CONSERVE WATER – SAVE LIFE

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MINISTRY OF WATER RESOURCES

केंद्रीय भूजल बोर्ड

CENTRAL GROUND WATER BOARD

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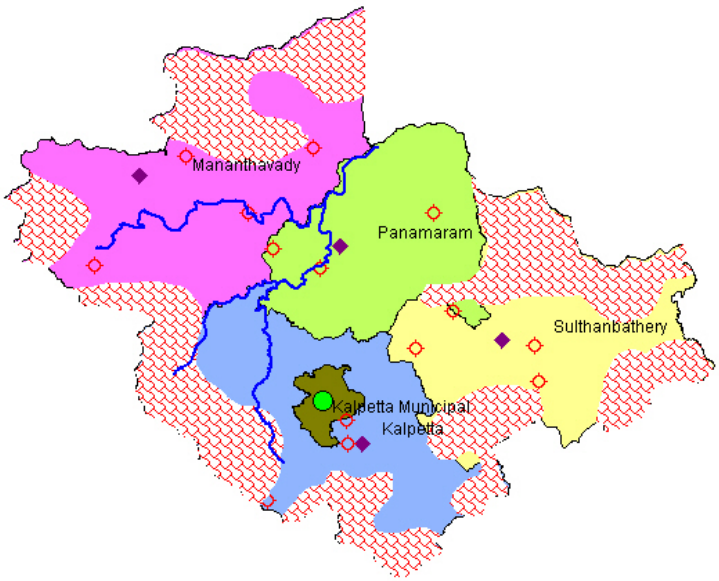
GROUND WATER INFORMATION BOOKLET OF WAYANAD DISTRICT, KERALA STATE



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GROUNDWATER INFORMATION BOOKLET WAYANAD DISTRICT OF KERALA

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WAYANAD DISTRICT AT A GLANCE

Sl.No	Items		
GENERAL			
1	Geographical area sq.km	2131	
2	Taluks	3	
3	Revenue villages	49	
4	Municipalities	1	
5	Development blocks	4	
6	Panchayats	25	
POPULATION - 2011			
7	Population	816558	
8	Density (as per 2011 Census)	383	
9	Literacy rate, %	84.31	
CLIMATE			
10	Annual rain fall (2011)	2630	
11	Number of rainy days / year	128	
12	Maximum Temperature	33.97 °C	
13	Minimum Temperature	13.87 °C	
Hydrogeology & Chemical quality			
14	Aquifer types	Alluvium	Crystallines
15	Dug well depth, m	3.5-7.8	6-9
16	Bore well depth (m)	-	10-100
17	Yield, LPH	500-10,000	250-40,000
18	Water quality	Good	Good
19	Number of exploratory wells drilled by CGWB	17	
20	Geology	Crystalline Rocks, Riverine Alluvium and Valley fill	
21	Type of Abstraction structures feasible	Dug Well, Bore Well	
22	Artificial Recharge Structures Recommended	Rainwater harvesting, Check dams, Subsurface dykes, Gulley plugs and Percolation tanks	
23	Pre monsoon depth to water level mbgl (2011 April)	1.68-12.00	
24	Post monsoon depth to water level m.bgl (2011 November)	0.37-11.50	
25	No. of Auto flow wells in the area	2 (Irulam & Kottakolly)	
26	Total groundwater resources (MCM) as in March 2009	306.98	
27	Net groundwater availability (MCM) as in March 2009	276.28	
28	Gross groundwater draft for all uses (MCM) as in March 2009	47.68	
29	Stage of groundwater development (%) of the district	17.22	
30	Category;- (a) Safe blocks (b) Semi critical blocks (c) Critical (d) Over exploited	3 Nil Nil Nil	

GROUNDWATER INFORMATION BOOKLET
WAYANAD DISTRICT, KERALA

1.0 INTRODUCTION

Wayanad is a small hill district in Kerala with an area of 2131 km^2 **.** When the State of Kerala came into being in 1956, Wayanad was part of Cannannore district. Later in 1957, South Wayanad was added to Kozhikode district and North Wayanad remained with Cannannore district. By amalgamating the North Wayanad and South Wayanad, present Wayanad district came into being on November 1, 1980 comprising of three Tehsils viz. Vythiry, Mananthawady and Sulthan's Bathery. The district is also divided into three blocks- Kalpetta, Mananthawady, and Sulthan Bathery. Recently one more block has been created in the district namely Panamaram by including 5 Panchayats i.e. Kaniambetta, Mullankoly, Panamaram, Poothadi and Pulapalli. Now the district consists of four blocks namely Kalpetta, Mananthawady, Panamaram and Sulthan Bathery is shown in the Index map **(Figure 1).** The district is having 25 grama panchayats and one municipality (Kalpetta). It has a population of about 8.16 lakh of which 90% depend upon agriculture for sustenance. There are 40,129 farmers, 74,813 agricultural labourers and 17,413 plantation labourers in the district. Another 37,267 people earn their livelihood from animal husbandry and forest produce (Source: District Project Draft Development, Wayanad, 2001, Govt. of Kerala). The district has highest tribal population of about 1.25 lakh consisting 17% of the total population. Even though, the term Wayanad is derived from the word "Vayal Nadu", which means the land of paddy fields now it is famous for its spices and coffee plantations. The major crops grown here are coffee, pepper, tea, cardamom, arecanut etc. These are perennial cash crops.

Till not very long ago, Wayanad had plenty of water. But today the entire region is facing drought due to change in rainfall pattern, unchecked deforestation and large-scale conversion of paddy fields into plantations. In 1980, there were 30,000 hectares of paddy fields in Wayanad. It has shrunk by more than 76 percent to 7000 hectare at present. The ecosystem and environment of the district, which is famous for its bio-diversity is greatly endangered today. Afforestation, protection of paddy fields, conservation of water resources and artificial recharge to groundwater are to be carried out in the district to protect the ecosystem and environment of Wayanad, which will in turn reduce the impact of drought on agriculture.

Almost the entire Wayanad district is drained by *Kabani* and its three main tributaries viz. *Panamaram, Mananthawady and Tirunelli*. Other tributaries include *Bavelipuzha* and *Noolpuzha*. *Kabani* River is one of the three east flowing rivers in Kerala and is an important

tributary of *Cauvery* River. *Kabani* and its tributaries carved the present landscape of the district. Other drainages in the district are *Chaliyar* and *Valapattanam*.

Panamaram River originates from *Lakkid*i and its main tributaries are *Kavadam puzha*, *Kadaman thodu*, *Venniyode puzha*, *Karapuzha* and *Narassipuzha*. *Panamaram River* joins with *Mananthawady* rivulet originating from Thodarmudi at an elevation of 1500m amsl. After joining with *Mananthawady* River, it is known as *Kabani*. After entering the Karnataka State *Kabani* joins with *Cauvery*. The salient morphometric characteristics of drainages in the district are given in **Table 1**.

Table 1: The salient morphometric characteristics of drainages in Wayanad District

Sl. No	Name	Basin length, km	In Wayanad	Total Catchment Area, km^2	Catchment area in Wayanad, km^2
1	Kabani	56.60	56.60	1934.50	1934.50
2	Chaliyar	169.00	12.00	2539.80	120.00
3	Valapattanam	54.00	6.00	421.04	50.00
Total		279.60	74.60	4895.34	2104.50

There are no major irrigation projects in the district but has two medium irrigation projects viz. Banasurasagar multi purpose project and Karapuzha irrigation project. Karapuzha irrigation project (KIP) under implementation in the Kabani sub basin of Cauveri basin is planned to irrigate a net ayacut of 5221 hectares of land in Vythiri and Sulthan BatheryTaluks. Apart from this there are a number of tanks and ponds, minor irrigation projects and lift irrigation projects in the district. All these ponds need rejuvenation due to siltation. The areas irrigated from these sources are given below **(Table 2).** With failure in rainfall groundwater dependent irrigation is getting momentum.

