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भारत सरकार

Central Ground Water Board

Ministry of Water Resources, River Development and Ganga

Rejuvenation

Government of India

Report

on

AQUIFER MAPPING AND GROUND WATER MANAGEMENT

Upper Cauvery Basin, Tamil Nadu

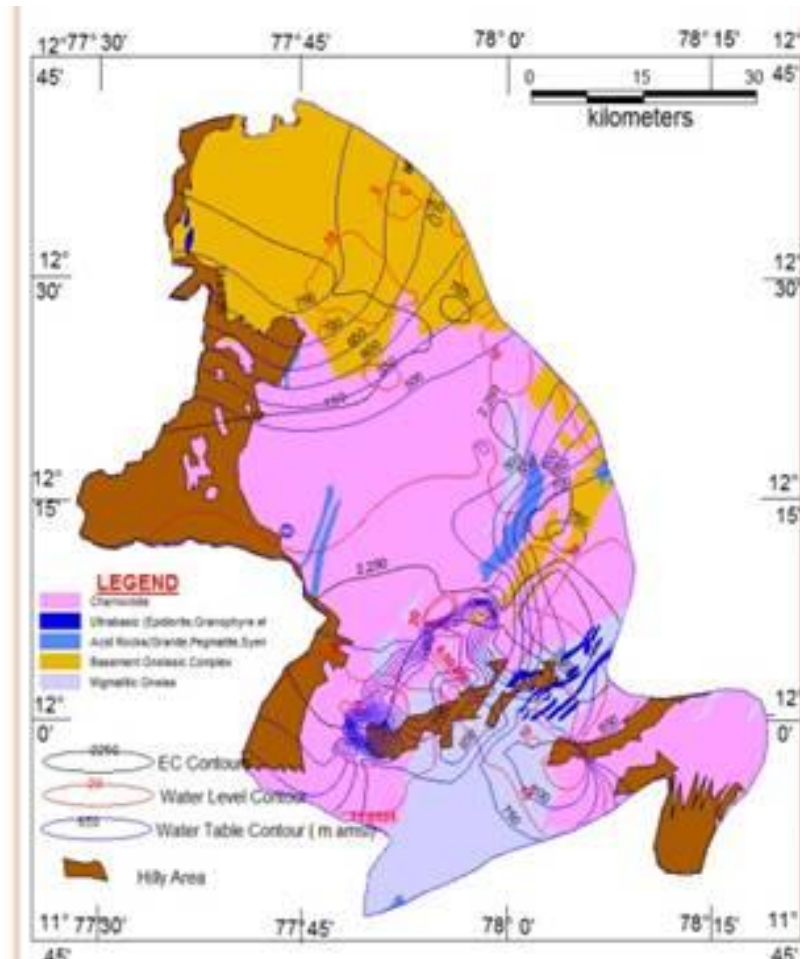
दक्षिण पूर्वी तटीय क्षेत्र, चेन्नई

South Eastern Coastal Region, Chennai



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REPORT ON AQUIFER MAPPING FOR SUSTAINABLE MANAGEMENT OF GROUNDWATER RESOURCES IN UPPER CAUVERY AQUIFER SYSTEM, TAMIL NADU



भारत सरकार

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Foreword

Groundwater is the major source of freshwater that caters the demand of ever growing domestic, agricultural and industrial sectors of the country. This renewable resource has been indiscriminately exploited in some parts of the country by several users as it is easily available and reliable. Intensive and unregulated groundwater pumping in many areas has caused rapid and widespread groundwater decline. Out of 6607 ground water assessment units (Blocks/ mandals / taluks etc.), 1071 units are over-exploited and 914 units are critical. These units have withdrawal of ground water more than the recharge (over exploited) and more than 90% of recharge (Critical).

Central Ground Water Board (CGWB) has taken up largest Aquifer mapping endeavour in the world, targeting total mappable area of country ~ 23.25 lakh sq. km with a vertical extent of 300 mbgl in soft rock areas whereas down to 200 mbgl in hard rock area. The extent of aquifer, their potential, resource availability, chemical quality, its sustainable management options will be addressed by National Aquifer Mapping (NAQUIM). The NAQUIM programme will also facilitate participatory management of ground water to provide long term sustenance for the benefit of farmers. Currently, focus is on ground water stressed areas of eight states comprising 5.25 lakh sq.km viz. Tamil Nadu, Haryana, Punjab, Rajasthan, Gujarat, Andhra Pradesh, Telangana, Karnataka and Bundelkhand region.

South Eastern Coastal Region, Central Groundwater Board, Chennai Under NAQUIM has been envisaged with the Mapping of an area of 70,102 sq.km during 2012-17 (XII five year plan) in Tamil Nadu and UT of Puducherry. This report deals with the Aquifer mapping studies carried out in water stressed upper Cauvery basin covering an area of 4561 sq .km with 3634 sq.km as mappable area. The basin comprises of drought prone districts of Dharmapuri, Krishnagiri and parts of Salem with 32 firkas (15 Over Exploited and 8 Semi-critical), and is mainly dependent on groundwater (85%) for its agricultural needs. The major issues in the basin include declining groundwater levels, non-sustainability of wells and high Fluoride concentration in some pockets leading to a risk of dental and skeletal fluorosis. Two aquifer units were deciphered with aquifer Unit - I being the weathered, occurs from ground level to 36 m bgl and Aquifer Unit –II is the fractured/Jointed zone existing from 11 to 140 m bgl (2-5 fractures are encountered). In order to arrest the declining groundwater levels and to improve the sustainability of wells, firka wise groundwater management plans were formulated.

I hope this report will be of immense use for the district administrators, water managers, stakeholders including farmers in knowing the aquifer disposition and properties through which managing the resources of the aquifer effectively.

A.Subburaj
Head of Office

EXECUTIVE SUMMARY

Aquifer mapping studies were carried out in the Upper Cauvery basin/aquifer system covering an area of 4541sq. km. covering districts of Dharmapuri, Krihnagiri and Salem districts of Tamilnadu. The data pertinent to geology, geophysics, hydrology, hydrochemistry was collected, synthesised and analysed to bring out this report. This report mainly comprises the Aquifer geometry and Aquifer properties of the study area which are considered to be measuring scales of groundwater availability and potentiality. Keeping these parameters in view a sustainable management plan has been suggested through which the groundwater needs can be addressed in a rational way.

The basin area experiences semi-arid climate with 875 mm of annual normal rainfall. About 51 thousand hectares of area is under groundwater irrigation in the basin and accounts for 11.6% of the geographical area. The main crops irrigated are paddy, sugarcane, groundnut, maize, cotton, ragi and other minor crops grown are turmeric, vegetables and flowers.

Main aquifers constitute, weathered zone at the top followed by a discrete anisotropic fractured/fissured zone at the bottom. Groundwater occurs under unconfined condition in the weathered zone and unconfined to semi-confined conditions in the fractured/fissured zone and flows downward from the weathered zone into the fracture zone. The predominant water levels are in the range of 5-20 m bgl during pre-monsoon season and are within 2-10 mbgl during post-monsoon season (2014). The net annual ground water availability is 282 MCM and the gross ground water draft is 335 MCM and the average stage of groundwater development is of 119%.

The fluoride levels in the ground waters of the basin exceed the permissible limit of 1.5ppm in few parts of Dharmapuri and Krishnagiri districts due to geogenic contamination. This problem is addressed through drinking water supply to the affected villages from Hognekal reservoir.

Aquifer systems from the area can be conceptualized as weathered zone down to ~36m and fractured zone between ~20-200 m bgl. The weathered zone is disintegrated from the bed rock (upper part–saprolite zone) and partially/semi weathered in the lower part (sap rock zone) with transmissivity varying between 5–20 m²/day and specific yield of 1-3 %. The fractured zone is fractured gneiss or Charnockite which occur in limited extent, associated sometime with quartz

vein. The average transmissivity of this zone varies between $<1-30 \text{ m}^2/\text{day}$ and storativity varies from 0.0002 to 0.001.

Fast growing urban agglomerations shares the groundwater which otherwise is being used for irrigation purpose resulting in either shortage for irrigation needs or creates excessive draft to meet the both demands in groundwater potential areas. The study formulates management strategies for supply side as well as demand side. The supply side measures include construction of artificial recharge structures of 302 Check dams, 421 Percolation ponds, 300 recharge shafts in addition to the 689 ponds earmarked for rejuvenation with recharge shafts in all the 15 OE firkas of the basin. The estimated cost for construction of these structures is to be Rs. 308 Crores. The estimated recharge to groundwater system through these structures will be in the order of 61.75 MCM with an average rise of water levels of 2.28m/year. In addition water conservation plan is proposed through low pressure water distribution system in 1391 Ha irrigation area and digging of 1362 farm ponds which support storage as well as recharge. The expected savings in groundwater through this water conservation plan is estimated as 10.8MCM/year.

The existing regulatory measures may be modified suitably for optimal utilization of groundwater as well as for sustainable development of rural agricultural based economy. To achieve this goal opinion pool has to be obtained from more user groups and valid suggestions of may be incorporated in the regulatory acts.

**REPORT ON
AQUIFER MAPPING FOR SUSTAINABLE MANAGEMENT OF
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GROUNDWATER RESOURCES IN UPPER CAUVERY BASIN, TAMIL NADU**

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AQUIFER MAPPING AND MANAGEMENT PLAN FOR UPPER CAUVERY AQUIFER SYSTEM, TAMIL NADU

1.0. INTRODUCTION

National Project on Aquifer Mapping (NAQUIM) initiated by Ministry of Water Resources, River Development and Ganga Rejuvenation, Government of India with a vision to identify and map the aquifers at the micro level with their characteristics, to quantify the available groundwater resources, propose plans appropriate to the scale of demand and institutional arrangements for participatory management in order to formulate a viable strategy for the sustainable development and management of the precious resource which is subjected to depletion and contamination due to indiscriminate development in the recent past.

Ground water is being increasingly recognized as a dependable source of supply to meet the demands of domestic, irrigation and industrial sectors of the country. The development activities over the years have adversely affected the ground water regime in many parts of the country. Hence, there is a need for scientific planning in development of ground water under different hydrogeological situations and to evolve effective management practices with involvement of community for better ground water governance.

Aquifer Mapping has been taken up in Upper Cauvery aquifer system/basin in a view to formulate strategies for sustainable management of the groundwater resource which help in drinking water security and improved irrigation facility. It will also result in better management of vulnerable areas.

1.1.Objective:

The objectives of the aquifer mapping project in Upper Cauvery can broadly be stated as

1. To define the aquifer geometry, type of aquifers and ground water regime behaviors,
2. Hydraulic characteristics and geochemistry of two-layered aquifer systems on 1:50,000 on a 3-D section
3. To develop an Aquifer Information and Management System for sustainable management of ground water resources based on the aquifer maps prepared.

4. And to involve the local community for self governance so that the user community will be aware of the available resource and shoulder responsibility in proper optimal utilisation.

1.2. Scope of the Study:

The important aspect of the aquifer mapping programme is the synthesis of the large volume of data already generated during specific studies carried out by Central Ground Water Board and various Government organizations with a new data set generated that broadly describe the aquifer system. The available generated data are assembled, analysed, examined, synthesized and interpreted from available sources. These sources are predominantly non-computerized data, which is to be converted into computer based GIS data sets.

Data gaps have been identified after proper synthesis and analysis of the available data collected from different state organisations like TWAD Board, PWD, Agricultural Engineering Department. In order to bridge the data gap, data generation programme has been formulated in an organised way in the basin. Exploration work has been carried out in different segments of the basin and aquifer parameters have been estimated. Groundwater monitoring regime has been strengthened by establishing additional monitoring wells. 2D and 3D sections have been prepared twice, one prior to the generation of data based on the data collected, assembled and synthesized through different sources and two, after generation of data at identified gaps. The latter prepared maps are of more realistic as the data points are more closure.

1.3. Approach & Methodology:

Multi-disciplinary approach has been adopted involving geological, geophysical, hydrological and hydrogeological and hydrogeochemical components of study on toposheet scale of 1:50000 to meet the objectives of study. Geological map of the basin has been generated based on the GSI maps, geophysical data has been generated through vertical electrical soundings and geoelectrical layers with different resistivities have been interpreted in corroboration with the litho stratigraphy of the observation wells and exploratory wells down to depths of 200m bg. Hydrological and Hydrometeorological_data has been collected from state PWD and IMD departments. Drainage, Soil and Geomorphology of the basin is compiled based on the maps collected from Water Resources Department, Anna University, Chennai.

Based on the data gap analysis data generation process has been scheduled through establishing key observation wells, pinpointing exploratory sites, collecting geochemical samples in order to study groundwater regime, geometry of the aquifer and aquifer parameters, and quality of the groundwater respectively. Groundwater recharge and draft have been computed through different methods and resources of the basin estimated through groundwater balance method. A three-dimensional mathematical model of regional groundwater flow was used.

to provide a mechanistic description of groundwater flow in the aquifer system of Upper-Cauvery basin. The model was simulated using the finite-difference approximation of three-dimensional partial differential equation of regional groundwater flow and was calibrated for steady and transient conditions to forecast the dynamic groundwater flow under different recharge and stress conditions.

Based on the above studies Management strategies have been evolved for augmentation of groundwater through artificial recharge and water conservation and formulated plans for sustainable management of the resource.

1.4. Area:

The Cauvery river enters Tamil Nadu at Hognekal of Dharmapuri district from the west and takes a southern course from Mettur and again takes south-eastern course at Erode and then flows to Bay of Bengal flowing through Trichirapalli, Thanjavur and Cuddalore districts. The study area forms part of Cauvery basin, which lies on left banks of Cauvery river. The total area of the basin is of 4541 sq.km. mainly drained by Chinnar river, tributary of Cauvery which confluences at Hognekal of Dharmapuri district. The other tributaries flows in the selected area for study are Doddahalla, Nagavati and Thoppaiar. Out of the 4541 sq.km total area, hilly part consists of 907 sq.km and the rest 3634 sq.km is mapable and falls in three different districts of Tamil Nadu viz., Krishnagiri, Dharmapuri and Salem. The area lies between $11^{\circ}46'$ and $12^{\circ}42'$ north latitudes and between $77^{\circ}29'$ and $77^{\circ}29'$ east longitudes and falls on Survey of India toposheet numbers 57H/7,8,10,11,12,14,15,16,57L/3,4,8,58E/9,13, and 58I/1&5.

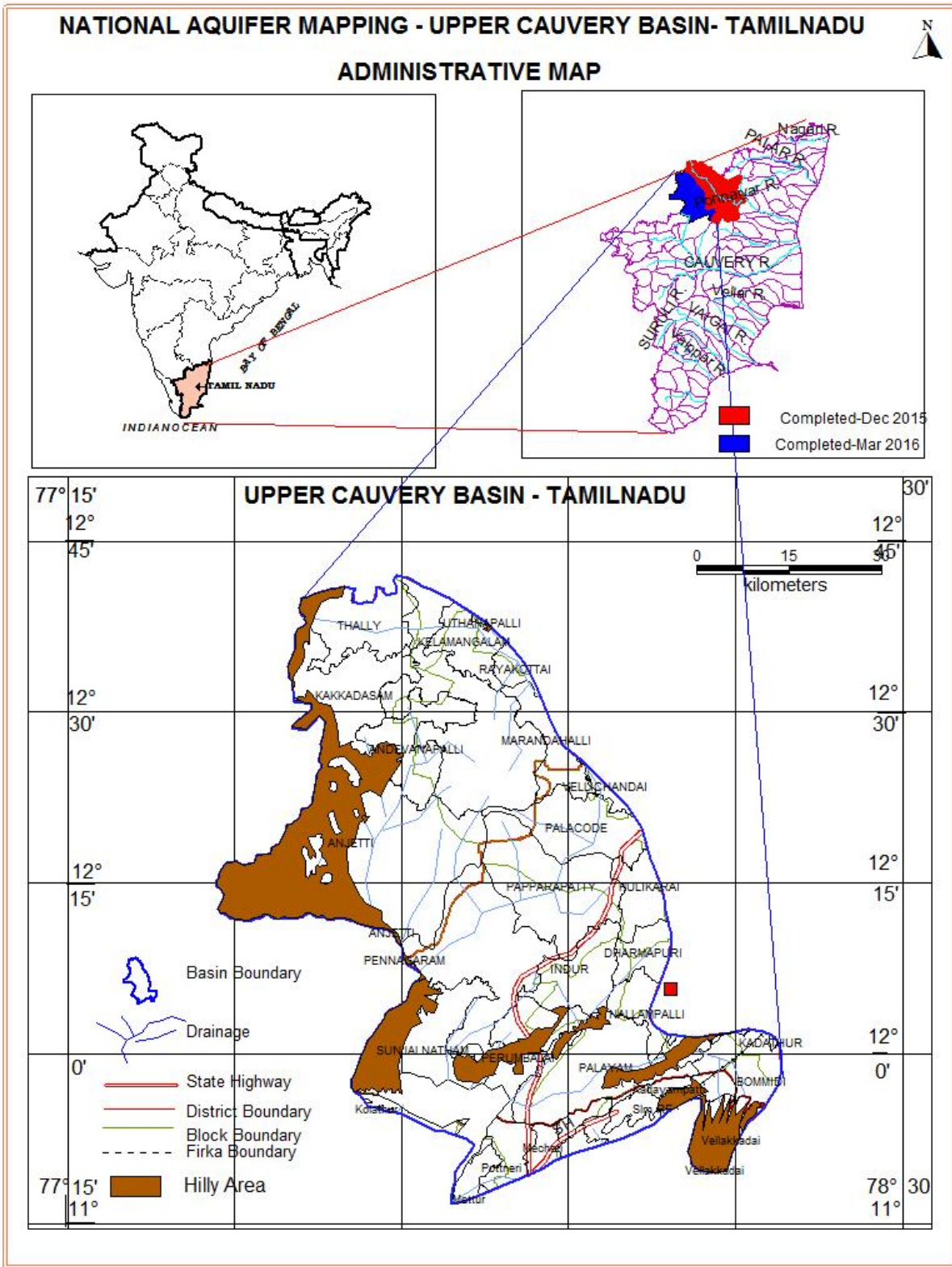


Fig. 1.1. Location and administrative map of the basin

1.5. Data availability

During the Aquifer mapping period, existing data of CGWB i.e. exploration, depth to water level, water quality, geophysical logging and ground water resource data have been collected and compiled. In addition to this, Bore well data, Water quality & Water level data have been collected from Tamil Nadu water Supply and Drainage Board. Cropping pattern and Soil data has been collected from Agricultural Department. Groundwater level and groundwater exploration data have been collected from Public Works Department. Thematic layers such as geology (GSI) soils, land use/landcover, geomorphology, etc., from various State Government agencies has been collected, compiled and used in this study.

