8847	Kodathi	Kodathi	Bangalore-East
2	77.7385	13.0616	Cheemasandra	Avalahalli	Bangalore-East
3	77.7031	13.0775	J.I.Kada Agrahara	Bidarahalli	Bangalore-East