Table 2: The salient morphometric characteristics of drainages in Wayanad District

S. No	**Block Name**	**Private Tank**		**Minor Irrigation Project**		**Lift Irrigation Project**	
		Total No	**Area (ha) irrigated**	**Total No**	**Area (ha) irrigated**	**Total No**	**Area (ha) irrigated,**
1	Sulthan Bathery	13	100.00	40	863.25	6	387.57
2	Kalpetta	14	131.00	24	299.81	1	10.62
3	Mananthawady	47	791.81	79	920.34	5	226.56
Total		74	1022.81	143	2083.40	12	624.75

Central Ground Water Board (CGWB), Kerala Region has carried out detailed hydrogeological investigations in the district. The Hydrometeorological and Hydrological studies were carried out in 1993 as part of groundwater regime studies. Groundwater Exploration programme of CGWB could decipher the deep potential zones along fractures and lineaments. The report on "Groundwater Resources and development potential of "Wayanad district" was published in 1997. The qualitative and quantitative changes in the groundwater regime have been subjected to study in the Reappraisal hydrogeological survey carried out during 2004 - 05. Geological Survey of India, Kerala Unit, carried out the geological mapping of the District. The Systematic and reappraisal surveys carried out by CGWB at frequent intervals made use of relevant data generated by different State and Central government agencies worked in the district. Periodical water level and water quality monitoring is being carried out in the district by CGWB and State Groundwater Department. An integrated Monitoring network has been established for this purpose. An integrated study on geology, hydrogeology, hydrometeorology and geomorphometry was carried out by Central Ground Water Board in collaboration with Geological Survey of India, Kerala State Land Use Board, Soil Survey and Dept. of Agriculture, Thiruvananthapuram in 1992 under the title 'Operation Wayanad'. Groundwater management training was organized at Kalpetta in 2005 and pamphlets depicting groundwater scenario of the district were distributed to the public.

2.0 RAINFALL AND CLIMATE

Wayanad experiences salubrious climate with mean rainfall of 2786 mm. Lakkidi, Vythiri and Meppady are the high rainfall experiencing areas. It is seen that southern, southwestern and northeastern areas of the district receive more than 3000 mm of annual normal rainfall. Eastern and northeastern areas receive lesser rainfall of less than 1500 mm.

Some areas bordering Karnataka state experience still lower rainfall with some areas falling under rain shadow region. An increase in rainfall is observed towards south, southwest and northeast. The SW and NE monsoons contribute rainfall in the area with 80 % of the rainfall from SW monsoon. The month of June experiences abundant rainfall and is the wettest month. The months of July, August and October also receive heavy rainfall. The annual rainfall received in Wayanad district from the year 2006 to 2011 is presented in **Table 3**

Table 3: Annual rainfall received in Wayanad district

Year	2006	2007	2008	2009	2010	2011
Rainfall (mm)	2586.2	3092.8	2142.4	2769	2040.3	2630

The change in rainfall distribution during the last six years i.e. from 2006- 2011 during different months is shown in the **Table 4**.

Table 4: Monthly rainfall in Wayanad district.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2006	10	0	67.4	64	361.5	443.2	691.2	382.4	314.6	133	118.9	0
2007	0.3	9.5	1.3	134.4	113.8	501.1	1147.2	590.7	385	172.9	29.1	7.5
2008	0	19.2	166.3	89.4	102	312.5	416.7	413.8	159.3	450.7	11.8	0.7
2009	0	0	95.7	47.1	123.9	309.8	1256.1	185.4	240.3	183	203.6	77.6
2010	37	14.1	13.1	131.3	124.4	376.2	494.8	292.8	163.5	170.7	218	4.4
2011	0	35	22	240	43	699	532	440	296	221	95	7

3.0. GEOMORPHOLOGY AND SOIL TYPES

The district may be divided into three physiographic zones- Wayanad plateau (WP), Central Sahyadri High land (CH) and Mountainous regions of Central Sahyadri (MR) as per Soil Survey Organisation. On the basis of topographic features the area can be divided into different physiographic zones like high ranges with rugged topography, high ranges with moderately rugged topography, intermontane valley and flood plains.

High ranges with rugged topography include hill ranges in the west, northwest and southwestern part of Wayanad district and elevation ranges from 1400 to 2100 m amsl. This area is occupied by dense mixed jungles and is having rugged topography with steep slopes and narrow valleys.

Hill ranges along the eastern part and isolated hills come under high ranges with moderately rugged topography. The altitude of the physiographic zones ranges between 1000 and 1400 m amsl with moderate slope.

Intermontane valleys are the valleys between high ranges. These areas are occupied by colluvium formed by depositional processes. Erosional intermontane valleys are also reported. The flood plains with apparent alluvial thickness of more than 10 m are quite common and form productive aquifers.

The landform units identified in Wayanad are alluvial plain, flood plain, valley fill, linear ridge, hillcrest, sloping terrain, rocky slope (scarp face) and hilly terrain. The flood plain and

valley fill are the major fluvial landforms whereas moderately sloping terrain (S2), highly sloping terrain (S3), rocky slope (scarp face), linear ridge and hillcrest are major denudational landform units. Flood plains are relatively smooth valley floors adjacent to and formed by rivers, which are subject to overflow. There is no lithological control over land use in the area. Landform unit with highest slope (90°) identified in the study area is scarp face (rocky slope). Landform studies and data from well inventoried in different landform units of the study area indicate that fluvial and gently sloping terrains are promising zones of groundwater. Denudational landforms are unproductive zones.

3.1 Soil Characteristics

In the study area there are four types of soil viz. laterite soil, brown hydromorphic soil, forest loam and riverine alluvium.

Laterite soil seen in some areas of Wayanad is reddish brown in colour, formed under tropical monsoonal climate with alternate wet and dry seasons. The organic matter in the soil is very less with moderate nitrogen, phosphorous and potash. The pH of soil ranges between 5.5 and 6.5 and texture is clayey loam to silty loam with 5 to 20 % coarse fragments. Laterites on high grounds are more compact when compared to the low-lying areas.

Forest soil is found in Mananthawady, Kalpetta and Sulthan Bathery blocks. They are rich in organic matter, nitrogen and humus. Forest loam is dark reddish brown in colour formed by weathering under forest cover with loamy to silty loam texture. The pH of the soil ranges between 5.3 and 6.3 and is slightly acidic in nature.

Brown hydromorphic soil (BHS) is mainly seen between undulating topography in Wayanad district. The BHS is very deep brownish in colour with sandy loam to clayey texture. The BHS is formed by transportation and sedimentation of material from hill slopes. The pH of this soil ranges between 5.2 and 6.3 and is slightly acidic in nature.

Alluvial soils are found along the banks of Kabani, Chaliyar and its tributaries. Riverine alluvium is very deep with sandy loam to clayey loam texture. Majority of the area under riverine alluvium was once occupied by paddy. Those areas are now utilized for the cultivation of various crops especially plantain. The riverine alluvium contains moderate organic matter, nitrogen, phosphorous and potash.

4.0 GROUNDWATER SCENARIO

Groundwater occurs in the weathered, fractured, crystalline and alluvial formations in the district. Phreatic conditions exist in weathered formation and are mostly developed by dug

wells for domestic and irrigation purposes. Semi-confined conditions exist in deep fractures and storage and movement of groundwater is mainly controlled by the fracture system. Deep high yielding bore wells are located along fractures / lineaments.

4.1 Hydrogeology

All the four blocks in the district are having similar hydrogeological conditions. The major water bearing formations in the district are weathered/fractured crystallines, alluvium and valley fills.