1.6. Data adequacy

Exploratory well data is available for 122 wells drilled by CGWB and State Departments. Water level and Water Quality monitoring data for 23 Observation wells is available for a period of more than ten years. Landuse, Cropping and irrigation data has been collected from Statistical department. After plotting the available historical data on 1:50,000 scale maps, data gaps have been identified and data generation process has taken up in those gap areas to complete the Aquifer map on the desired resolution of 1:50,000 toposheets.

1.7. Data Gap Analysis & Data Generation:

As per the guidelines of data gap analysis for aquifer mapping, it is proposed to have 98 monitoring wells to monitor the regime of the first aquifer and 8 bore wells for the second aquifer monitoring and to know aquifer parameters. 98 Dug wells have been established to monitor the first phreatic aquifer and 6 bore wells drilled down to a depth of 200m bgl to know the aquifer characters of semi-confined aquifer system which is extensively developed in recent years. It is also proposed to carryout quality monitoring through 65 established dug wells for first phreatic aquifer and through 67 irrigation/domestic bore wells for the second semi-confined aquifer and collected water samples from all the 132 wells and analysed in order to assess the groundwater quality for drinking and irrigation purposes. Similarly as per the proposed data gap analysis of aquifer mapping, 52 VES have been taken up down to the depth of 200 m bgl to know the vertical characteristics of the aquifer down to 200m.

1.8. Climate and Rainfall

The basin area experiences tropical climate being hot and dry for the greater part of the year. The period from March to June is generally hot. The temperature ranges from 20° to 40°C. The area receives rainfall through both south-west and north-east monsoons. About 40 percent of the precipitation is contributed by south-west monsoon and north-east monsoon accounts for 30 to 40 percent. The average annual rainfall for the basin area is 875mm.

1.9. Physiography:

The study area is Upper Plateau Region of Tamil Nadu with many hill ranges and undulating plains in between. The highest peak in the basin is Devarabetta (1026mamsl) located in Tali reserve forest area from where the river Chinnar (Sanatkumara) river the tributary of Cauvery, which drains major area of the basin under study. Chinnar river flows towards east from its origin on west of Tali, from the hills of Tali Reserve Forest, till it reaches south of Kelamangalam; and takes a Southern turn at Marandahalli and follows south and reaches Chakkilinnattam and again changes its course towards south-west and joins Cauvery at Uttamalai. Many small swift streams join Chinnar drained from the hill ranges on either side of the Chinnar course.

1.10. Geomorphology:

The western part of the basin is covered with series of hill ranges and form upland. Many lower order streams flowing from this upland region join Doddahalli and Chinnar rivers. Pediments form on northern and eastern parts of the basin. More than ninety percent of the area is occupied by upland and pediment zones. Structural and residual hills, pediplains and Bajadas are the other geomorphic features manifested in the basin in lower proportion. Habitation and agricultural practices are more common in pediment areas, whereas and the Upland zone is fully forested.

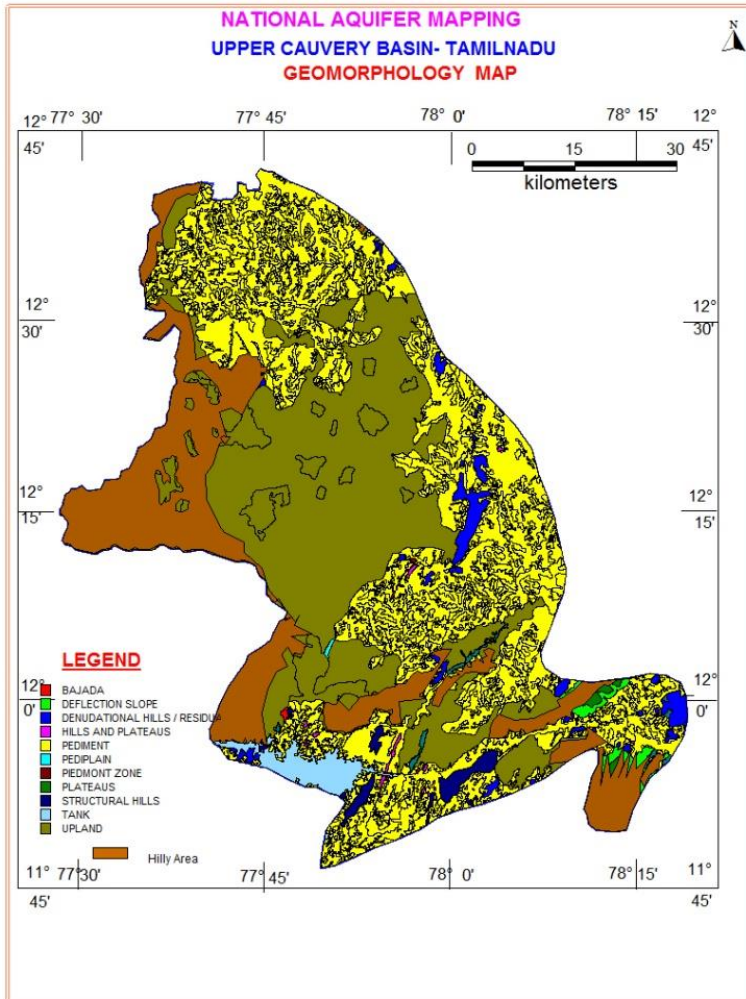


Fig. 1.2. Geomorphology

1.11. Land use:

Forests occupy major part of the basin (43%), mainly on western and southern parts of the study area. Deciduous and Evergreen forests occupy one third area each and the other one third area is occupied by scrubs and other forests. The cropping area is 33% of the basin area and 10% of the area is under plantation, mainly consisting of coconut and mango plants. Fallow land accounts for 3% and rural settlements confined to only 1% of the total geographical area. Water bodies including Mettur reservoir and irrigation tanks etc., spread over 3% of the geographical area. The remaining part of the basin is occupied by scrubs and stony waste.

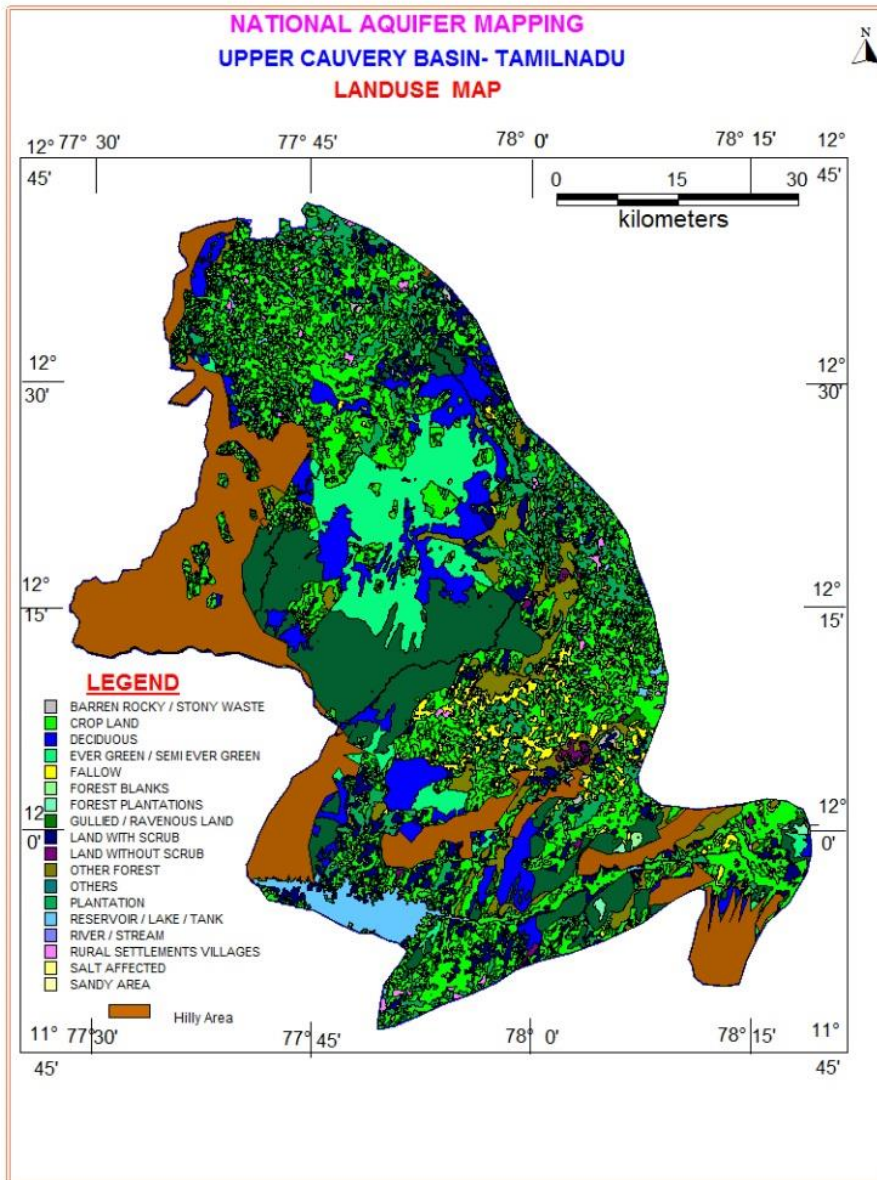


Fig. 1.3. Land use

1.12. Soils:

The soils of the basin mainly consist of black and mixed loam red ferruginous. The black or regular loam is very fertile due to its moisture absorbing character. On the other hand the red ferruginous soil is good for plant productivity. The soils in the basin are generally deep, loose and friable with its colour varying from red to dark reddish brown. The soils of the basin have low nitrogen and phosphate content. The highly undulating terrain in the basin especially in the upper reaches accelerates run-off causing soil erosion.

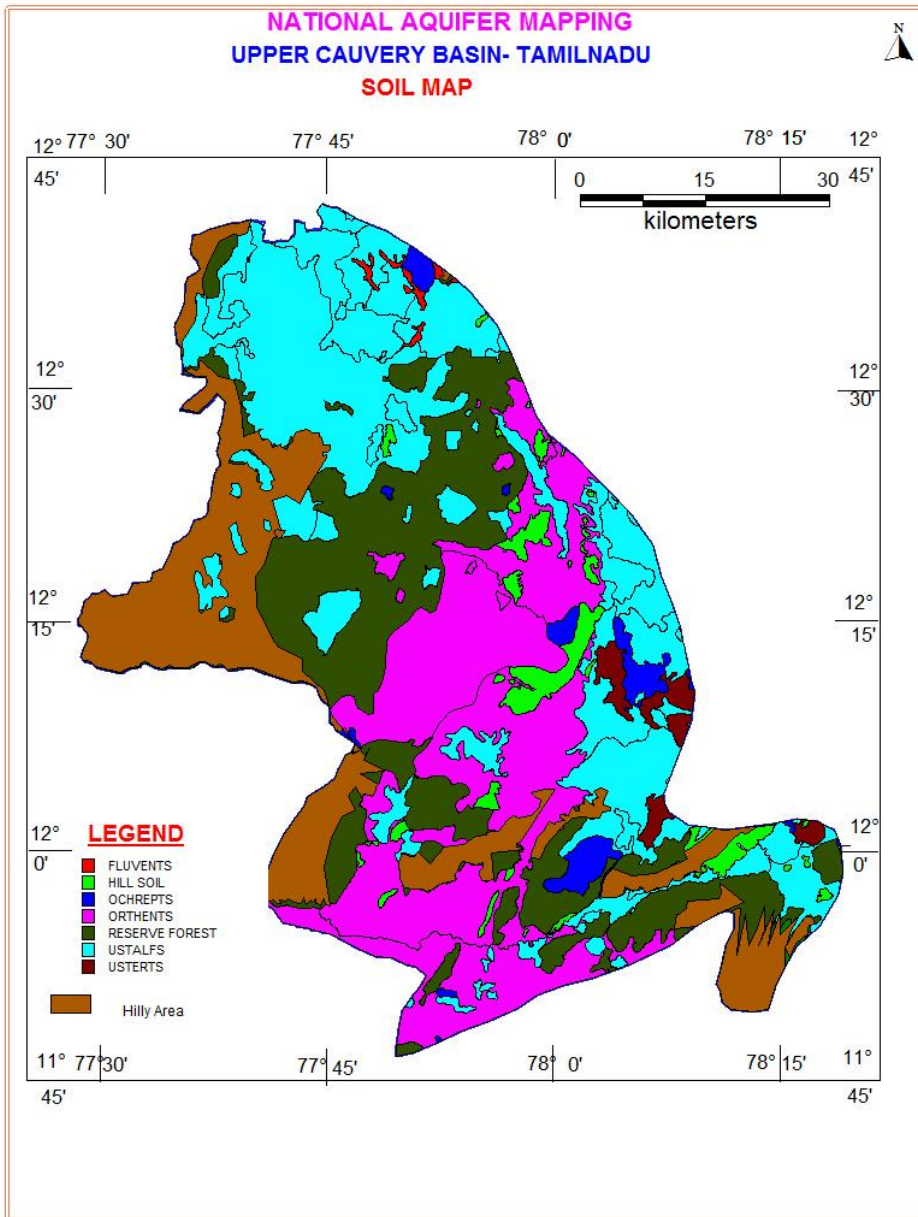


Fig. 1.4. Soils of the basin

1.13. Hydrology and Drainage :

Doddahalla, Chinnar, Nagavati and Thoppaiyar are the rivers form the Study area and all these are tributaries of Cauvery river. Doddahalli mainly drains forest area of northern basin. The Chinnar also known as Sanatkumara Nadi originates in the State of Karnataka and enters Tamil Nadu at Tali and it has a south-easterly course upto Marandahalli from where it takes a southerly

course till it meets Pikkili Malai hills from where it takes a south-westerly course until it joins the Cauvery river immediately after Hoghenakkal Water Falls and drains major part of the study area. The other two rivers Nagavati and Thoppaiyar originate from Pikkili and Yercud hills respectively and flows south-westerly and westerly respectively and join Cauvery river at Stanley Reservoir at Mettur.

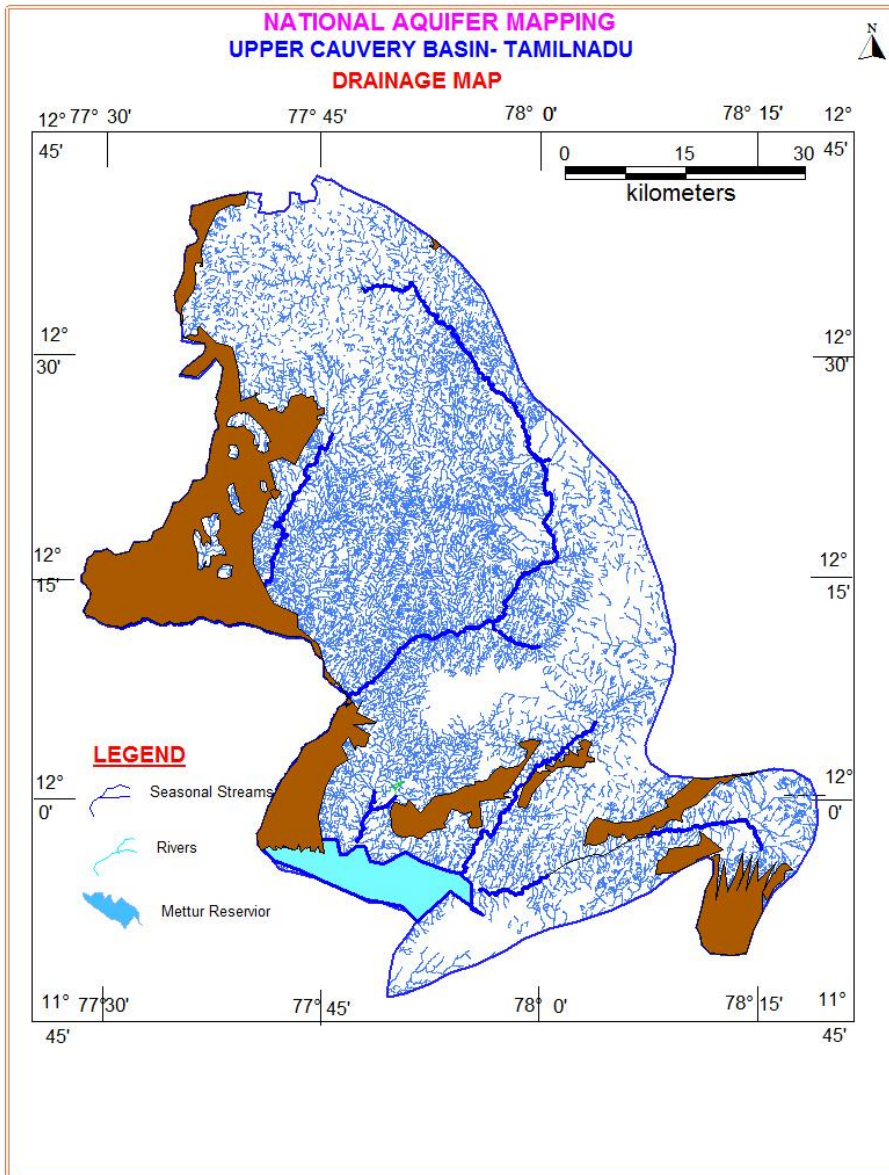


Fig. 1.5. Drainage of the basin

1.14. Agriculture:

Agriculture is the main stay of the rural population in the entire study area. The main crops irrigated are Paddy, Sugar cane, groundnut, Maize, cotton, Ragi etc., and other minor crops are turmeric, flowers and vegetables.