Alluvium and valley fills are seen along the river courses and broad valleys. The alluvial aquifers are better represented in Kalpetta and Sulthan Bathery blocks and considerable thickness of this formation are seen in and around Muttil, Kainatti, and Varadur and in different parts of Panamaram Watershed. The thickness of alluvium varies from 3 to 9m and that of valley fills from 2 to 9m. In these formations groundwater occurs under phreatic condition. Dug wells are suitable abstraction structures for this formation with depth range varying from 3.5 to 7.8 mbgl. The depth to water level varies from 2.6 to 3.7 mbgl during pre monsoon (April) and from 0.70 to 2.60 during post monsoon (November). The yield of dug wells in this formation ranges from less than 500 LPH to about 10,000 LPH with pumping duration ranging from less than 1 to 4 hours in a day.

The hard rocks (crystalline) cover the entire district with thin deposits of alluvium and valley fills over it as mentioned above. Groundwater occurs under phreatic condition in weathered crystallines. Semi confined to confined conditions exist in deep fracture system, which forms potential aquifers and is developed by bore wells. The depth of wells and water levels in the weathered crystallines varies with respect to the parent rock formation as depicted in the hydrogeological map **(Figure 4)**

The weathered granite and granitic gneisses in Kalpetta and Sulthan Bathery Blocks form potential phreatic aquifers along valleys and topographic lows. The depth of dug wells in this formation generally varies in the range of 6 to 9m with water levels ranging from 4 to 8 mbgl during pre monsoon and from 3 to 5 mbgl during post monsoon.

The weathered charnockites seen in Kalpetta block and along the hill ranges of the Western Ghats form poor aquifer and can sustain only domestic wells. The depth of wells in this formation generally varies in the range of 7 to 10 m with water levels ranging from 4 to 9 mbgl during pre monsoon and from 3 to 7 m during post monsoon.

The weathered migmatite and gneiss seen along the central portion of the district form moderately potential aquifers and cover a major area of all the four blocks. The depth of dug wells in this formation generally varies from 14 to 20 m with water levels ranging from 10 to 15 mbgl during pre monsoon and from 8 to 11 m during post monsoon.

The weathered gabbro and diorite rocks seen in the northern portion of Manathawady block form moderately potential aquifers. The depth of wells in this formation generally varies from 8 to 12 m with water levels ranging from 5 to 12 mbgl during pre monsoon and form 3 to 11 mbgl during post monsoon. The pre monsoon (Decadal) and post monsoon (Decadal) water levels in the district are shown in **Figures 2 and 3** respectively.

The yield of dug wells in the crystallines varies in general from less than 500 LPH to 6000 LPH and can sustain pumping for a period of from less than 1 to 3 hours in a day.

Deeper aquifers in the crystallines with secondary intergranular porosity and fractures are feasible locations for bore wells. High yielding wells can be located along fracture zones identified by proper hydrogeological and geophysical studies. The depth of bore wells in the district generally varies from 10 to 100m with yield in the range of 250 LPH to 22,000 LPH. Out of 300 bore well data analysed only 6% of the wells are yielding more than 10,000 LPH and about 20% of wells are yielding 5000 to 10,000 LPH. The yield of bore wells in charnockites varies between 280 and 2900 LPH and that in diorite and gabbro formations varies between 400 and 22,000 LPH. Diorite and gabbro formations yield more compared to other formations in the district. Exploratory drillings by CGWB revealed deep potential fractures between 122 and 140 m along lineaments. The maximum discharge observed from these wells is around 40,000 LPH **(Annexure I).**

The casing depth of bore wells varies form 3 to 53 mbgl. The over burden thickness is maximum in gneisses in central and eastern parts of the district and is generally in the range of 20-35 m. While, on western and northern part of the district covered by charnockites, dolerite and gabbro it is generally in the range of 15-25m.

Seasonal fluctuation of the water table is due to variation in the rainfall, evapotranspiration, withdrawals for irrigation and other purposes, base flow, seepage from surface water bodies etc. The annual water level fluctuation is in the range of 0.72 to 2.60 m in alluvium and valley fills and that in weathered crystallines it ranges from 1.02 to 3.5 m.

4.2 Groundwater Resources

The methodology used for the resources assessment is based on Groundwater Resource Estimation Methodology 1997 (GEC-'97). The net ground water availability, existing ground water draft for irrigation and gross ground water draft for domestic water supply and industrial use and total gross ground water draft for all uses for all the three blocks is shown in Table **5**

Table 5: Dynamic Ground Water Resource of Wayanad District as in March 2009

Sl. No.	Block	Net Annual GW Availability	Existing Gross GW Draft for irrigation	Existing Gross Groundwater Draft for domestic and industrial water supply	Existing Gross GW Draft for all uses	Stage of Groundwater Development, (%)	Categorization for future groundwater development
1	Kalpetta	86.64	2.25	12.15	14.40	16.63	Safe
2	Mananthawady	86.41	1.42	14.08	15.50	17.94	Safe
3	Sulthanbathery	103.22	2.85	14.92	17.77	17.22	Safe
	Total	276.28	6.52	41.15	47.68	17.26	

Existing gross groundwater draft for irrigation in Kalpetta, Mananthawady and Sultan's Battery Blocks is 2.25, 1.42 and.2.85 MCM and that for domestic & industrial use is 12.15, 14.08 and 14.92 MCM respectively.

All the three blocks are falling in safe category where the stage of ground water development is 16.63% for Kalpetta, 17.94% for Mananthavady and 17.22% for Sulthanbathery and as shown in the table-5

4.3 Groundwater Quality

The quality of water from shallow and deep aquifers in the district is good for domestic and irrigation purposes. The ground water samples collected fro NHS during the month of April 2009 were analyzed and results of the analysis is shown in the annexure-II. The electrical conductivity (E.C) is a measure of mineralisation in water. The E.C of water from shallow aquifer ranges from 41 to 641 micromhos/cm at 25^0C indicating that the water is potable. The pH value of water ranges from 7.09 to 8.59 indicating alkaline to neutral and occasionally acidic nature. Total hardness of less than 200mg/l shows soft nature of dug well water.

The water from springs and rivers are also very fresh and suitable for all purposes. As per the drinking water standards of India (BIS) all the major chemical constituents including fluoride

in the groundwater of this district is within the permissible limit. In general the quality of ground water is good nd is suitable for domestic as well s for irrigation purpose in the district.

4.4 Status of groundwater development:

The stage of groundwater development in the district during 2009 is 17.26%, leaving scope for further development. At present about 6.52 MCM of groundwater is used for irrigation out of the net annual groundwater availability of 276.28 MCM. A balance of about 221.58 MCM is left for future irrigation developments. This shows the vast scope for irrigation using groundwater. The block wise stage of groundwater development and resource available for future development is given below.

S.No.	Block	Net annual groundwater availability (MCM)	Net groundwater available for future development (MCM)	Stage of groundwater development, (%)
1.	Kalpetta	86.64	70.21	16.63
2.	Mananthavady	86.41	68.43	17.94
3.	Sultan Bathery	103.22	82.94	17.22
Total		276.27	221.58	17.26

The groundwater is mostly used to irrigate the standing paddy crops during fag end of the season and some cash crops and vegetables after the monsoon. During June to December, being rain fed months, no irrigation is required. Dug wells and bore wells are mainly used for irrigation. The yield of dug wells located along the valleys and in alluvium is higher than that in weathered crystallines. The yield of dug wells varies from less than 500 to 10,000 LPH can sustain pumping for a period of less than an hour to 3 hours. Mostly centrifugal pumps of 1 to 3 HP are installed in shallow irrigation wells. The cost of construction of dug wells in alluvium and valley fills comes to Rs. 20,000 to Rs. 25,000 including the cost of pump set. In weathered crystalline it may go up to Rs. 30,000.

In the district of Wayanad public tube wells, public dug wells, public tanks/ponds, public taps are employed for urban and rural water supply. The public taps are the main means of water supply followed by public dug wells, public tanks/ponds and public tube wells. The Drinking water facility in Wayanad District in different Panchayats, blocks and Kalpetta Municipality is compiled and is shown below.

Drinking water sources in Wayanad District

SL. No.	Name of Panchayat	Public Tube Wells	Public Dug wells	Public Tanks/Ponds	Public Taps	Others (rivers,springs)
		Nos.	Nos.	Nos.	Nos.	Nos.
1	2	3	4	5	6	7
1	Kalpetta	84	535	130/1	572	2
2	Mananthawadi	54	644	738/50	761	242
3	Sultan's Batterri	151	723	160	1147	64
	Total (Rural)	289	1902	1028/51	2480	308
	Kalpetta Urban)	6	88	6	261	0
	District	295	1990	1034/51	2741	308

5.0 GROUNDWATER MANAGEMENT STRATEGY

Being a hilly district, Wayanad needs specific water management strategies to suit its physiography. The run off in the district is high and the groundwater levels in valleys are shallow. High lands are more sensitive to vagaries in climatic conditions and need more attention in the implementation of water conservation and recharge structures. Suitable groundwater conservation and recharge structures for high lands and valleys are to be designed and promoted with people's participation to make it a success.

There are numerous soil conservation structures like contour bunding, terrace cultivation, gully plugging etc, which act as water recharge structures in high lands. Construction of such structures is to be promoted in big way in the district. Most of the NGOs working in the district are mainly concentrating on rainwater harvesting practices to do away with the drinking water scarcity problems in high land area. The wide network of drainage developed by the rivers in the district has numerous ideal locations for check dams, which may act as water conservation and recharge structures. As most of the area receives high rainfall, rainwater harvesting for groundwater recharge as well as for storage in tanks for drinking purpose can be promoted by popularizing the techniques on water harvesting.

The artificial recharge structures suitable for this district are gully plugs and other soil conservation structures like percolation tanks, check dams, sub-surface dykes and roof top rainwater harvesting,

Roof top rainwater harvesting can be practiced by all including individuals with small land holding especially in the block of Kalpetta. Gully plugs are suitable for all high land areas with local break in slope such as the plateau terrains of Kalpetta, S. Bathery and Mananthawady blocks. Percolation tanks are suitable for areas with thick alluvial patches

like Kainatti, Panamaram, Muttil and areas with valley fill, colluvium and highly weathered rocks. Check dams can be constructed across small streams with gentle slope with permeable beds and such sites are available in all the blocks. Sub-surface dyke along gently slopping wide valleys with narrow out let are effective groundwater conservation structures and there are such sites at Ambalavayal and Thrikkaipatta areas. Dug well recharge can be practiced in and around Perikallur, Kappiset and areas bordering Karnataka State. A large number of springs in the district can be developed for drinking water supply. Desiltation of tanks / ponds may augment the groundwater recharge. The rainwater harvesting and other water conservation and recharge structures can be popularised through mass awareness programmes and training programmes on these techniques.

5.1 Groundwater Development

For categorization of blocks for groundwater development, stage of groundwater development and long term trend of pre and post monsoon water levels in the area are considered. Stage of groundwater development in Kalpetta, Mananthawady and Sulthan Bathery Blocks are 16.6%, 17.94% and 17.22% respectively and come under Safe category.

Groundwater draft in Wayanad district is mainly through open dug wells and hand pumps fitted with bore wells. These are the common abstraction structures in all the blocks and are mainly used for drinking and irrigation purposes. Irrigation wells in general are large in diameter. Bore wells are mainly used for irrigation and there is a spurt in construction of bore wells in the district in recent years.

5.2 Water Conservation & Artificial Recharge

The district is suitable for implementation of Minor Irrigation (M I) schemes such as lift irrigation, diversion weirs, vented cross bars (VCB), check dams, irrigation tanks/ ponds as it is covered by a good drainage net work formed by Kabani, Chaliyar and Valapattam rivers and their tributaries. An increase in check dam construction in the district has been noticed in recent years. Local enquiries reveal that the check dams have positive impact on rising the groundwater levels in all the upstream portions of the scheme areas such as in Koileri and different parts of Mananthawady and Sultan's Batterry. The MI schemes are utilized for integrated paddy field development, Western Ghat Development and drought mitigation.

6.0 GROUNDWATER RELATED ISSUES AND PROBLEMS

Decline in water level, water scarcity, localized pollution and ground water marketing are some of the major problems noticed in the area.

6.1 Decline in water level

Decline in water level is observed at many places bordering Karnataka State. In those areas fluctuation is also high. It is noticed that rainfall in those areas are comparatively low.

6.2 Groundwater Marketing

Groundwater marketing (GM) is the process of selling groundwater by accepting money. Ground water is a saleable commodity in some parts of the district. The GM is usually practiced by wealthy farmers to exploit marginal and poor income groups. Actually groundwater is not the wealth of individuals and is a natural resource, belongs to nation. In Irulam and Kappiset areas people purchase water for domestic and non-domestic purposes by giving money to those having auto flow wells.

6.3 Artificial Recharge Area

There are a number of places where check dams and nala bunds were constructed by people for recharging surface water to groundwater. Rainwater-harvesting structures are constructed in a number of places. Most of these are storage tanks for collection of rainwater falling on rooftops. They are doing only storage than recharge to groundwater system. Steps can be taken to recharge this roof top rain water for recharging the ground water system so that it will be helpful in bringing up ground water level in the area.

6. 4 Water draft from rivers

In a number of villages bordering Karnataka State situated on the bank of Kabini River, people pump water directly from rivers. Some people exploit the river water by constructing infiltration galleries to their large wells and the galleries are open to the river channel.

6.5 Water Scarcity

Water scarcity is a severe problem during the drought period in the villages bordering Karnataka State. It is noticed that rainfall in these areas is comparatively lower than remaining area and some part of it comes under rain shadow area. The areas such as Mullenkolly, Pulpally, Tamitheruvu, Kappiset, Padichira and near by areas come under rain shadow areas.

7.0 AWARENESS & TRAINING PROGRAMME

Mass Awareness Programmes to educate people about the need to conserve and protect the groundwater resources are being conducted by CGWB from 1996 onwards. In addition to this, CGWB started imparting training on Rain Water Harvesting and artificial recharge to

groundwater resources. During the period from April 2006 to March 2007 two such two days training programmes and one mass awareness program (MAP) were conducted by CGWB in the district.

Mass Awareness program helps in making the general public, NGOs and private organizations aware of the problems of over exploitation and its harmful effects. These mass awareness programmes have helped the general public in understanding the problems that they may face in future if the groundwater is continued to be over exploited as well as polluted. Mass Awareness Program at Mananthavady witnessed a gathering of more than 350 people, majority of them were women and tribals (adivasis).

Water Management Training program was conducted at Sultan Bathery to impart training on rainwater harvesting. The training programmes have been found very useful by the participants as was evident by the number of queries and discussions that followed the lectures.

8.0 AREAS NOTIFIED BY CGWA/SGWA

No block in Wayanad district is notified by CGWA or SGWA at present.

9.0 RECOMMENDATIONS

1. The stage of groundwater development in Wayanad District as on 2009 is 17.26 % leaving wide scope for future ground water development in the district.
2. As number of abstraction structures including private bore wells is on the increasing trend, proper census of the abstraction structures is necessary for recommending new structures for future development.
3. Groundwater development should be limited with conjunctive use of rainwater and surface water. More stress should be given for watershed development for better water management. The existing water resources viz. dug wells, ponds & tanks should be protected and conserved.
4. In the district there are 24 numbers of springs, which are the perennial sources for drinking water. These have not been developed so far effectively. Attention may be given for the proper development of springs as the spring water can be supplied to the down streams just by gravity flow.
5. There should be proper water budgeting in the district. There are number of minor irrigation and water supply schemes in the district, which require periodic maintenance and attention. Priority should be given to micro level water supply projects.