1.15. Irrigation:

The total area irrigated under different crops is 50,928 Ha out of the total geographical area of 4,38,300Ha, which accounts for 11.62%. Out of the 32 firkas of the basin the highest area under irrigation is in Bommadi (30% of firka area) followed by Marandahalli (27.8%), Pulikarai (27.6%), Uthanapalli (27.63%), Palakodu (21.4%); while the lowest area irrigated in Mettur, Semmandapatti and Pottaneri firkas (<3% of the respective geographical area). The irrigation area within the basin is relatively more in Dharmapuri district part followed by Krishnagiri and Salem district parts.

1.16. Recharge Practices:

Ground water is being augmented through the recharge structures by departments/ agencies of State such as, Agricultural Engineering Department, Agricultural Department, PWD, TWAD Board and Forest Department. In addition, recently PWD is taking up Repair, Renovation and Restoration (RRR) of surface water bodies with central fund, which will be of immense use in groundwater augmentation in addition to the increase in storage capacity of the tanks.

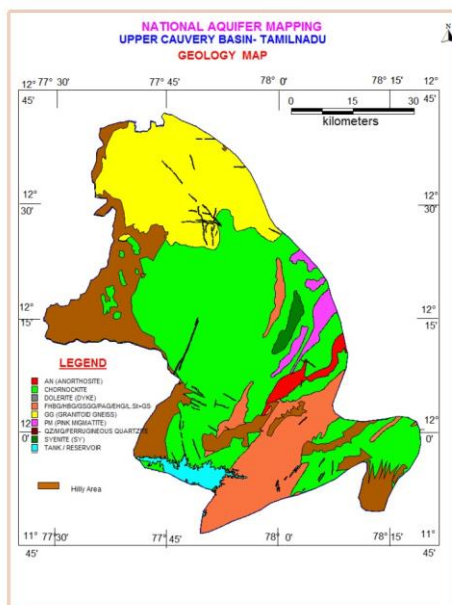


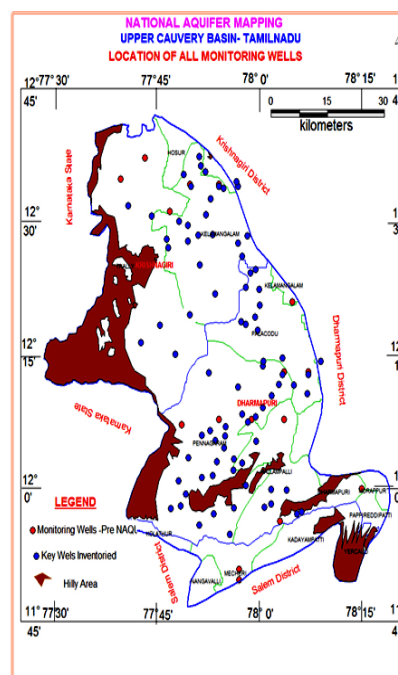
Fig. 1.6. Geology of the basin area

2. Data Collection and Generation.

Periodical data pertaining to water levels, pumping tests and slug tests were collected during aquifer mapping studies apart from water sample collection to assess the groundwater quality. In addition Geophysical data has been generated through conducting Geo electrical soundings after evaluation of data gap analysis.

2.1. Hydrogeological data:

The periodical monitoring of ground water level implies the groundwater recharge and discharge (natural and manmade) occurring in the aquifer systems. It also reveals that the interaction between surface and sub-surface water systems. In Upper Cauvery basin, 23 no's of groundwater monitoring wells established earlier to the present study were monitored periodically. To fill data gap in the basin, 97 additional wells were established and monitored periodically during the five year aquifer mapping study period in order to record the temporal and special changes in aquifer system. The details of monitoring wells are presented as Annexure-1. The locations of the monitoring wells are presented in **Fig.2.1**. The groundwater level monitoring was carried out four times in an year since May 2014 to Jan 2016.



Pumping test data of 8 bore wells was collected from both PWD (Groundwater), Dharmapuri, Govt.of Tamil Nadu and CGWB and results were tabulated in table No.1.

Table-1 : Pumping test data

Sl.	Location, Well number ,	Lithology	Results of aquifer performance test						
No.	Co-ordinates,		SWL (mbgl)	Discharge (lps)	Specific capacity (lpm/m of Draw down)	T (m2/day)	S	K (m/Day)	Specific yield(%)
	Toposheet Number		Date						
	and R.L. of G.L. (mamsl)								
1	KELAMANGALAM(EW)	Charnockite and Granite Gneiss	11.25	1.65	5.18	8.58	2.6 x		
	(12° 36' 10";77° 51' 50"-57 H/11) 788.29		--			Average	10-3		
	KELAMANGALAM(OW-I)		4.98	1.76	26.59	12.14	2.6 x		
	(12° 08' 38"; 77° 52' 33"-57 H/11) 788.29		18.1.88				10-3		
	KELAMANGALAM(OW-II)	Sand withKankar, Granite		1.65	5.89	--	1.4 x10-3		
2	DODDALAMPATTI	Charnockite		3.85	8.3	19.93		3.54	
	12°13'55":78°03'45'								
3	PAPPARAPATTY	Charnockite		2.31	2.59	24.56		0.6	
4	NAKKALAPATTI	Charnockite		0.24	1.248	3.17	0.0003	0.27	0.03
	12°12'30':78°06'05'								
5	ALAMARATHUPATTY	Charnockite		0.01	0.012	0.702	0.0001	0.012	0.01
	12°10'30':78°01'50'								
6	PIKKILI			0.42	10.42	31.01	0.0378	12.92	3.78
	12°14'15':78°01'30'								
7	KOTTUR			0.174	3.3	9.09	0.0052	2.88	0.5
	12°18'20':77°58'20'								
8	MARANDAHALLI			0.023	0.024	0.856	0.00001	0.015	0.001
	12°10'30':78°06'05'								

Slug tests were conducted on 8 exploratory wells drilled by CGWB during the study period and shown as Table-2.

Table2: SLUG TESTS DETAILS

Sl.No	Location	Co-ordinates		Depth of the well(mbgl)	Lithology	Static water Level(bgl)	T(m ² /day)
1	Mugulur	12°32"40'	78°01"11'	176.1	Migmatite	71.4	1.2
2	Odayandahalli	12°29"15'	78°01"24'	101	G.Gneiss	10.85	1.47
3	Maniyambadi	12°27"00'	77°47"06'	200	Charnockite	24.03	0.42
4	Geddahalli	12°25"12'	77°51"12'	200	G.Gneiss	5.14	4.5
5.	Somanahalli	12°08"27.6'	78°01"39'	100	Charnockite	8.03	34.56
6	Elagiri	12°2"36'	78°04"5.3'	100	G.Gneiss	10.01	9.8
7	Anjatti	12°20"00'	77°43"00'	300	Granite	11.20	1.40
8	Konagihalli	12°08"01'	77°58"510'	181.18	G.Gneiss		0.193

2.2. Hydro chemical data:

The groundwater quality of the basin was studied by collecting water samples from dug well and bore well. The sample locations were plotted on the map and identified data gap In the basin, groundwater quality of 12 nos wells were monitored periodically. To fill data gap in the basin, 132 nos of water samples were collected. Water samples have been collected from the study area in different aquifers (Aquifer unit - I & Aquifer unit -II, **Fig- 2.2**) to assess the groundwater quality for drinking and irrigation purpose. The analytical results are given as (Annexure-1I) & (Annexure-III) for aquifer unit I &II respectively.

Ground water quality data has been collected from TWAD, Govt. of Tamilnadu in respect of 6119 locations.

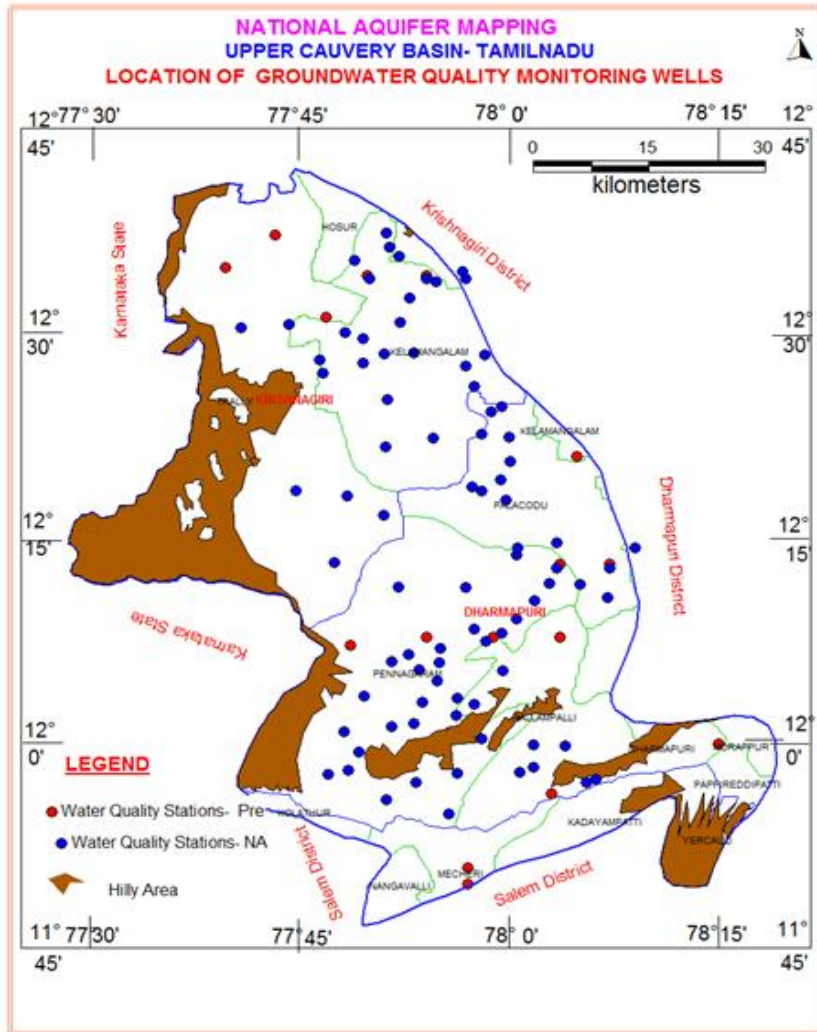


Fig 2.2 Location of Groundwater Monitoring Wells

2.3. Geophysical data:

The geophysical survey was conducted in the study area consisting of Vertical Electrical Soundings (VES) by employing Schlumberger configuration with maximum half current electrode separation of 300m. The objective of the study area is to decipher the sub surface conditions such as weathered and fractured layer resistivity and thicknesses and massive formations up to the depth of 200 m. A total number of 52 VES were carried out and geo electric layers inferred through interpretation of the results obtained. The locations of the VES are presented in the following **Fig-2.3**.

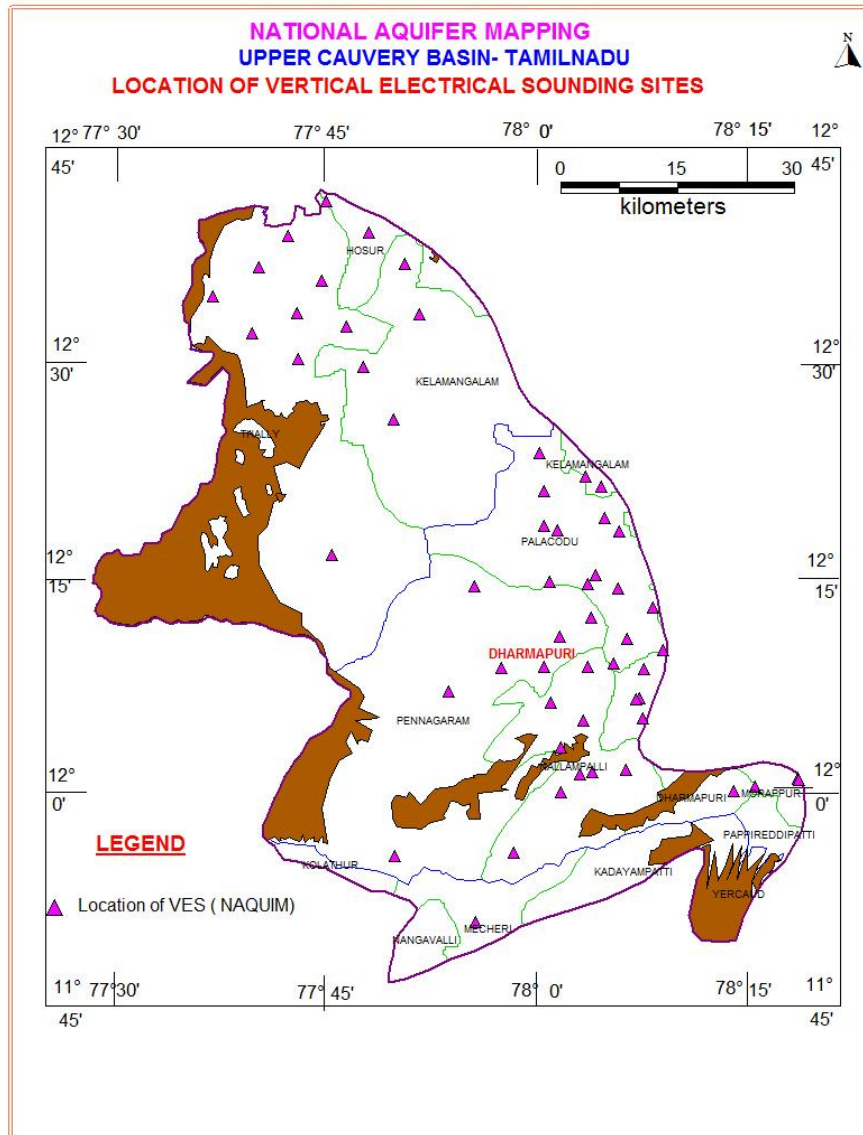


Fig. 2.3 Location of Vertical Electrical Sounding Sites

2.3.1.Data acquisition and interpretation

The Vertical Electrical Soundings (VES) were conducted in the survey area and the data acquired by deploying the CRM 500 Aqua meter and WDDS-2/2B Digital Resistivity meter by adopting the Schlumberger electrode configuration with a maximum current electrode separation (AB) of 400m. The data was processed and interpreted by IPI2Win software developed by Moscow State University, after marginally modifying the manually interpreted results in corroboration with geology and hydrogeology.

Table,3: Geophysical Inferred data.