6. Mass awareness programmes may be organized in Panchayath level to make awareness among people about the importance of conservation of water resources. Stress should be given for integrated water shed management and conjunctive use of water resources in the district.
7. A comprehensive artificial recharge and groundwater conservation plan has to be prepared for this district for a better water management. Site specific rainwater harvesting and artificial recharge schemes should be practiced in the district. In situ rainwater collection and artificial recharge to groundwater is to be practiced in the district.
8. A technical data base has to be created at CGWB Regional Office, incorporating data from GWD and other agencies. This may be disseminated to the public through local bodies and NGOs.
9. The agriculture as well as inhabitation is concentrated along valleys and in certain pockets. Groundwater draft is restricted to such areas. Whereas, the groundwater resources are computed for the entire district. Due to this peculiar situation, the recharge computed is comparatively high in the district. Hence, the resource assessment made on watershed/ micro-water shed basis will be more useful and reliable.

Figure 1: Index map of Wayanad District, Kerala

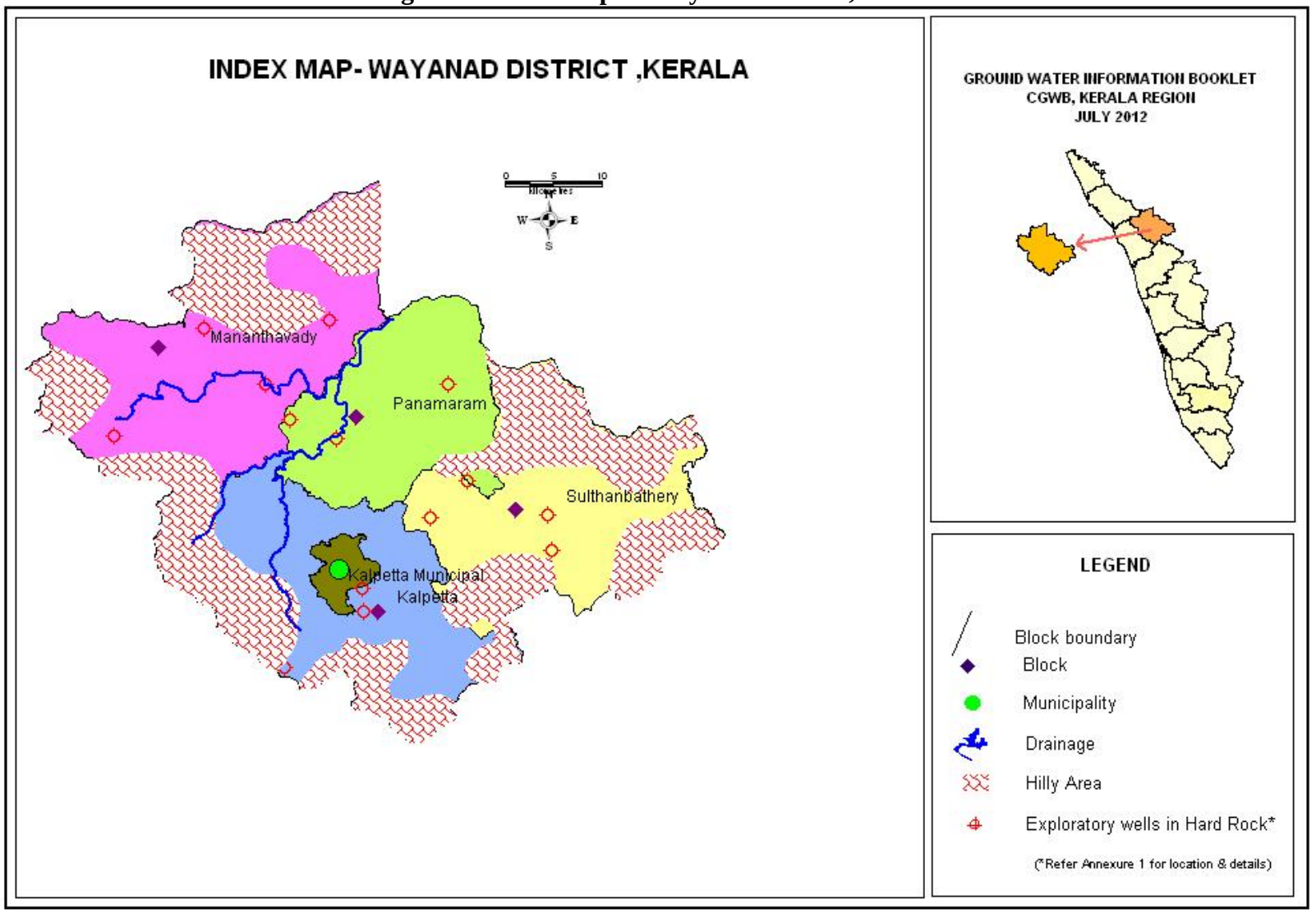


Figure 2: Depth to Decadal Average Water Level, Premonsoon (April 2002-11)

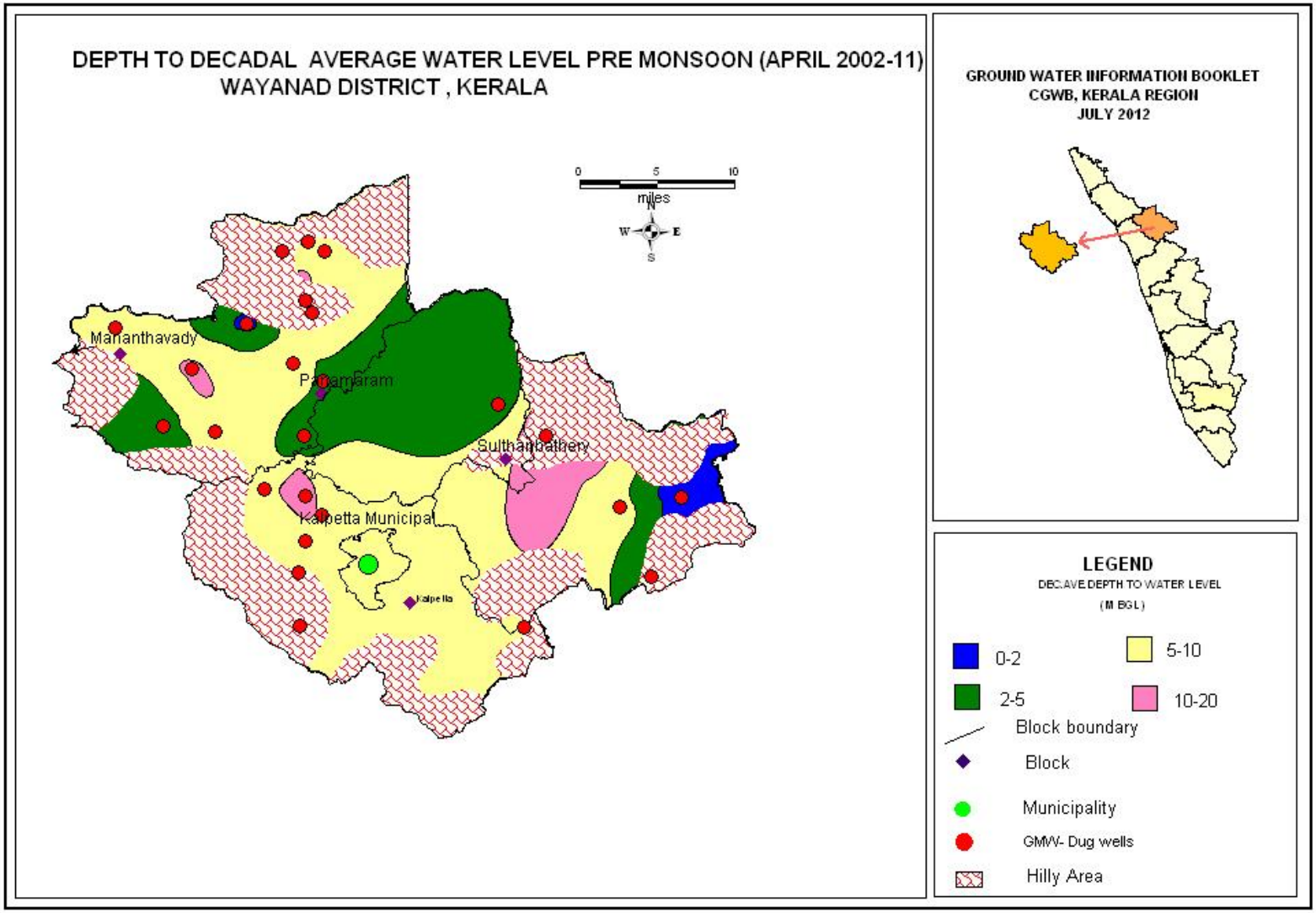


Figure 3: Depth to Decadal Average Water Level, Post monsoon (Nov-2002-2011)