Sl.No	Location	LAT	LONG	Thickness (m.)					Inferred depths of Fractures in m
				RL	Top Soil	Weath er ed	Fractured	Massive	
1	BIKKAMPATTI	12.14	78.00	469	2.5	16	Nil		NIL
2	PANGUNATTAM	12.10	78.01	465	0.7	7.3	25	200	8, 15, 25
3	SOMISETTIPATTI	12.02	78.06	487	1.6	18.4	60	200	15, 20, 60
4	JARUGU	12.00	78.02	463	2.8	7.2	50	200	8, 40, 50
5	THADANGAM	12.11	78.12	475	1.5	13.5	185	200	15, 20, 50, 65.
6	ADAGAPADI	12.15	78.09	467	1.5	11	110	200	45, 55, 110
7	NAGARKUDAL	12.08	78.05	368	0.5	17	25	200	20, 25
8	ERRAPATTI	12.05	78.03	363	0.5	8.5	80	200	10, 15, 20, 30.
9	ATHIYAMANKOTTAI	12.10	78.13	484	0.5	2.5	50	200	50
10	KONDAGAPATTI	12.00	78.23	452	0.9	3.5	70	200	50, 60, 70
11	ALAMARATHUPATTI	12.18	78.03	495	1	17.5	90	200	20, 75, 90
12	MARENAHALLI	12.14	78.06	460	0.5	11.5	60	200	15, 60
13	PIKKILI	12.24	78.01	532	0.8	15.2	30	200	20, 30,
14	MARANDAHALLI	12.39	78.00	588	2	20	60	200	25, 40 & 60
15	MALLAPURAM	12.35	78.00	576	3	9	20	200	20
16	PUDUR	12.36	78.17	508	2	16	180	200	50, 150 & 180
17	AATTUKOTTAI	12.31	78.00	528	1	10	150	200	50 & 150
18	BOPPADI	12.30	78.02	524	1	17.5	60	200	25 & 60
19	ODAYANDAHALLI	12.48	78.01	700	1.5	10	50	200	15, 50
20	BAALEYANURKOTTAI	12.51	78.05	653	0.6	5.6	150	200	40, 80, 120 &
21	PATTIPAARA	12.51	78.58	578	1.6	11	30	200	30
22	MUGALUR	12.54	78.03	695	1.0	13	120	200	60, 80 & 120
23	DODDATIMMANAHALLI	12.62	77.91	716	2.0	15	-	200	-
24	NAAGAMANGALAM	12.56	77.94	697	1.5	30	-	200	-
25	NAAGADUNAI	12.56	77.91	740	1.5	30	60	200	60
26	IRUTAALAM	12.58	77.9	803	1.0	25	80	200	80

27	MUDHAMPATTI	12.54	77.98	752	1.5	25	60	200	60
28	KUTHANDAHALLI	12.47	77.97	617	2.0	25	-	200	-
29	KURUMARAKOTTAI	12.41	77.98	617	2.5	30	-	200	-
30	ULAGAMPATTI	12.37	77.99	622	1.5	6	40	200	40
31	VELANGAADU JUNCTION	12.38	77.97	613	3.0	25	-	200	-
32	KELAMANGALAM	12.61	77.86	776	2.0	10	80	200	60 & 80
33	KAARUKKONDAPALLI	12.34	78.00	788	2.0	7.5	50	200	50
34	KUTTUR	12.62	77.82	785	2.0	12.5	-	200	-
35	DODDA BELUR	12.58	77.83	788	1.0	20	50	200	25 & 50
36	GOWTHALAM	12.57	77.83	794	1.3	15	150	200	60 & 150
37	PACHAPPANATTI	12.56	77.85	797	2.0	10	30	200	30
38	LAKSHMIPURAM	12.54	77.87	767	3.0	10	-	200	-
39	KOTTAIULIMANGALAM	12.53	77.76	930	1.0	4.0	30	200	30
40	KANDAGAANAPALLI	12.51	77.73	950	1.0	20	-	200	-
41	MANIYAMBADI	12.44	77.79	806	2.4	5	30	200	30
42	JAARKALATTI	12.5	77.83	802	1.3	15	150	200	150
43	GOVINDAPALLI	12.47	77.89	886	3.0	15	-	200	15
44	THIPPASANDIRAM	12.47	77.85	804	3.0	20	-	200	20
45	GADDAHALLI	12.42	77.85	886	1.5	20	-	200	20
46	SAPPARANAPALLI	13.2	80.11	800	1.5	20	-	200	60
47	SANDANAPALLI	12.47	77.82	856	2.0	10	30	200	30
48	PANCHAPATTI	12.45	77.94	633	1.0	15	40	200	40
49	BELAMAARANAHALI	12.32	77.99	520	1.0	5	50	200	50
50	BELLUHALI	12.32	77.95	604	3.0	25	-	200	-
51	DODDABHAVILI	12.34	78	567	2.0	10	-	200	-
52	SIRIYANAHALI	12.31	77.99	538	2.0	10	-	200	-

2.4 Groundwater Exploration data:

A total of 27 Nos of exploratory wells were drilled in the basin under groundwater exploration activity of the Central Ground Water Board, SECR, Chennai prior to National

Aquifer Mapping project. These wells were plotted on the 1:50,000 scale topographical map. As per the National Aquifer Mapping guidelines for the hard rock, data requirements were identified on the plotted topographical map. Based on the data requirements, 9 nos of exploratory wells were drilled in the aquifer mapping area of the basin as part of the data generation. **(Fig-2.4)** The data such as lithology, fracture depth, yield, water level, aquifer properties were generated and utilised to depict the prevailing aquifer systems of the basin **(Annexure-1Va)**.

Similarly wells drilled by state department of about 100 no,s wells data has been collected and used for aquifer mapping studies. **(Annexure-1Vb)**.

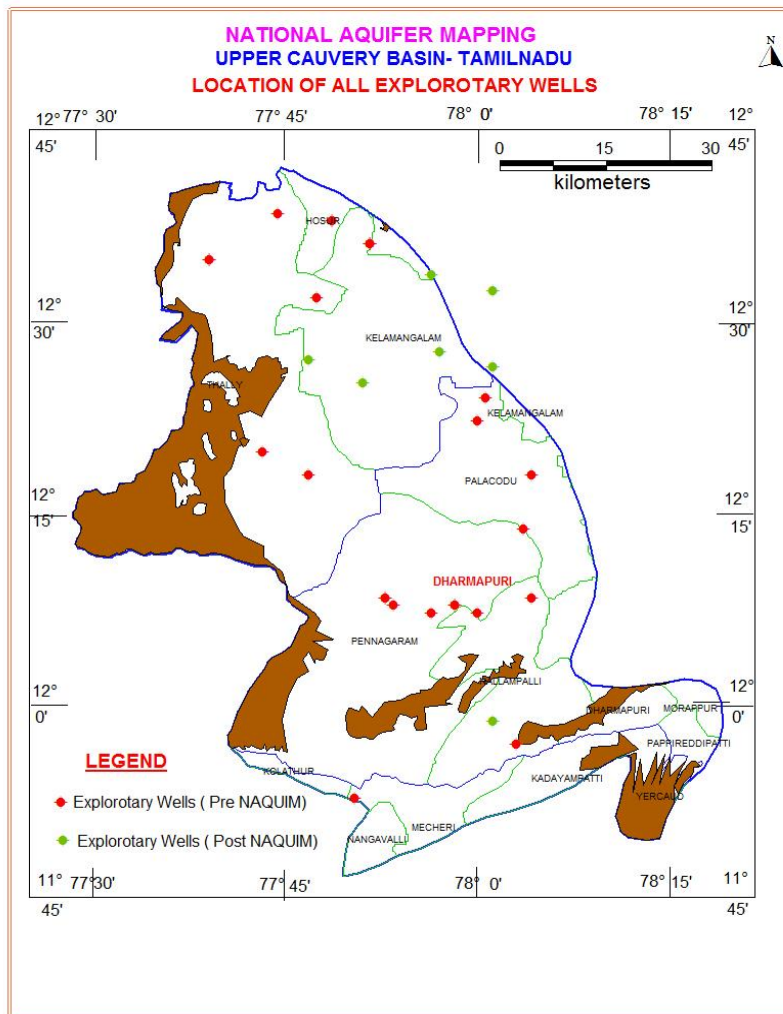


Fig 2.4 Location of all Exploratory Wells

3. Data Interpretation, Integration and Aquifer Mapping

3.1 Hydrogeological Data Interpretation

3.1.1 Groundwater Level

During Aquifer Mapping studies in Upper Cauvery Basin 23 Groundwater monitoring wells which were monitoring regularly were used along with 97 key wells established (**Fig:2.1**) in different formations in order to know the behaviour of the groundwater regime. Out of total 98 wells 46 wells were established in Charnockite, 41 wells were established in Gneiss, 4 wells in Granite, 3 each in Hornblende gneiss and Migmatite formation respectively. The water levels were monitored from May 2014 to Feb 2016(four times in a year). The depth of key wells ranged from 6.00 to 28.75 mbgl.

3.1.1.1 Depth to Water level for aquifer I (May2014)

Based on the data of key well inventoried and NHS wells, the water level data pertaining to the period of May 2014(pre monsoon) was used for the preparation of depth to water level map of the basin (**Fig-3.2**). The depth to water level during May 2014 is varied from 2.85 mbgl (Melur, Kelamangalam block) to 21.55mbgl (Vellakkal, Nallampalli block). Depth to water level ranging from 0 to 2 mbgl was not observed during this period. Water level ranging from 2 to 5 mbgl is shown in 12 wells (12.37%), water level ranging from 5 to 10 mbgl shows in 42 wells (43.29%). Water level ranging from 10 to 20 mbgl is shown in 41wells (42.27 %), only 2 wells (2.1%) shows water level more than 20 mbgl during May2014. Major part of the basin shows water level in the range of 5 to 20mbgl. Only few patches recorded water level in the range of 2 to 5 mbgl and found in North eastern portion and Southern central portion of basin. One patch having water level more than 20 mbgl is found around Vallakkal of Nallampalli block in the central portion of basin. Water levels ranging 5 to 10mbgl are observed in the whole Thally block, southern part of Kelamangalam block, western part of Palacode block, central part of Pennagaram block, southern part of Nallampalli block and northern part of Kadayampatty blocks of the basin.

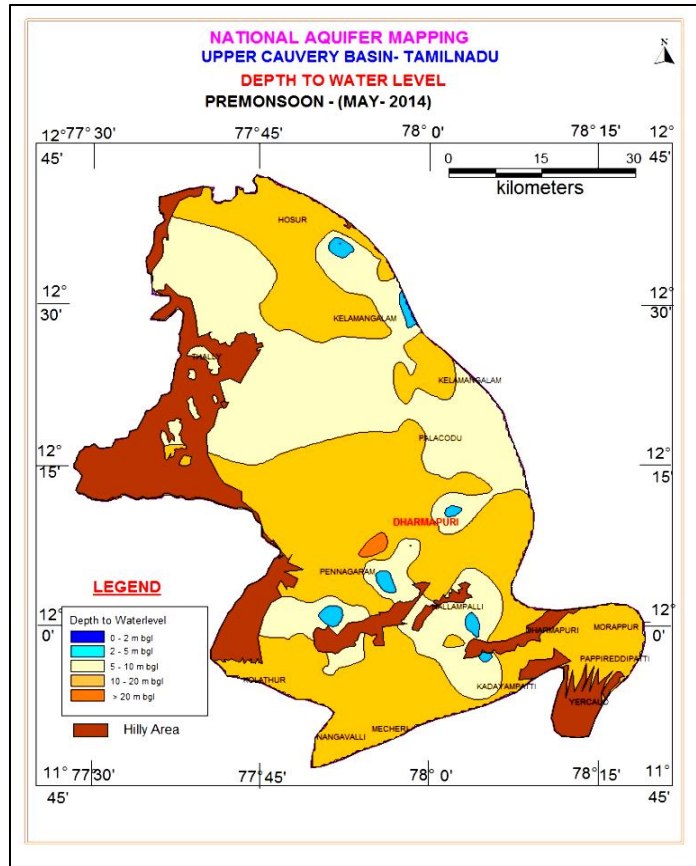


Fig. 3.1 Depth to Water Level – Premonsoon (may 2014)

3.1.1.2. Depth to Water level For aquifer II (May2014)

During May 2014, the depth to piezometric surface in the deeper aquifer in the basin ranged from 11.56 m bgl (Vellar-Mecheri block) to 57.29 (Konnagihalli-Pennagaram block). 55% per cent of wells analysed have recorded depth to piezometric surface in the range of 10 to 20 mbgl and noted in Kelamangalam, Palacode, Nangavalli, Mecheri and Nangavalli blocks. 22 percent of the wells analysed have recorded 20 to 40 mbgl and noted in Kolathur and Nallampalli blocks. 23 percent of wells analysed have recorded more than 40 mbgl range and noted predominantly in Kadayampatty and Pennagaram blocks.

3.1.1.3. Depth to Water level For aquifer I (Jan-2015)

The depth to water level map for the period of January 2015 based on the key well and NHS data collected from the basin area is presented as **Fig. 3.2**. The depth to water level during Jan 2015 is varied from 1.95 mbgl (Kelamangalam, Kelamangalam block) to 20.7mbgl (Kottai

Uliamangalam, Kelamangalam block). Depth to water level ranging from 0 to 2 mbgl was observed in a small patch (1%) near Kelamangalam village. Water level ranging from 2 to 5 mbgl is shown in 31 wells (32%), water level ranging from 5 to 10 mbgl shows in 40 wells (41%), water level ranging from 10 to 20 mbgl is shown in 25 wells (26%), only 1 well (1%) shows water level above 20 mbgl during Jan 2015. Major part of the basin(73%), shows water level in the range of 5 to 10mbgl, covering Northern part of Thally block, most parts of Kelamangalam block, western part of palacode block, eastren parts of Pennagaram block and north eastern parts of Nallampalli block. Water level ranging 10 to 20 mbgl is observed in central part of Thally block, eastern part of Dharmapuri block, southern part of Nallampalli block and all most all part of blocks in Salem district, i.e. Kolathur, Nangavalli, Mecheri and Kadayampatty blocks. Water level more than 20 mbgl is found in a small pocket around north central portion of the basin (Kottai Uliyamangala of Kelamangalam block).

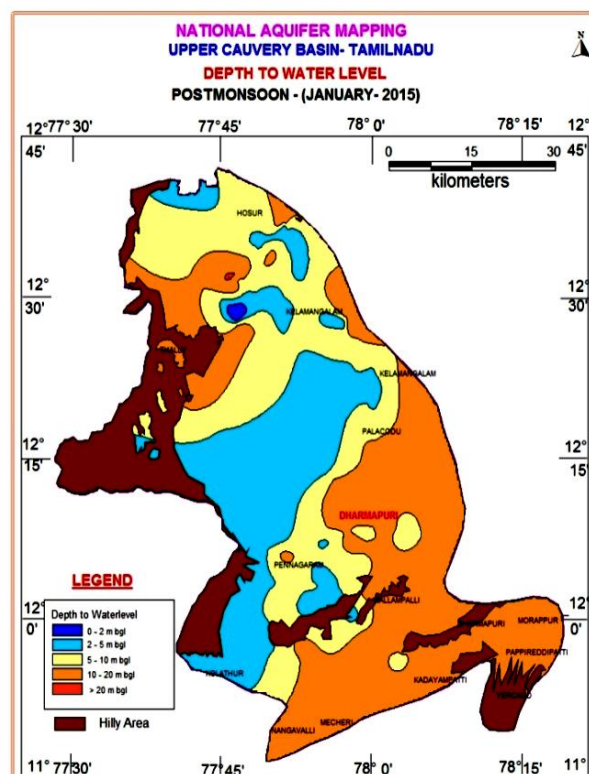


Fig. 3.2 Depth to Water Level for Aquifer 1 (Jan-2015)

3.1.1.4 Depth to Water level for aquifer II (Jan-2015)

During Jan-2015, the depth to piezometric surface of the deeper aquifer in the basin area ranges from 6.6 m bgl (Marandahalli-Palacode block) to 56.26mbgl (Kadayampatty-Kadayampatty block). Depth to piezometric surface less than 5 mbgl was not observed in the basin. Piezometric surface ranging from 5 to 10 mbgl is observed in 20 wells (45%) , 10 to 20 mbgl is observed in 10 wells (22%), in Kolathur and Nallampalli blocks. 10 wells (22%) recorded water levels in the range of 20 to 40 mbgl in Kelamangalam and Pennagaram blocks. 5 wells (11%) have recorded water levels of more than 40 mbgl and noted predominantly in Kadayampatty block. In major part of the basin the depth to the piezometric surface is within the range of 5 to 20 mbgl.

3.1.1.5 Water Level Fluctuation:

Water level fluctuation in the observation wells in an area between two periods is indicative of the net changes in the ground water storage during the period in response to the recharge and discharge components and is an important parameter for planning for sustainable ground water development. The seasonal water level fluctuation in the area has been analysed using the water level data of May 2014 and January 2015(**Fig-**). As both southwest and northeast monsoons are active in the area the fluctuation recorded in ground water levels of January 2015 in comparison to the water levels of May 2014 indicate the extent of replenishment of the shallow aquifer due to the monsoon rainfall.

The water level fluctuation in the basin ranged from a decline of 5.35 m. (Chinnakoundanahalli, Kelamangalam block) to a rise of 13.87 m (Panchapalli, Palacode block) during the period. The analysis indicates that water levels have risen during post-monsoon period in comparison to pre-monsoon in the major part of the basin, indicating replenishment of phreatic aquifer due to rainfall recharge. Rise in water levels during the period have been observed in more than 84% of the wells considered. Fall has been observed in 16% of the wells considered. The rise in water levels is in the range of 0.1 to 13.87 m and fall in the range of 0.20 to 5.35m.

Rise in the water levels in the range of 0 to 2 m is observed in 43 wells (51%); 2 to 4 m rise observed in 20 wells (25%); and more than 4 m rise observed in 19 wells (24%). Fall in the

water levels in the range of 0 to 2 m is recorded in 12 wells (80%); of 2 to 4 m fall observed in 2 wells (14%); and more than 4 m fall is observed in 1 well (6%).

Fall in water levels is observed in about 16 percent observation wells in the district during the period, indicating recharge insufficient to compensate the withdrawal of ground water from phreatic zone. Decline in water levels during the period was observed in isolated pockets of Kelamangalam, Palacode, Pennagaran and Nallampalli blocks.

3.1.1.6. Water Table Elevation :

Water table elevation map of phreatic aquifer of the basin during May 2014, along with flow lines showing the direction of ground water movement is shown in **Fig-3.4**. The water table elevation ranges from 809.92 (D.Tamandrapalli/Kelamangalam block) to 255.78 mamsl (Puchchur/Pennagaram block) in the basin. The groundwater movement in northern part of the basin is towards south east and then turns south direction .Finally groundwater movement is towards south west, ie., towards main Cauvery river. The general groundwater flow is from east to southwest direction in southern parts of the basin (parts of Salem district).