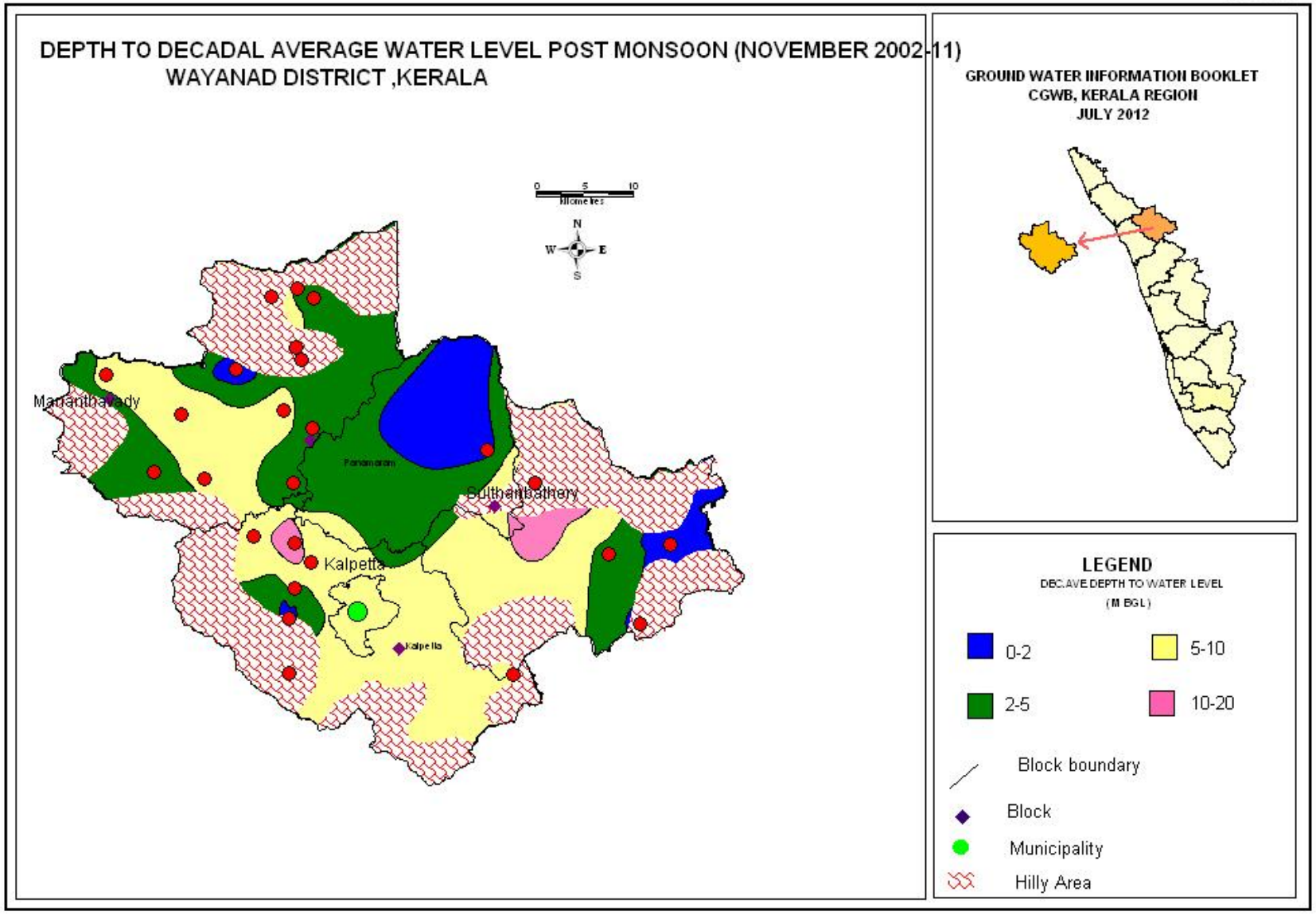


Figure 4: Hydrogeology of Wayanad District, Kerala State

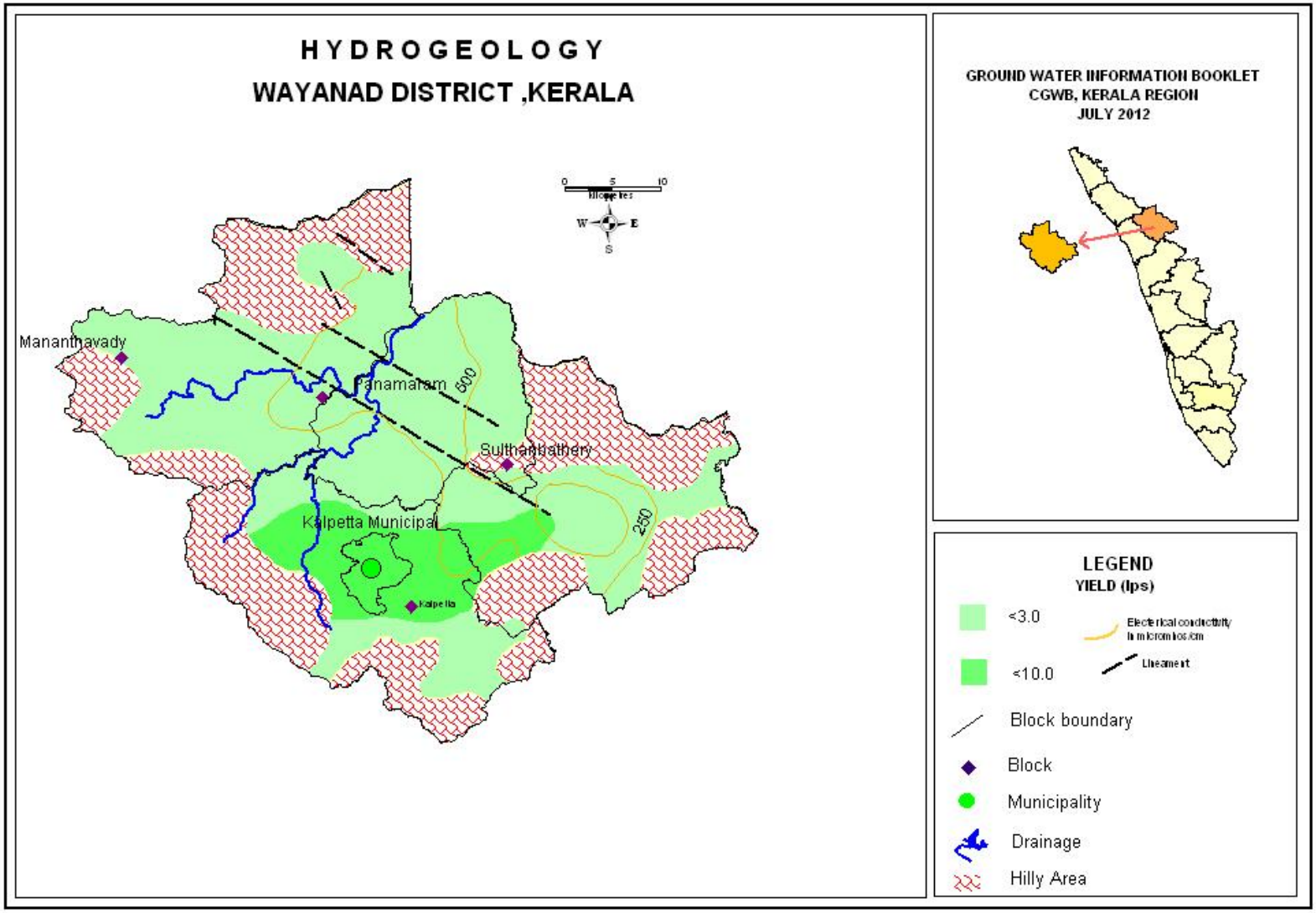


Figure 5: Categorization of Blocks in Wayanad District

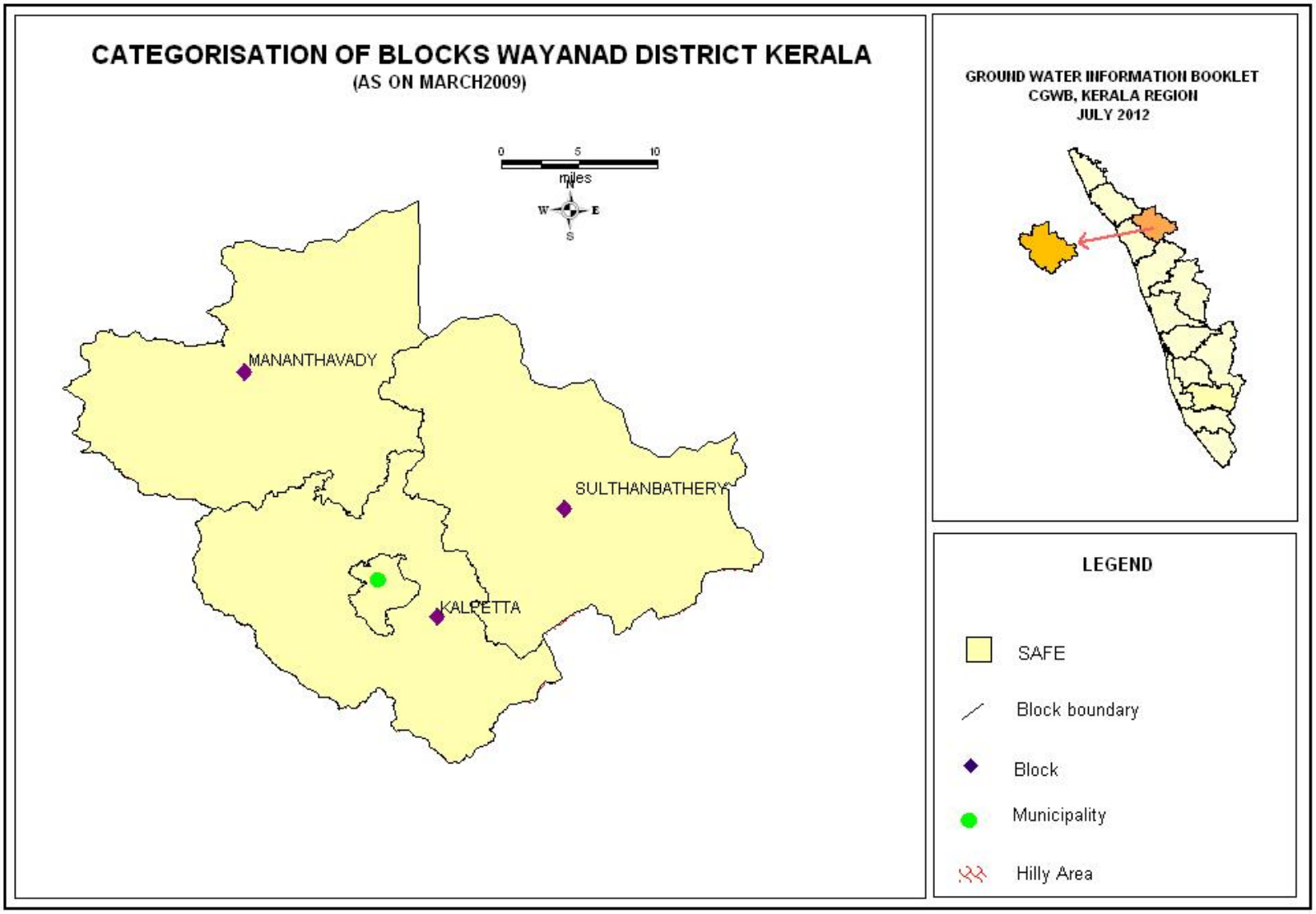
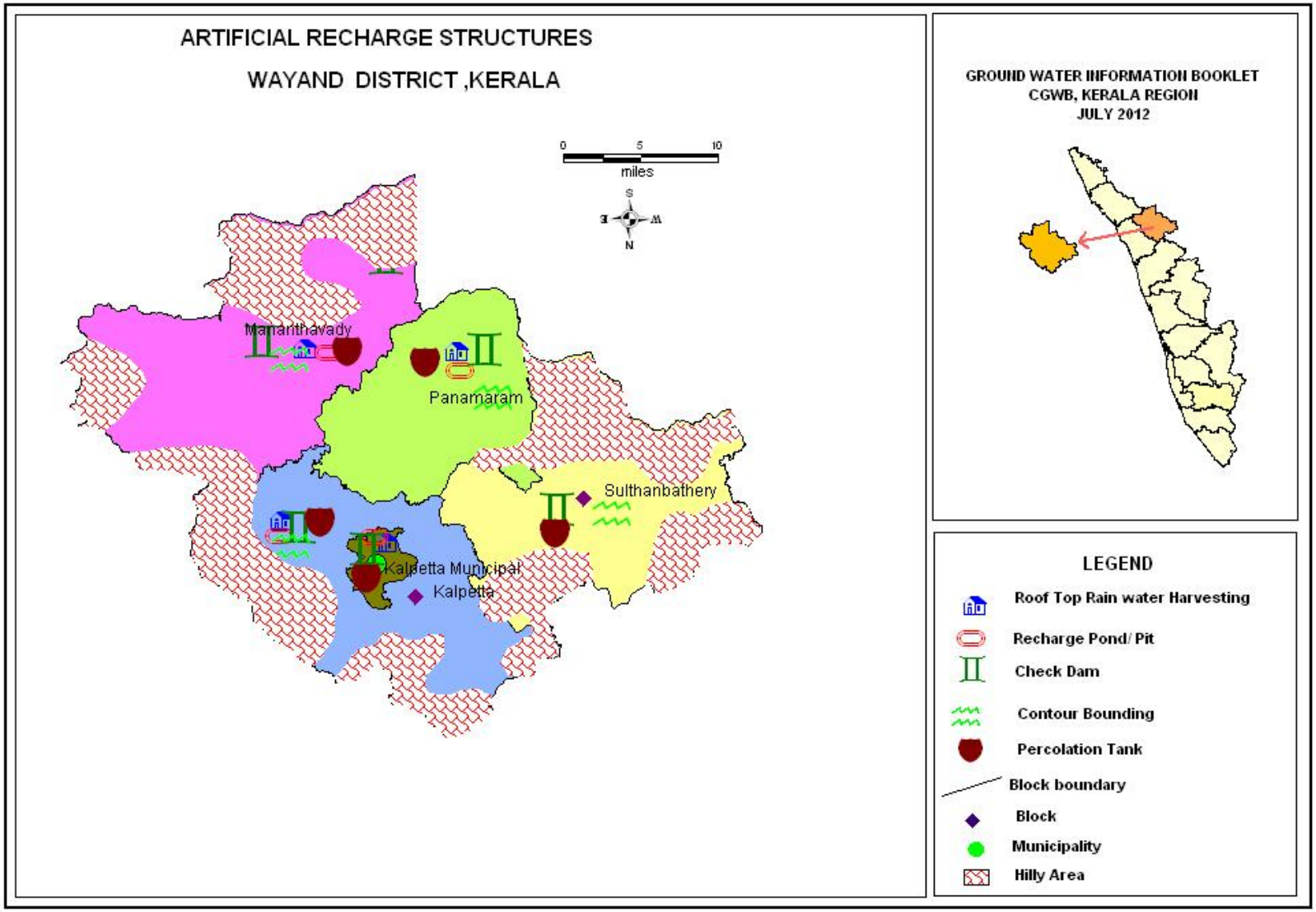