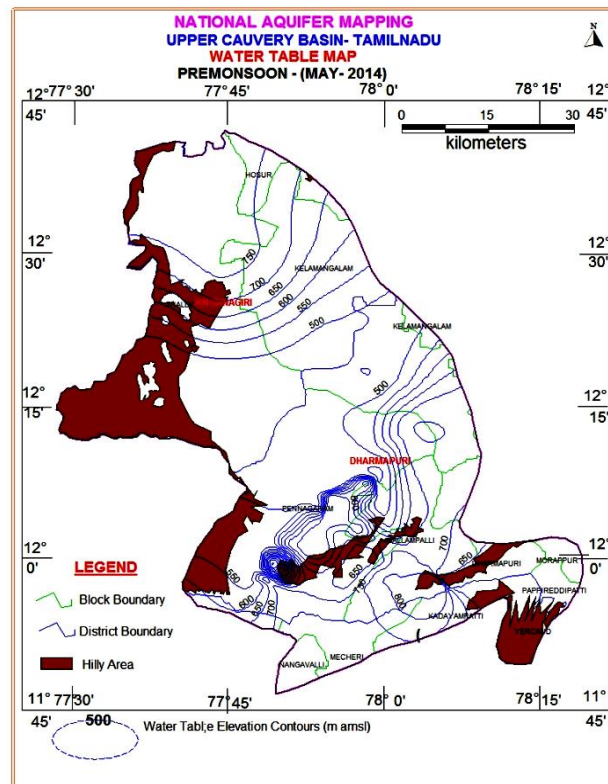


Fig. 3.4 Water Table Elevation Map – Pre monsoon (May-2014)

3.1.2. Pumping Tests

The yields of the wells in the study area are widely varied. Many of Dug wells in the area have less than one meter water Column during most of the year and about 80 to 95 % of wells get dry during summers. Most of the time dug wells are used as storage tanks to collect water from a number of bore wells and to distribute the collected water for irrigation as the yield of each bore well is much less to support irrigation. The wells located in favourable hydrogeological settings like shear zones, topographic lows, river alluvium etc., are able to sustain at a rate of 100 lpm for 2 to 3 hrs of pumping. The yield of large diameter wells tapping the weathered mantle of crystalline rocks ranges from 20-50 m³/day for a drawdown of 2-3 m and are able to sustain 1-3 hours of pumping. The specific capacity of the porous weathered formation ranges from 7 to 35 lpm/m/dd. The Transmissivity values of the weathered formation computed from pumping tests ranges from 5 to 20 m² /day and storativity ranges from 4.37x10⁻⁴ to 7.89x10⁻³. At a very few places the weathered mantle extends down to 19 m bgl.

A number of bore wells have come up in the area for Irrigation and drinking water purpose in the recent past. The depths of bore wells generally vary from 150 to 350 mbgl with yields varying from 0.01 to 7.49 lps. The duration of pumping tests vary from 500 to 1000 minutes. The maximum drawdown of the wells ranging 2.5 to 60.10m. The specific capacity value varies from 5.18 to 10.42 lpm per meter drawdown. The Transmissivity value of these aquifer system ranges from 9 to 24.56 m²/day. The computed storativity value ranges between 0.0378 to 0.00026. Permeability value ranges from 0.015 to 3.54 m/day. Slug tests were conducted on the bore wells drilled by the CGWB. Computed Transmissivity value ranges from 0.42 to 4.5 m²/day.

3.2. Hydro chemical Data Interpretation

Chemical composition of Groundwater in aquifer is influenced by various factors such as the chemical composition of litho units, composition and permeability of soils, degree and pattern of weathering etc. It is also influenced by agricultural, drainage and irrigation practices prevalent in the area. The chemical characteristics of ground water in the phreatic zone in

Upper Cauvery basin has been studied using the analytical data of groundwater samples collected from key wells, Network stations of Central Ground Water Board and observation wells of State Groundwater Department, Government of Tamil Nadu.

3.2.1. Quality of Groundwater in phreatic aquifer:

The analytical data of groundwater samples collected from key wells during May 2014 have been used for detailed study of various aspects of water quality in the basin. Groundwater in phreatic aquifers in Upper Cauvery basin, in general is colourless, odourless, and slightly alkaline in nature. The range of concentration of the various chemical constituents and the degree of mineralization in groundwater samples of phreatic aquifers in the area are presented in **Table 4**.

Table 4: Chemical Constituent

Chemical Constituent	Range of Chemical constituent	
	From	To
pH	7.02	8.06
EC(μ S /cm at 25° C)	381	3320
Total hardness	55	1200
Ca	10	295
Mg	7	815
Na	30	800
K	1	42
HCO ₃	61	647
Cl	10	518
SO ⁴	11	678
NO ³	5	193
F	0.31	2.6

The waters are generally alkaline with pH varying from 7.02 (Halapuram/Pennagaram block) to 8.02 (Gowdanur / Palacode block).

The Specific electrical conductance of groundwater in phreatic aquifer is in the range of 381 (Dinnur / Kelamangalam block) to 3320 (Doddabavalli/Palacode block) in the basin. In the major part of the basin Electrical Conductivity is in the range of 750 to 2250 $\mu\text{S}/\text{cm}$. Conductance exceeding 3000 $\mu\text{S}/\text{cm}$ have been observed in parts of Pennagaram and Palacode blocks.

Chloride in phreatic groundwater varies from 10 to 518 mg/l in the basin and is below 500 mg/l in major part of basin. Value 518 mg/l, more than permissible limit only found in Doddabavalli village in Palacode block. This may be due to human activities in and around the area.

Nitrate is one of the major indicators of anthropogenic sources of pollution. The negative charge and high mobility favours its persistence in nature and transport along the ground water flow path. Nitrate is the ultimate oxidized product of all nitrogen containing matter and its occurrence in ground water can be fairly attributed to infiltration of water through soils containing domestic, vegetable and animal waste, fertilizer and industrial pollution. As the lithogenic sources of nitrogen are very rare, its presence in ground water is almost due to anthropogenic activity. The concentration of Nitrate in the phreatic groundwater ranged between 5(Ramakondahalli/Pennagaram block) and 193(Pudur/Palacode block) mg/L. About 45% of the samples showed the drinking desirable limit of nitrate below 45 mg/L, 33% of the samples showed nitrate between 46-100 mg/L and about 22% of the samples showed nitrate 100 mg/L, which are above permissible limit of BIS. These wells are located in Western, Eastern part of Nallampalli block, Eastern, Southern part of Pennagaram and western part of Palacode blocks.

Fluoride exists naturally in all waters derived from the dissolution of fluoride containing minerals. Surface water generally has low fluoride while ground water may have high concentrations of fluoride as has been found in many parts of the world. The formation of high fluoride ground waters is principally governed by climate, composition of bedrock and hydrogeology. Areas with semi-arid climate, crystalline, igneous bedrock, and alkaline soils are the most affected. Fluoride is an impurity commonly found in phosphate fertilizers used in the agriculture. Accumulation of fluoride in the soils eventually results in leaching by

percolation into the groundwater aquifer and thereby increases the concentration of fluoride level. In the shallow groundwater, the concentration of fluoride ranged between 0.31(Mudampatty /Kelamangalam block) to 2.6mg/L(Samanur / Palacode block). About 43% of samples showed fluoride < 1mg/L, which is the desirable limit for drinking. About 42% of samples showed fluoride in the range of 1 to 1.5mg/L, the maximum permissible limit in the absence of alternate sources. About 15% of samples showed fluoride > 1.5mg/L. These wells are located predominantly in the central part of Kelamangalam block, Westren part of Palacode block and Southern central part of Pennagaram blocks in the study area.

3.2.2. Quality of Groundwater in The Fractured Aquifers:

Quality of Groundwater in the fractured zones at depth has been studied using the analytical data of water samples collected from Irrigation wells, Hand pumps during well inventory and exploratory bore wells drilled by CGWB. However these samples have been collected represent the cumulative quality of all water yielding fractures in the well, they have been used only to get an idea about the water quality of the deeper aquifer as a whole.

The range of concentration of the various chemical constituents and the degree of mineralization in groundwater samples of fractured aquifers in the area are presented in **Table 5**.

Table 5:

Chemical Constituent	Range of Chemical constituent	
	From	To
pH	7.03	8.9
EC(μ S /cm at 25° C)	301	2910
Total hardness	75	1050
Ca	20	410
Mg	2	640
Na	41	800
K	1	25

HCO ₃	70	665
Cl	10	405
SO ⁴	10	729
NO ³	2	253
F	0.24	2.3

The Chemical analysis result indicates that there is considerable variation in the chemistry of groundwater from the deeper aquifer as well.

The Specific Electrical Conductance of ground water in the fracture aquifers ranges from 301(μ S /cm at 25° C) (Irudukottai/Kelamangalam block) to 2910(μ S /cm at 25° C) (Naganur/Pennagarn block. Chloride ranges from 10 mg/l(Irudukottai/Kelamangalam block) to 405mg/l (Rayakottai/Kelamangalam block),Nitrate ranges from 2 (Melur/ kelamangalam block) to 253(Suligunta/Kelemangalam block) and Fluoride ranges from 0.24(Rayakottai/Kelamangalam block) to 2.3(Samanur/Palacode block). As the occurrence of groundwater in the deeper zone is restricted to fractures which may or may not have continuity on a regional basis, preparation of maps showing the distribution of groundwater quality has not been attempted. Suitability of Groundwater for domestic uses has been analyzed with reference to various constituents and the results are given in **Table 6**.

Table - 6: Ground water quality in different aquifers in Upper Cauvery basin, Tamil Nadu.

S.No	Parameters	Range	Classification	% of samples	
				Aquifer-I	Aquifer-II
1	Electrical Conductivity μ s/cm at 25°c	< 750	Fresh	20	18
		75 1- 2250	Moderately Fresh	63	78
		2251- 3000	Slightly mineralized	11	5
		> 3000	Highly mineralized	6	Nil

2	Chloride mg/l	< 250	Desirable limit	85	91
		251-1000	Permissible limit	15	9
		> 1000	Above permissible limit	Nil	Nil
3	Fluoride mg/l	< 1.0	Desirable limit	44	29
		1.1- 1.5	Permissible limit	41	46
		>1.5	Above permissible limit	15	25
4	Nitrate mg/l	<45	Permissible limit	45	49
		46-100	Above permissible limit	55	41
		> 100		Nil	10

In the study area the pH ranged from 7.14 to 8.5 and 7.20 to 8.33 for aquifer- I and aquifer-II respectively. Most of the samples have pH ranging between neutral to slightly alkaline in nature and are within the limits of drinking water standard of BIS 10500:2012.

3.2.3. Electrical Conductivity:

Electrical conductivity is the indicator of the total mineral content of water and hence it indicates the total dissolved solids (TDS) present in water. TDS of water determines its usefulness to various purposes. Generally water having TDS <500 mg/L is good for drinking and other domestic uses. However, in the absence of alternative sources TDS up to 2000 mg/L may be used for drinking purposes. The distribution of EC in different aquifers are in **Fig. 3.5**.

The phreatic aquifer ground water quality is fresh in about 20% , as indicated by the EC value less than 750 $\mu\text{s/cm}$ at 25°C. In about 63% of the Ground Water indicating the moderately fresh showing the EC varies between 751 -2250 $\mu\text{s/cm}$ at 25° C, 11% of Ground Water showing EC between 2251-3000 $\mu\text{s/cm}$ at 25° C indicating that the ground water is slightly mineralized and about 6% of groundwater wells the EC is more than 3000 $\mu\text{s/cm}$ at 25°C indicating that the ground water is highly mineralized.

The fractured zone ground water quality is fresh in about 18%, as indicated by the EC value less than 750 $\mu\text{s}/\text{cm}$ at 25°C. In about 85% of the Ground Water, the EC varies between 751 - 2250 $\mu\text{s}/\text{cm}$ at 25° C indicating that groundwater is moderately fresh and 05% of groundwater are between 2251-3000 $\mu\text{s}/\text{cm}$ at 25° C indicating that the ground water is slightly mineralized .There was no Ground Water wells the EC is more than 3000 $\mu\text{s}/\text{cm}$ at 25°C during this studies.

3.2.4. Chloride:

The classification of concentration of chloride in phreatic aquifer groundwater is that about 85% shows with in desirable limit, where as in fractured aquifer 91%shows with in desirable limit., 15% of samples in phreatic aquifer and 9% of samples in fractured aquifer are within permissible limit respectively. There were no water samples shows above permissible limit of Chloride concentration either in phreatic aquifer or in fracture aquifer.

3.2.5 Nitrate:

The concentration of Nitrate in the phreatic groundwater shows that about 45% of the samples nitrate below 45 mg/L, the desirable limit , 55% of the samples showed nitrate between 46-100 mg/L and no samples showed nitrate 100 mg/L, which are above permissible . Nitrate concentration in the fractured aquifer shows that about 49% of the samples nitrate below 45 mg/L, the desirable limit for drinking and 41% of the samples showed nitrate between 46-100 mg/L and about 10% of the samples showed nitrate more than 100 mg/L, which are above permissible limit of Burea of Indian standard (IS 10500:2012).

3.2.6 Fluoride:

In the Phreatic groundwater, the concentration of fluoride shows that about 44% of samples fluoride is < 1mg/L, which is the desirable limit for drinking. About 41% of samples showed fluoride in the range of 1 to 1.5mg/L, the maximum permissible limit in the absence of alternate sources. About 15 % of samples showed fluoride > 1.5mg/L. In fractured aquifer the groundwater shows that about 29 % of wells fluoride is in the range of 0 to 1.0mg/L, about 46% in the range of 1.1 to 1.5mg/L and about 25% more than 1.5mg/L. It clearly indicates that more number of wells about 25% in deeper aquifers have fluoride more than 1.5mg/L compare to 15% of phreatic aquifer water. High concentration(>1.5 mg/l) of fluoride in fractured aquifer

has been restricted to areas of southern central part & western part in Kelamangalam block and north western part of palacode block.

3.3. Geophysical Data Interpretation

3.3.1 Surface geophysical investigation:

Surface geophysical investigation in the form of Vertical Electrical Soundings (VES) was conducted in the study area. The preliminary objective of the study area is to decipher the sub surface conditions such as weathered and fractured layer resistivity and thicknesses and massive formations up to the depth of 200 m.

3.3.2. Data acquisition and interpretation

In all 52 Vertical Electrical Soundings (VES) were conducted in the survey area. The data was acquired by deploying the CRM 500 Aqua meter and WDDS-2/2B Digital Resistivity meter by adopting the Schlumberger electrode configuration with a maximum current electrode separation (AB) of 400m. The data was processed and interpreted by IPI2Win software developed by Moscow State University, after marginally modifying the manually interpreted results keeping in view the local geology and hydrogeology. Location of VES in the study area shown in **fig 3.6** and some of the VES curves are shown in **fig 3.7 to 3.10** .

All the VES data have been interpreted in both qualitative and quantitative manner. Based on the interpreted results of Vertical Electrical Sounding conducted in the area, three to five subsurface geoelectrical layers are revealed by A, H, AA, HA, KH and QHA types of curves. The analysis of the VES results indicates that the first layer resistivity was varying in the range of 11.2 - 255 ohm. m which is Top Soil. The thickness of this layer is varying in the range of 0.5 - 3 m. The second layer resistivity which was varying in the range of 12.2 – 250 ohm. m was considered as weathered formation. In this range the lower order of resistivity indicates higher weathered content and higher order of resistivity indicates dryness. The thickness of this formation is varying in the range of 2.5 – 30 m. The resistivity in the range of 34 - 999 ohm.m was recorded as third and/or fourth and/or fifth layer which was considered as massive formation with fractures at different depths. In general the thickness of this formation was

varying in the range of 20 – 185 m. The resistivity ranges for different litho units and hydrogeological conditions was given in **Table 7**.