Figure 6: Artificial Recharge Structures proposed in Wayanad District



Annexure - 1: Exploratory wells drilled by CGWB

Well No	Location, coordinates & toposheet No.	Lineament Direction	Depth drilled/ SWL mbgl	Depth of Casing (m.bgl)	Fracture zones (m)	Discharge (lpm) during drilling	Rock type
1	Lakkidi, 11^{0}31'20", 76^{0}01'20", 58 A/2	NE-SW	200.00	21.70	177.3-179.3		Granite gneiss
2	Vaduvanchal,11^{0}32'53"76^{0}13'49", 58 A/2	NE-SW	60, 7.95	21.80	Nil	20	Granite gneiss
3	Kunnampetta,11^{0}34'25",76^{0}05'55", 58 A/2	NNW-SSE	124, 1.95	12.60	15.6-17.6, 39-40, 74.6-75.6, 122.4-124.4	360.0	Horneblende gneiss
4	Kalpetta, 11^{0}35'45", 76^{0}05'50", 58 A/2	NW-SE	200.00, 2.60	21.00	30.9-31.9, 149.9-150.9	20	Granite gneiss
5	Ambalavayal, 11^{0}36'25", 76^{0}13'45", 58 A/2	NE-SW	200.00, Dry	5.80		Dry	Granite gneiss
6	Koliyadi, 11^{0}37'10", 76^{0}16'45", 58 A/6	NW-SE	200.00, 0.30	11.50		24	Granite gneiss
7	Minangadi, 11^{0}39'45", 76^{0}09'45", 58 A/2	E-W	200.00, 8.10	15.0	15.6-17.6, 100-101	60.0	Horneblende gneiss
8	Sultan Battery, 11^{0}39'55", 76^{0}16'30", 58 A/6		200.00, 8.39	26.50	30.9-31.9, 149.9-150.9	130	Granite gneiss
9	Valavayal,11^{0}41'50",76^{0}11'50", 58 A/2	NW-SE	190.50, 5.41	7.60		480	Granite gneiss

10	Panamaran, $11^0$44'10", $76^0$04'20", 58 A/2	N-S	200.00, 5.50	16.70	43-44, 54-56, 97-98, 113-115	150	Horneblende gneiss
11	Niraval puzha,$11^0$44'20", $75^0$51'35", 49 M/14	EW	200.00, 5.56	16.00	102-103, 107-108, 195-196, 198-199	90	Charnockite
12	Ullissery, $11^0$45'15", $76^0$01'40", 58 A/1	E-W	83.80, 1.02	13.70	16-17, 66-67	300	Granite gneiss
13	Pulpally, $11^0$47'15", $76^0$10'46", 58 A/1	NW-SE	200.00, 14	13.60		110	Granite gneiss
14	Mananthavady,$11^0$47'15", $76^0$00'15", 58 A/1	E-SW	200.00, 9.325	23.80	44-45, 49-50, 141-142	610	Horneblende gneiss
15	Thalapuzha, $11^0$50'25", $75^0$56'45", 49 M/3	NW-SE	171.50, 1.67	15.40	16.6,27.80, 41, 81.70, 126, 170	175	Granite gneiss
16	Kartikulam, $11^0$50'50", $76^0$03'56", 58 A/1	NW-SE	200.00, Dry	29.10	Nil	Dry	Gabbro & Diorite
17	Tholpetti, $11^0$56'35", $76^0$03'35", 58 A/1	E-W	120.00, 10.98	23.30	24, 33, 39, 71, 77, 95, 101, 110	660	Granite gneiss

Annexure –2: Chemical Quality of Ground water in Wayanad district. (April 2009)

S:No	Location	pH	EC in us/cm at 25^0C	TH as $CaCO_3$	Ca	Mg	Cl	F	NO_3
				<----------Conc. in mg/L---------->					
1	Ambalavayal	7.92	266	44	14	2.4	28	0.35	45
2	Appappara	8.36	199	82	22	6.3	7.1	0.52	3.2
3	Chenad	7.91	150	46	12	3.9	11	0.34	9.8
4	Cheyyambam	8.45	481	164	24	25	60	0.73	2.9
5	Kalpetta	8.23	514	110	34	6.1	57	0.19	26
6	Kamblakat	7.88	165	40	10	3.4	11	0.36	28
7	Kartikulam	8.17	273	86	28	3.9	16	0.28	9.9
8	Kavumandam	7.88	96	24	7.2	1.5	8.5	0.2	5.3
9	Kellur	7.08	197	38	11	2.4	30	0.1	67
10	Koroth	7.09	85	28	9.6	0.97	8.5	0.19	4.4
11	Mannanthody	7.77	543	150	46	8.5	50	0.24	36
12	Meppady	7.46	162	30	9.6	1.5	26	0.24	14
13	Minangadi	7.89	361	84	23	6.3	40	0.39	43
14	Muthunga	8.02	334	92	26	6.8	28	0.24	6.8
15	Naykatti	8.21	419	112	34	6.8	48	0.39	17
16	Noolpuzha	7.82	151	46	9.6	5.4	5.7	0.43	2
17	Padinjarattara	8.59	104	36	10	2.4	5.7	0.21	0.93
18	Panamaram	-	173	28	8	1.9	26	0.3	7.8
19	Perikallur	8.15	522	145	38	12	68	0.34	21
20	Periya	7.82	41	6	2.4	0	5.7	0.12	4.2
21	Pozhutana	7.42	124	26	6.4	2.4	13	0.09	3.3
22	Pulpally	8.11	586	200	20	36	50	0.21	9
23	Sulthan Battery	8.03	641	135	24	18	96	0.32	8.5
24	Talapozha	7.72	96	24	8.8	0.49	13	0.35	2.1
25	Taruvana	7.45	124	24	5.6	2.4	21	0.39	10
26	Vaduvanchal	7.25	186	50	14	3.9	21	0.32	33
27	Valatt	7.64	113	42	15	0.97	5.7	0.19	5.8
28	Vyttiri	7.38	181	40	12	2.4	17	0.11	9.5
29	Vellamunda	7.2	68	18	4.8	1.5	7.1	0.12	2.4