Table 7: Resistivity ranges for different litho units

Resistivity range Ohm.m	Lithological unit
11.2 – 255	Top Soil
12.2 – 250	Weathered granite gneiss
250 – 500	Fractured granite gneiss
More than 500	Massive granite gneiss

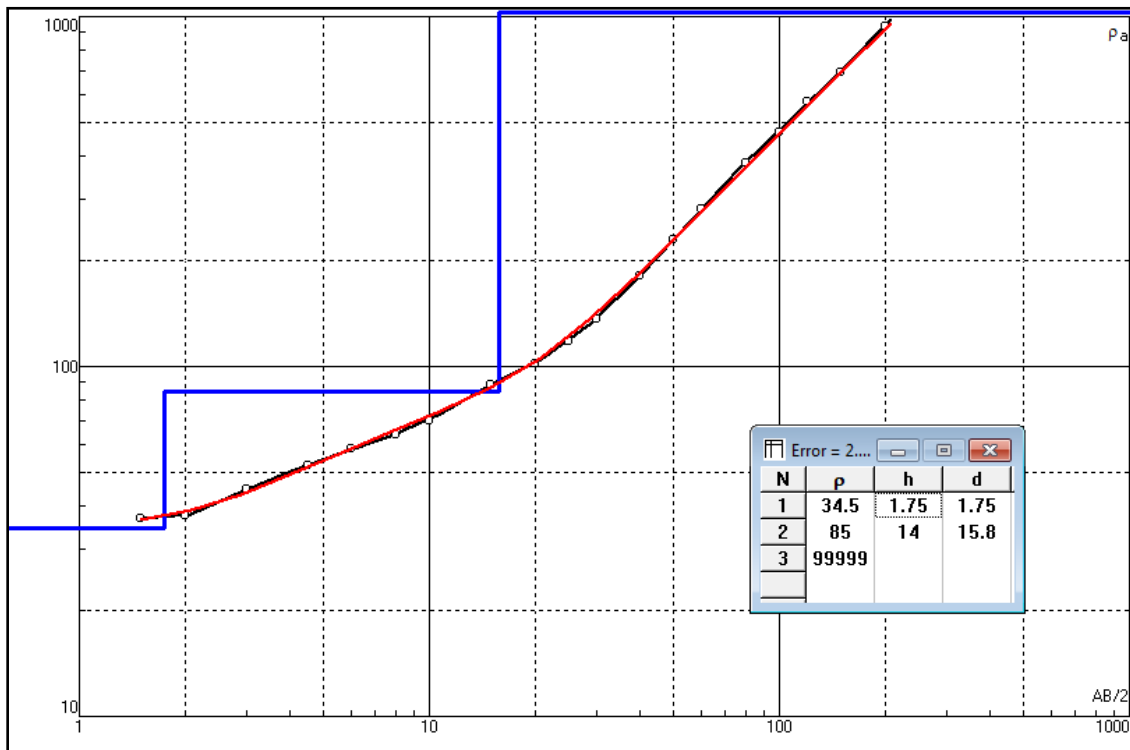


Fig – 3.7 Sandanapalli VES curve

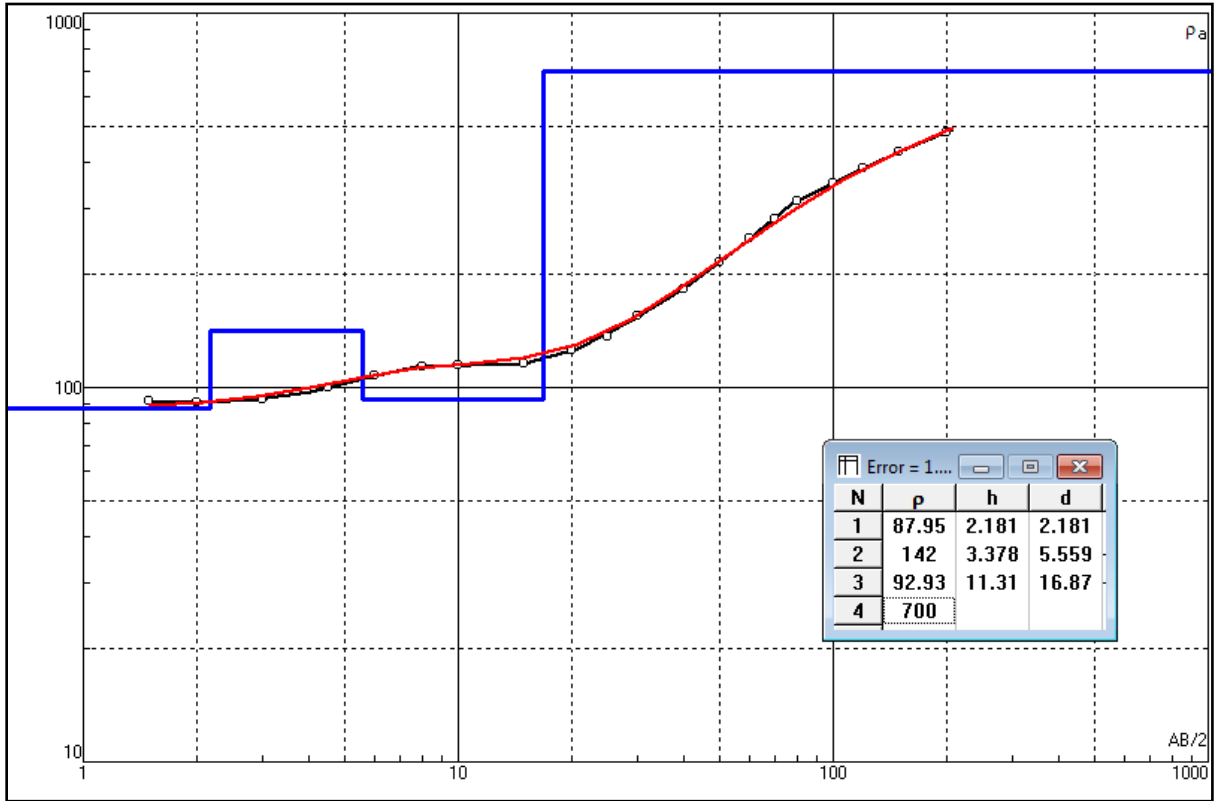


Fig – 3.8 Nadavalur West curve

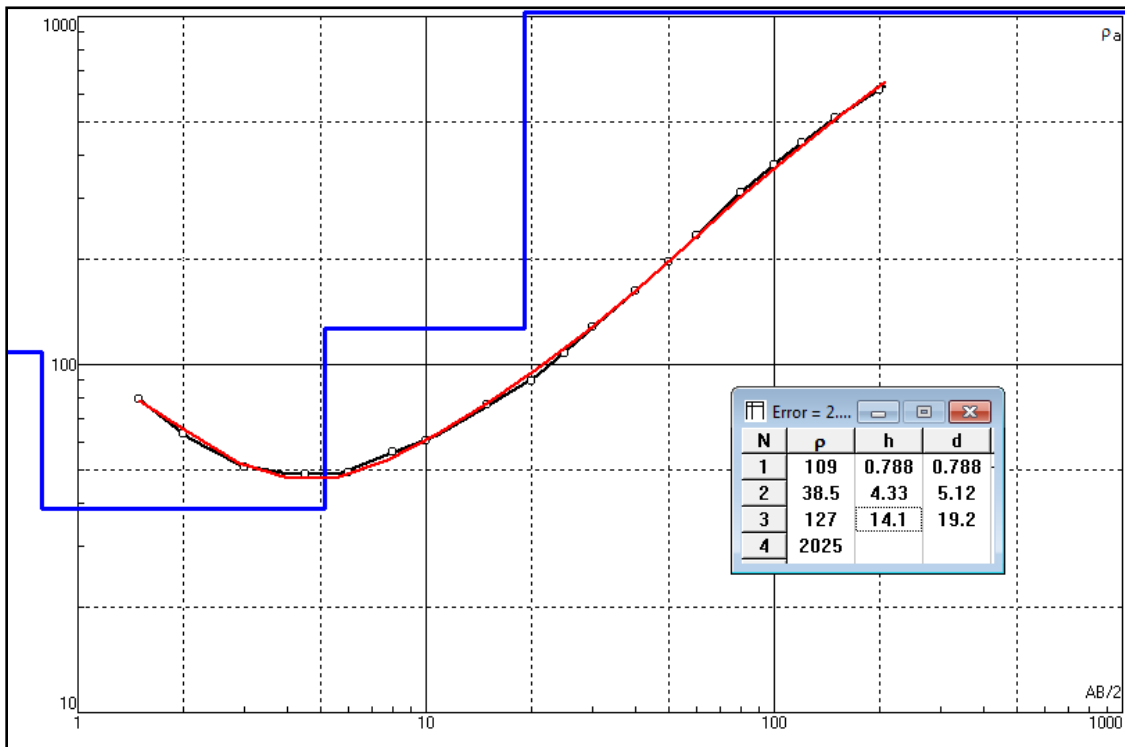


Fig. 3.9. Doddabelur VES curve

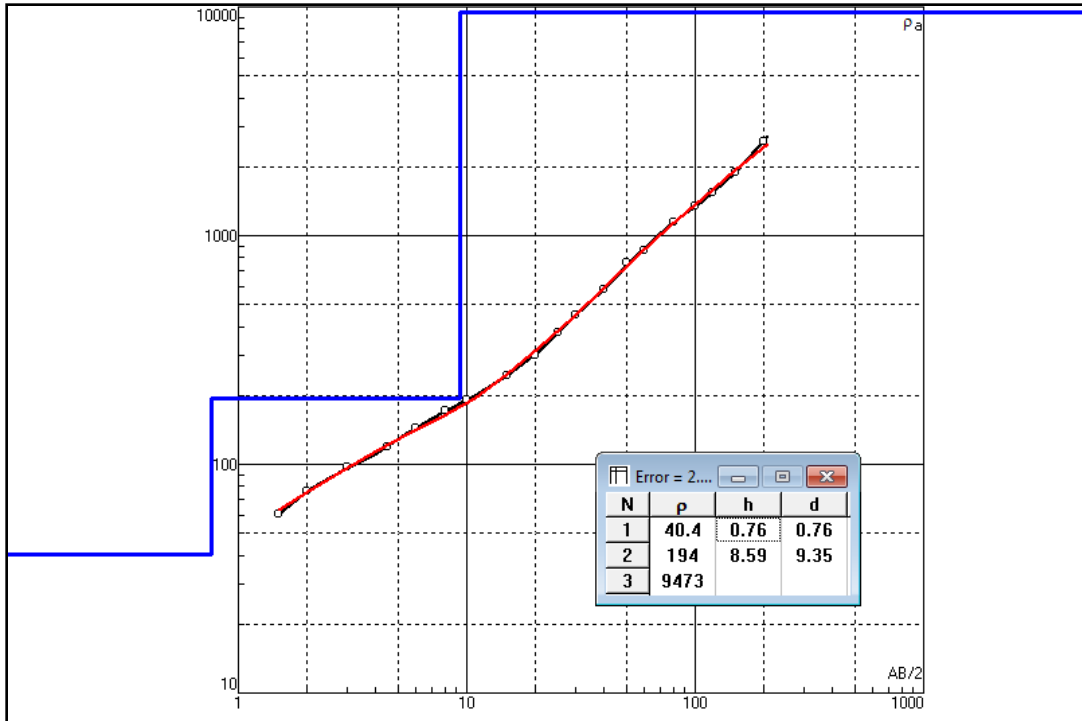


Fig – 3.10 Belamaranhalli VES curve

3.4. Groundwater Exploration data Results:

Groundwater exploration through drilling was taken up by CGWB before National Auqifer Mapping in the Krishnagiri, Dharmapuri and Salem districts. Total 27 exploratory wells have been drilled in the Upper Cauvery basin before national aquifer Mapping. As per the National Aquifer Mapping guidelines for the hard rock terrain, data requirements were identified and plotted on topographical map. Based on the data gap analysis, 9 exploratory wells were drilled in the aquifer mapping area of the basin as part of the data generation. A total number of 36 exploratory wells have been taken in to consideration to assess the thickness of the top weathered zone and the existence of deep seated fractures. The data such as lithology, fracture depth, yield, water level, aquifer properties were generated and utilised to depict the prevailing aquifer systems of the basin. Depth of Exploratory wells drilled in the basin ranging from 40 mbgl (Somanahalli/Palacode block) to 318 m.bgl (Sorangappapudur/Nallampalli block). Drilling data of the exploratory wells has revealed the presence of productive fractures in the area underlain by crystalline rocks. Over all productive fracture zones have been encountered in crystalline rocks at the depth range of 9.43 m. to 249.25 m.bgl. Depth to fracture zones encountered in Granitic gneisses, Charnockites and Granites at depth ranges of

9.43mbgl to 249.25mbgl, 19.12mbgl to 131.mbgl and 32mbgl to 188.50mbgl respectively. Discharge of these wells varies from 0.014 lps to 5.5lps in Granitic gneiss, 0.01 to 6.88 lps in Charnockite and 0.078 to 3.36 lps in Granite formation. (Annexure-5). The discharge of the 19 wells constructed in Granitic gneisses is moderate to high in comparison to the poor yields of the 14 wells constructed in Charnockite formation and 3 in Granitic formation. The fractures encountered in Granitic gneissic rock formations are more than that of other formations. A few of the wells have been abandoned due to poor yield.

Total 122 bore wells data have been analysed for fracture analysis in the study area. It shows that 1st fracture encountered in 120 wells with depth vary from 9.43 to 205 mbgl. 2nd fracture encountered in 100 bore wells with depth vary from 20.12 to 213 mbgl. Similarly 3rd fractured encountered in 68 bore wells with depth vary from 52 to 230 mbgl. 4th, 5th, 6th fractures were also encountered in 5, 2 & 2 bore wells with depth vary from 88.7 to 231, 169.52 to 185.2 and 195.38 to 215.77 mbgl respectively. 7th set of fracture is encountered in one bore well only at a depth of 249.25 mbgl. Two bore wells show no fractures with the depth of 200mbgl. Data clearly indicates that generally two fractures are available in the study area with depth of 20.12 to 213 mbgl.

The aquifer mapping studies reveals that the presence of two distinct aquifers in the hard rock formations. They are;

3.4.1. Aquifer Unit I : It comprises of weathered, partially weathered and first fracture to some extent in Granitic gneisses, Charnockites and Granitic formations. The depth of this first aquifer ranges from 3 to 36 m and contains ground water during monsoon seasons and gets dry by non-monsoon seasons. The aquifer with a thickness of 25 to 30 mbgl is high in Central eastern part of basin in and around Panchapalli, Samanur and Dasampatty along Chinnar river course. In the Northern (Bevanatham area) and Southern portions (Eriyur, Ramagondapalli, Nerupur area) of the basin the thickness of the aquifer is shallow with a thickness vary from 3 to 12 mbgl. The wells located in this aquifer zone yield ground water of 20-65 M³/day and sustain 1 to 2 hrs. of pumping. Specific Capacity and Transmissivity value of this aquifer across the basin ranges from 137.5 to 294 lpm per meter drawdown and 5-20 m²/day respectively.

3.4.2. Aquifer Unit II: It comprises of mainly of fractures (secondary porosity) developed during tectonic disturbances, occurs at depth generally ranges from 20.12 to 213 mbgl. The maximum yield of wells tapping this aquifer varies from 2.25 to 60 m³ /day and sustain for 2 to 4 hrs. of pumping. The Transmissivity value of the aquifer ranges between 0.19-31.01 m²/day while the Specific capacity values vary from 0.012 to 26.59 lpm/m drawdown. Storativity of the aquifer ranges from 0.00001 to 0.0378 in the basin.

3.5. Aquifer Maps

3.5.1. 2D models showing Aquifer Disposition:

Based on the lithologs of the exploratory wells and the well sections observed during field studies as part of Aquifer Mapping studies, 2D models of the aquifer system of the basin has been deciphered by using ROCKWORKS software. The data input for ROCKWORKS is prepared in following format as shown in **Table-8**, to generate 2D models of the basin along different selected sections.

Table 8: Database prepared for generation of aquifer models.

Data - 1

Bore	Township	Longitude	Latitude	Elevation	Total depth	Casing
Denkankottai	krishnagiri	77.79	12.38	883	222.6	12

Data - 2

Bore	Depth1	Depth2	Lithology
Denkankottai	0	12	Weathered
Denkankottai	12	188.5	Fractured
Denkankottai	188.5	222.6	Massive

Data - 3

Bore	Depth1	Depth2	Aquifer
Denkankottai	82.00	82.50	1st Fracture
Denkankottai	188.00	188.50	2nd Fracture

Data - 4

Bore	Type	Depth1	Depth2	Value(lps)
Denkankottai	Discharge	82.00	82.50	0.215
Denkankottai	Discharge	188.00	188.50	3.36

Data - 5

Bore	Depth1	Depth2	Stratigraphy
Denkankottai	0	1	Top soil
Denkankottai	1	12	Weathered
Denkankottai	12	82.00	Slightly Fractured
Denkankottai	82.00	188.50	Fractured
Denkankottai	188.50	222.6	Massive

3.5.1.1. Section along NW-SE direction:

Section along Northwest – Southeast (Fig-3.11) direction in the basin indicates that the 1 st Aquifer existis above 850mamsl to 450mamsl with thickness varying from 30 to 23m inbetween very high of 39m along Chinnar river basin, where sudden drop of topography along Chinnar river drainage.Second Aquifer existis 650 amsl to 150amsl with 100m to 140 m thickness and 2 to 3 sets of fractures.

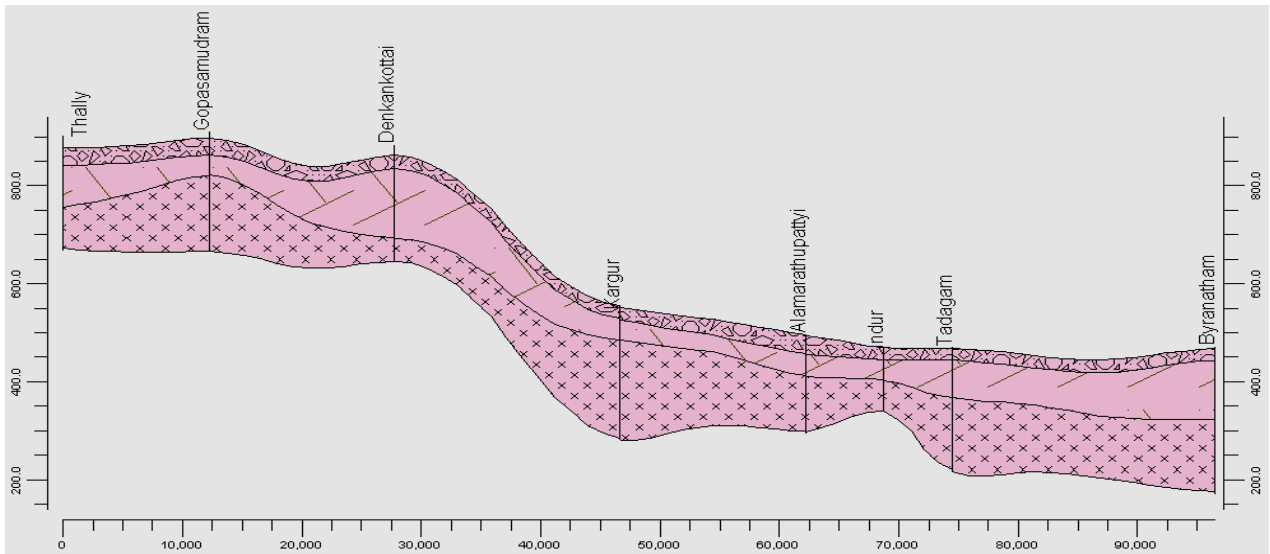


Fig- 3.11- 2D diagram of the Basin along NW-SE

3.5.1.2. Section along NNW- SSE direction:

Section (Fig-3.12) shows that Weathered aquifer spreads about 10 to 18 m thickness and it disappears at Thoppur drop where directly fracture aquifer starts in shallow depth. Fractured aquifer has attain its maximum thickness about 180m at stretch of 20 km distance, parallel to

Chinnar river, in the beginning of section. Rest of the stretch of section the fractured aquifer thickness is considerably very narrow and vary from 10 m to 60m with 1 to 2 sets of fractures.

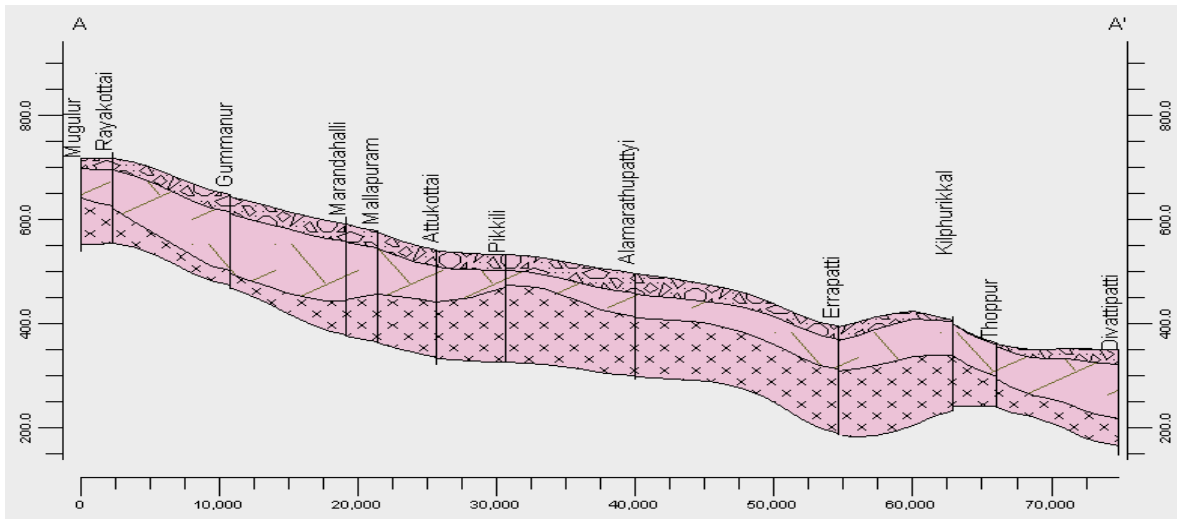


Fig 3.12: 2D Diagram along NNW-SSE direction

3.5.1.3. Section along NE – SW direction:

Section drawn(Fig 3.13) almost perpendicular to Chinnar and Thoppiar river basin indicates that the weathered aquifer spreads as a layer with thickness vary from 8 to 13m, middle of the section weathered aquifer is considerably high in thickness duo to river cross at 15 km(Chinnar) and 55km(Thoppiar) distance. Fractured aquifer also considerably very high in thickness vary from 150m to 80m along the section, where ever the river Chinnar and Thoppiar river cut across the section.

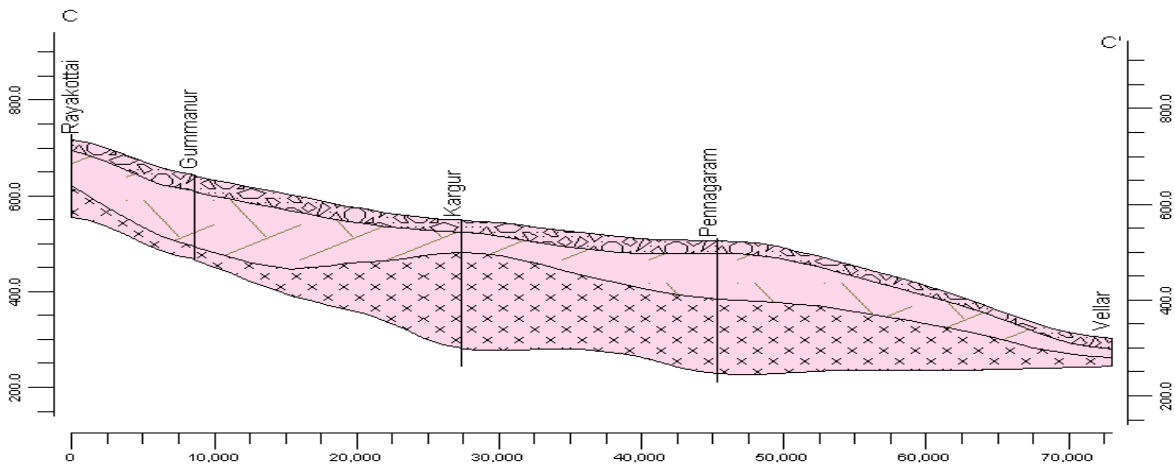


Fig 3.13: 2D Diagram along NE-SW direction

3.5.2. 3 D Model

3D (Fig 3.14) view shows that spreading of two aquifers through out the basin with 1st aquifer thickness vary from 3.7m to 36m and Fracture aquifer spread with thickness vary from 11 to 140m. 3D section indicates that thickness of weathered aquifer is considerably high in north portion compare to south. Thickness of fractured aquifer is considerably high in North & South compare to east, west and center of the basin.

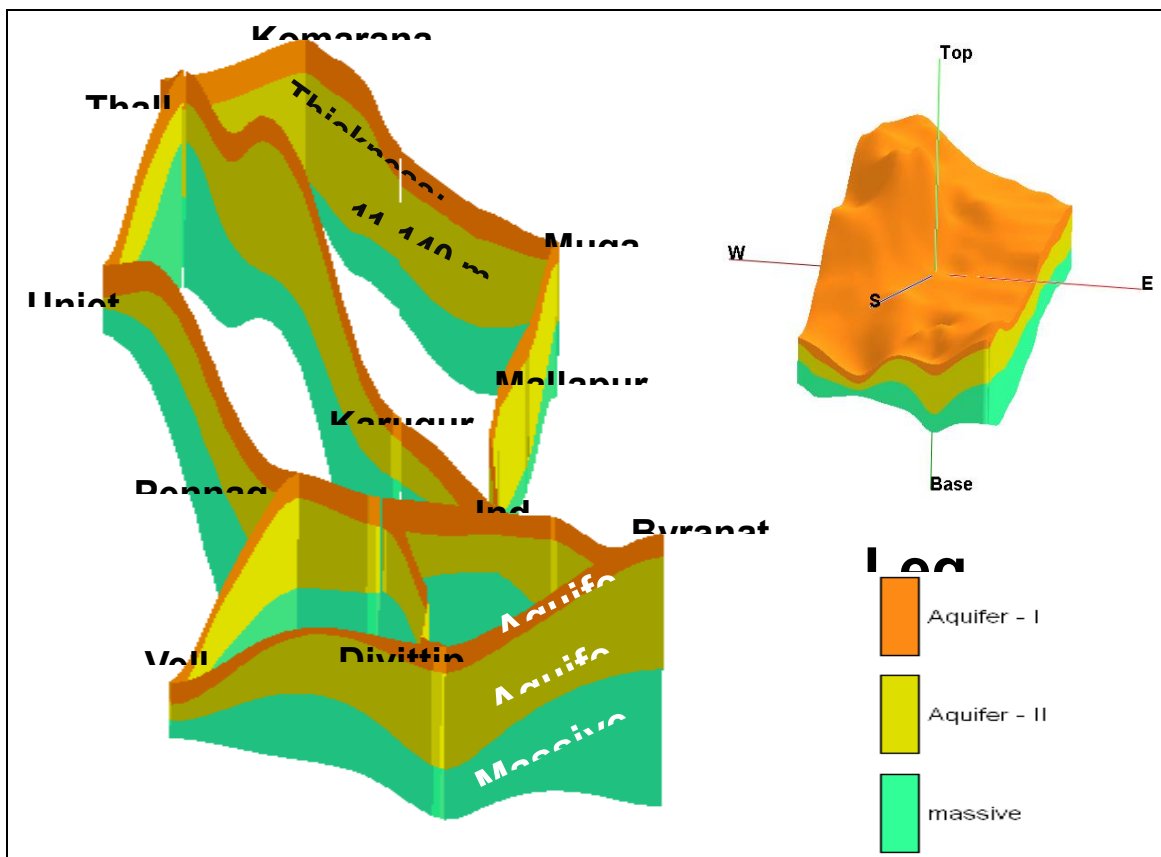


Fig: 3.14: 3D Disposition (Fence Diagram) of the Aquifer system of the Basin

4.0. Ground Water Resources:

The dynamic ground water resources are estimated as on 2010-11 based on the methodology suggested by Ground Water Estimation Committee (GEC) 1997.

The ground water recharge is calculated both by ground water fluctuation-specific yield method and by rainfall infiltration method. The annual replenishable ground water recharge is the summation of four components viz.,

- i) Monsoon recharge due to rainfall
- ii) Monsoon recharge from other sources
- iii) Non-monsoon recharge due to rainfall
- iv) Non-monsoon recharge due to other sources

Firka-wise dynamic ground water resources have been taken from the approved resources estimation done as on March 2011, jointly by State PWD of Tamil Nadu and CGWB, to arrive at the total resources available in the study basin. Out of the 31 Firkas of the study basin 15 firkas are falling totally in the basin and the rest 16 are falling partly. The resources have been apportioned to as per the ratio of the firka area within the basin and total firka area for the 16 firkas which are falling partly in the basin.

4.1. Net Ground Water Availability:

The net ground water availability refers to the available annual recharge after allowing for natural discharge in the monsoon season in terms of base flow and subsurface inflow/outflow. This annual ground water potential includes the existing ground water withdrawal, natural discharge due to base flow and subsurface inflow/ outflow in the monsoon season and availability for future development. As the ground water development progresses the natural discharge gets suitably modified and comes down to negligible quantities due to interception by different ground water structures. Hence, natural discharges in the monsoon season may not be considered and the total annual ground water recharge may be taken as net groundwater availability.

The net ground water availability of the basin for the year 2011 is arrived at 28,208 Ham, out of which the availability for 14 firkas of Dharmapuri district is 16,884 while 8 firkas of

Krishnagiri and 9 firkas of Salem districts have the availability of 7,909 and 3,414 Ham respectively. (Table 4.1)

4.2. Ground Water Draft:

The gross ground water draft has been assessed by using Unit draft method for irrigation draft component and by adopting formula suggested by GEC 1997 for domestic and industrial draft components.

The existing ground water draft for irrigation is maximum in Pulikarai Firka (3246 ham) followed by Palakodu (3113 ham), Indur (2411 ham) etc. The gross ground water draft for domestic and industrial uses is maximum at Kadayampatti of Salem district (186 ham) followed by Dharmapuri (113 ham), Mecheri (112 ham). The existing gross ground water draft in Dharmapuri, Krishnagiri and Salem districts is 25,520 ham, 4,615 ham and 3,335 ham respectively. And the total gross ground water draft of the basin is 33,472 ham against the availability of 28,208 ham.

4.3. Stage of Development and Categorization:

The stage of development is defined by stage of ground water development (%)

$$= (\text{Existing ground water draft} / \text{Net Ground water availability}) \times 100$$

The stage of ground water development is calculated for all the 31 firkas of the basin and it varies from 3% (Vellakadai, Salem district) to 260% (Perumbalai, Dharmapuri district). The Categorization has been done by considering the two factors as suggested by GEC 97, viz.,

- i) Stage of Development
- ii) Long term trend of pre and post monsoon water levels.

The following FOUR categories have been suggested by GEC-97 based on the above two factors.

- a) Safe
- b) Semi-critical
- c) Critical
- d) Over-exploited

Based on the above categorization 11 out of the 14 firkas of Dharmapuri district and 4 out of 9 firkas of Salem district falls under Over-exploited Category with a total area of 2103 sq.km (47% of the basin area). On the other hand area under Safe category is of 1828 sq km (40% of the basin area) comprising 6 firkas of Krishnagiri and 3 firkas of Salem districts. The

remaining 13% of the basin area (582 sq.km) falls under Semi-critical category comprising a total of 7 firkas; 3 of Dharmapuri, 2 of Krishnagiri and another 2 of Salem districts.(Table 4.1)

4.4.Static Ground Water Resource:

The ground water available below the zone of water level fluctuation is called Static Ground Water Resource. But in the present study basin static resource is developed in all the 15 Over-exploited firkas and a total quantity of 10,239 ham is being extracted from static resource as the available dynamic groundwater resource is only 14,656 ham against the gross draft of 24,895 ham. Static water resource of the basin has not calculated as it is not advisable for development under normal conditions.

5.0 REGIONAL GROUNDWATER FLOW MODELLING

Three-dimensional mathematical models of regional groundwater flow are beneficial to the management of groundwater resources as they allow the approximation of the components of hydrological processes and provide a mechanistic description of the flow of water in an aquifer. Such a modeling study was carried out in a part of Upper Cauvery aquifer system, Southern India. The study area is characterized by weathered and fractured aquifer system with very heavy abstraction of groundwater for agricultural purposes. The model simulates groundwater flow over an area of about 4541 square kilometers with 56 rows, 52 columns, with two vertical layers on the regional model. The detailed study area is divided into rows and columns with a size of 2.0 sq.km grids (Figure.1). The model was simulated in steady and transient state condition using the finite-difference approximation of three-dimensional partial differential equation of groundwater flow in this aquifer from January 2010 to December 2014. The model was calibrated for steady and transient state conditions. There was a reasonable match between the computed and observed heads. Based on the modelling results, it is found that this aquifer system is stable at this pumping rate. The transient model was run until the year 2025 to forecast the dynamic groundwater flow under various scenarios of over pumping and less recharge. The model predicts the behaviour of this aquifer system under various hydrological stress conditions.

5.1. Modelling objectives

Numerical three-dimensional groundwater flow model was developed for the Upper Cauvery Aquifer system, Southern India with the following objectives,

- to simulate regional groundwater flow to identify the distribution of heads,
- Impact on the aquifer system due to various hydrological stresses.
- To develop few scenarios for proper understanding of the aquifer system.
- For Efficient and sustainable management of the aquifer system.

5.2. Model Input Parameters

The model was developed by incorporating geologic data, measured and inferred hydrologic data. Two sets of data are required for the development of a groundwater model as given in **Table 1**. The two sets of data are the physical framework and hydrological stresses.

Groundwater flow equation

Anisotropic and heterogeneous three-dimensional flow of groundwater, assumed to have constant density, and described by the partial-differential equation given by Rushton and Redshaw (1979) was used to model the groundwater flow in this study

$$\frac{\delta}{\delta x} K_{xx} \frac{\delta h}{\delta x} + \frac{\delta}{\delta y} K_{yy} \frac{\delta h}{\delta y} + \frac{\delta}{\delta z} K_{zz} \frac{\delta h}{\delta z} - W = S_s \frac{\delta h}{\delta t}$$

Where,

K_{xx}, K_{yy}, K_{zz} - components of the hydraulic conductivity tensor

h - potentiometric head

W - source or sink term,

S_s - specific storage

t - time

Table 5.1: Data required in developing a numerical model

Physical framework	Hydrological stresses
Aquifer geometry	Groundwater abstraction and recharge
Type of aquifer	Solute concentration
Aquifer thickness and lateral extent	Aquifer stress
Aquifer characteristics	

5.3. Modelling Protocol

The modelling protocol used in this study for the construction of a numerical model involves the following steps:

- Data collection, acquisition and processing of primary data
- Conceptual model building
- Numerical model building
- Model application
- Result generation.

5.4. Model Conceptualisation

The conceptual model of the system was arrived from the detailed study of geology, borehole lithology, geophysical resistivity survey & logs, cross section and water level fluctuations in wells. Groundwater of the study area is found to occur in the weathered formations and in the fractured/jointed formations. Groundwater is found to occur in unconfined conditions in the weathered formation and unconfined/confined in fractured formation.

5.5. Boundary conditions

The study area forms a part of the upper Cauvery River basin. The boundary conditions modeled are as per the watershed boundary (Figure.2). The eastern boundary of the study

area is the Upper Ponnaiyar River Basin and western boundary is bounded by Karnataka state. Cauvery river flows from the western boundary to the southwestern boundary and was modeled as river boundary. The remaining sides of north, eastern and southern boundary are no flow boundary. Except these two regions, the remaining boundary was modeled as no flow boundary as the flow from outside the boundary is negligible. There are two dams within the area namely Panchapalli dam and Thoppaiyar dam. These two regions were modeled as general head boundary.

The aquifer top and bottom were derived mainly based on the lithology of boreholes and by intensive field surveys. The study area has been vertically divided into two layer. First unconfined layer comprises of the top soil and weathered formation, which is underlain, by fractured/jointed formation, which occurs under unconfined/confined conditions.

Grid Design

The geographic boundaries of the model grid covering 4541 km² of the study area were determined using the map module. The map was projected using the metric coordinates in the map module and then imported into the MODFLOW. The finite-difference grid was superimposed on the study area was constructed based on the conceptual model representing the physical properties of the groundwater system. The grid network has a constant spacing 2.0 km by 2.0 km. The model grid discretized into **2912** cells with 56 rows and 52 columns, and vertically by 2 layers (**Figure. 5.1**). The length of model cells is 2000 m along the east west and 2000 m along the north- south directions of the study area.

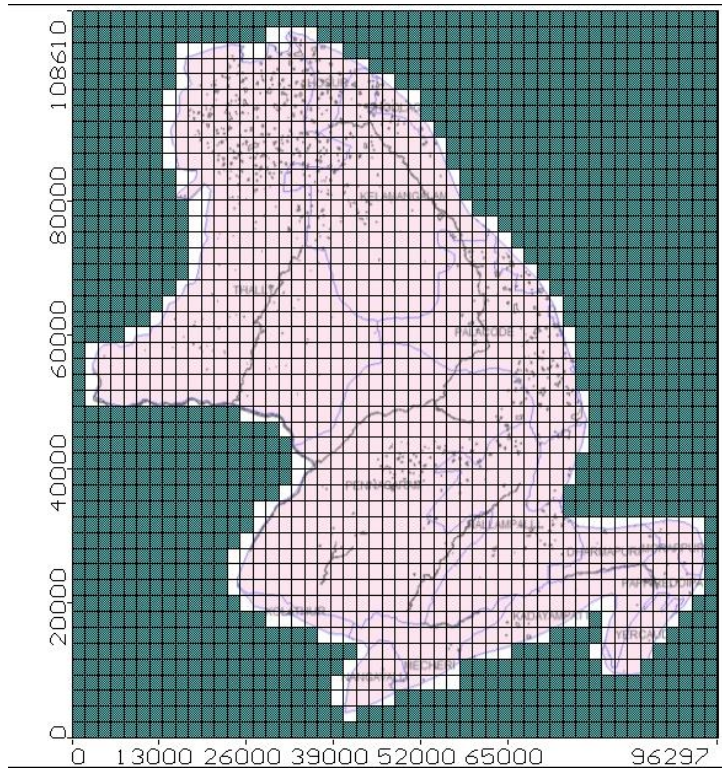


Figure.5.1 Discretisation of the study area.

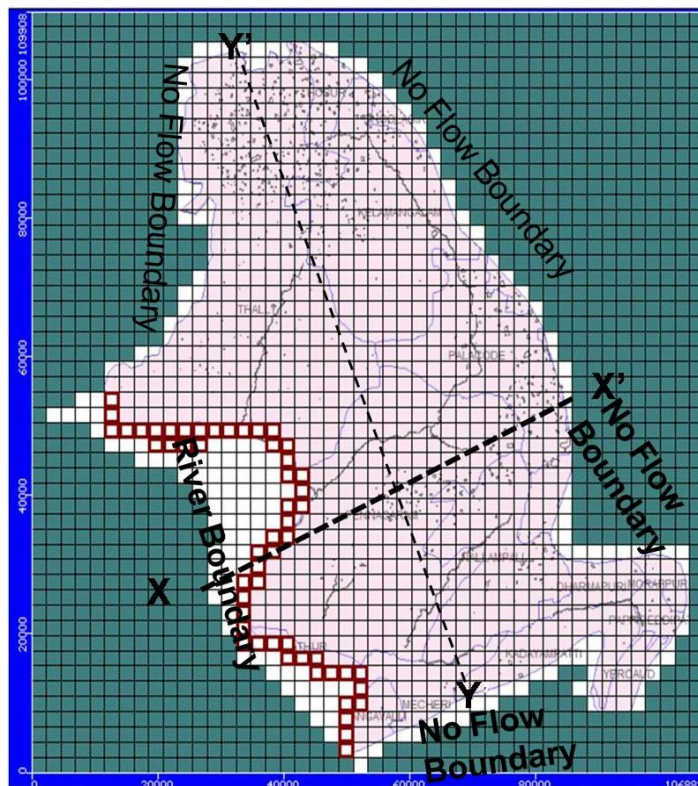


Figure.5.2 Boundary condition of the study area

Input Parameters

Initial Groundwater head

After detailed analysis of the hydrographs, rainfall and water level fluctuation, it was decided that the groundwater head data of Jan'2010 represents the spatial groundwater distribution of the study area. During this period the rainfall was also normal and the groundwater fluctuation was representative of the normal year.

Aquifer Geometry

The aquifer geometry includes defining the aquifer top, bottom of Ist layer and bottom of IInd layer for all the cells. They were mainly derived from the subsurface characterization using the lithologs, resistivity data and geological field work. These values were extrapolated for the entire area considering the lithological variations and field study of well sections. The Ist layer is characterized by weathered formation with a maximum thickness of 36m and is underlain by fractured/jointed formation with a maximum thickness of 140m. Sections west-east and north-south are presented as **figure 5.3a & b**.

Figure 5.3a&b

Model section along two direction X-X' and Y-Y' are given below:

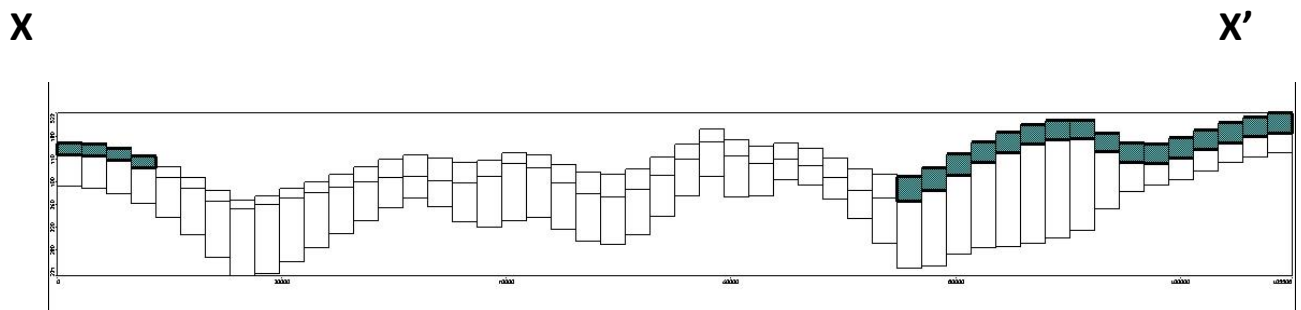


Figure 3a Section along x-x' direction

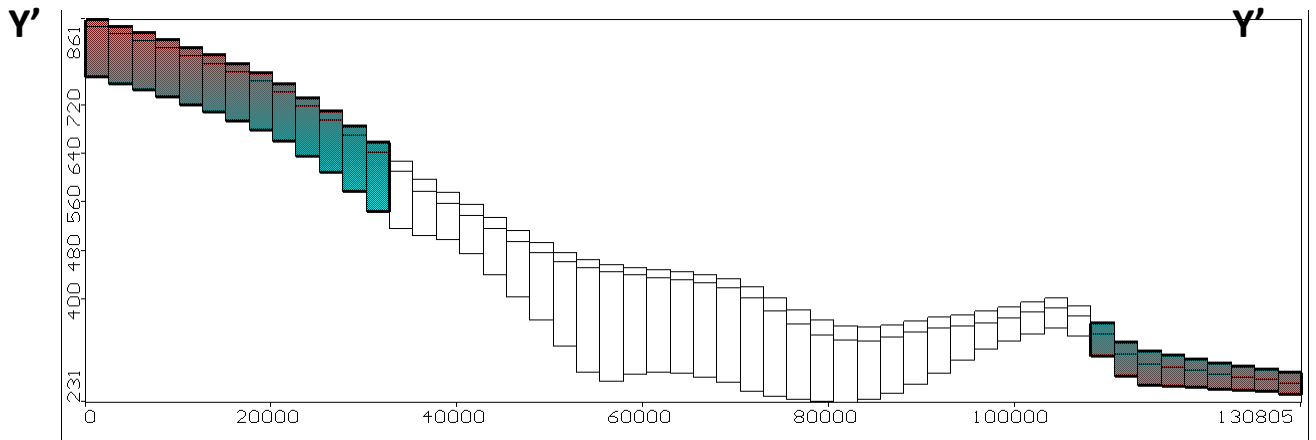


Figure 3b. Section along Y-Y' direction

Aquifer characteristics

The aquifer properties such as horizontal hydraulic conductivity, Specific yield and storativity used in the model were derived from 29 pumping tests results and is given in the **Table 5.2.**

Table.5.2: Summary of the Pumping test results

Formation	Hydraulic conductivity (k in m/day)	Specific Yield (%)	Storativity
Weathered Gneiss	4 to 9	0.015 to 0.06	-
Weathered Charnockite	3 to 7	0.015 to 0.05	-
Fractured/jointed Gneiss	2 to 6	0.034 -0.05	0.00017 to 0.00073
Fractured /jointedCharnockite	2 to 6	0.03 to 0.09	0.00032 to 0.000041
Ultramafic	1 to 2	0.01	-

5.6. Groundwater draft and recharge

5.6.1. Groundwater Abstraction

The groundwater of the study area is abstracted for irrigation, drinking water supply and domestic purposes. Agriculture activity of the study area is mainly dependant on groundwater resource and small region of canal/dam command area. The Landuse and landcover map was prepared to demarcate the area under cultivation. Information on the number of wells (open and borewells) available in the study area was collected from the department of economics & Statistics and also from the electricity board. The data obtained from electricity board included the number of wells energized and their horse power of the pump (**Table.5.3**). The domestic and drinking water requirement of the study area was calculated based on population.

Table.5.3 Groundwater draft details

Sl.no	District	Area (sq.km)	Dug wells	Aquifer I Draft (mcm)	Borewells	Aquifer II Draft (mcm)
1	Krishnagiri	2119	2170	56	3444	21
2	Dharmapuri	1315	39681	193	34333	132
3	Salem	1107	5276	21	1789	15

5.6.2. Groundwater Recharge

The recharge of the study area aquifer varies considerably due to differences in landuse pattern, soil type, geology, topography and relief. The recharge to the aquifer system is from rainfall, irrigation and inflow from the river and storage tanks. Rainfall is the principal source of groundwater recharge. The rainfall hydrograph were studied to understand the recharge pattern in the study area. The aquifer gets recharged and groundwater level shoots with rainfall above 40 mm. The entire portion of the study area is geologically covered by top soil, weathered and fractured/jointed formation. The

infiltration capacity of formation ranges from 0 – 12 % (Groundwater resources estimation committee report, 1997). The **table 5.4** shows the rainfall infiltration factor used in modeling for groundwater recharge calculation.

Table 5. 4 Rainfall vs infiltration factor used in groundwater recharge calculations.

S.No.	Rainfall (mm)	Infiltration factor (%)
1	0 -40	0
2	40 -100	8
3	100 -200	10
4	200 -300	12
5	300 -400	10

The rate of leakage between the river and aquifer was estimated using the difference between the river head and groundwater head. The rivers situated in the study area and its contribution to groundwater recharge was calculated based in the difference between the head in the adjoining wells and reservoir head. The data of the river head was inputted in the model. Cauvery river flows only for few days during August, September & October. Three recharge zones have been demarcated in the study area and they comprise of top soil zone, weathered Gniessic/charnockitic formation and ultramafics zone.

5.7. Model Calibration

The calibration strategy was to initially vary the best known parameters as little as possible, and vary the poorly known or unknown values the most to achieve the best overall agreement between simulated and observed. Steady state model calibration was carried out to minimize the difference between the computed and field water level condition. Steady state calibration was carried out with the water level data of Jan2010 in 17 wells distributed over the study area. Out of all the input parameters, the Specific yield value is the only poorly known as only 29 pumping tests were available in this area. The lithological variations in the area and borehole lithology of existing large diameter wells were studied. Based on this it was decided to vary hydraulic conductivity values upto 10% of the pumping test results for layer in order to get a good match of the computed and observed heads (Fig. 5). The figure indicates that there is a very good match between the calculated and observed water heads in most of the wells of the study area. Root mean square error and the mean error were minimized through numerous trial runs.

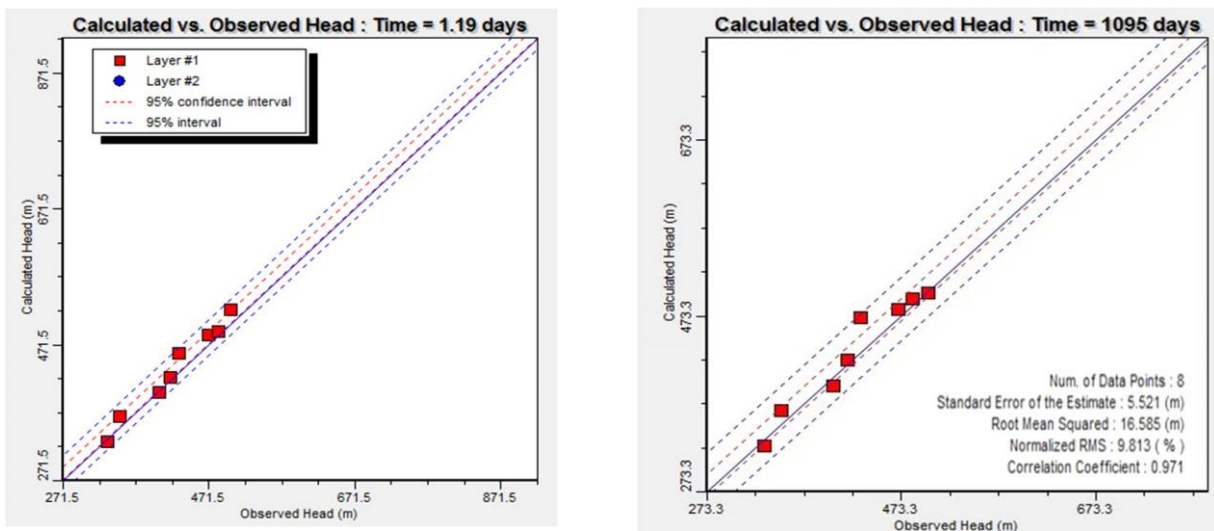


Figure.5.5. Comparison of computed and observed groundwater head under steady state & Transient state condition.

Transient state simulation was carried out for a period of 5 years from Jan2010 to Dec 2014 with monthly stress periods and 24 hour time step. The trial and error process by which calibration of transient model was achieved by several trials until a good match between computed and observed heads over space and time. The hydraulic conductivity values incorporated in the transient model were modified slightly from those calibrated by the steady state model. Based on the close agreement between measured and computed heads

from Jan 2010 to Dec 2014 at 17 observation wells distributed throughout the aquifer, the transient models were considered to be calibrated satisfactorily. The sensitivity of the model to input parameters were tested by varying only the parameter of interest over a range of values and monitoring the response of the model by determining the root mean square error of the simulated heads compared to the measured heads.

5.8. Simulation Results

The model was simulated in transient condition for a period of 5 years from 2010-Dec 2014. There was fairly good agreement between the computed and observed heads (**Figure.6a & b**). A study of the simulated potentiometric surface of the aquifer indicates that the highest heads are found on the Northern side of the study area, which attribute to the topography. During the simulation period, it is observed that most of the cells in the first layer i.e., weathered zone get dried up. The number of dry cells gradually increases with the summer season and number of dry cells reduces with arrival of monsoon. The regional groundwater flow direction is from east to Southwest. The groundwater flow vectors for the month of May & December 2014 are given in figure.7a & b. The comparison of observed and computed heads is given in **figure 8a&b**.

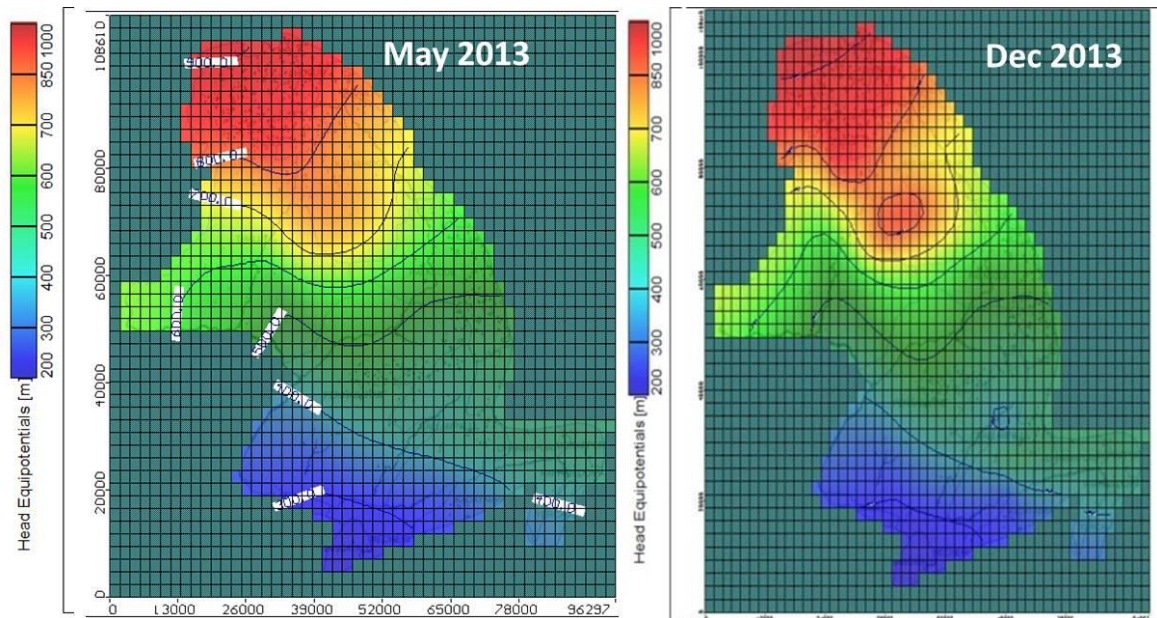


Figure.5.6 a&b Simulated groundwater head during May & December 2013.

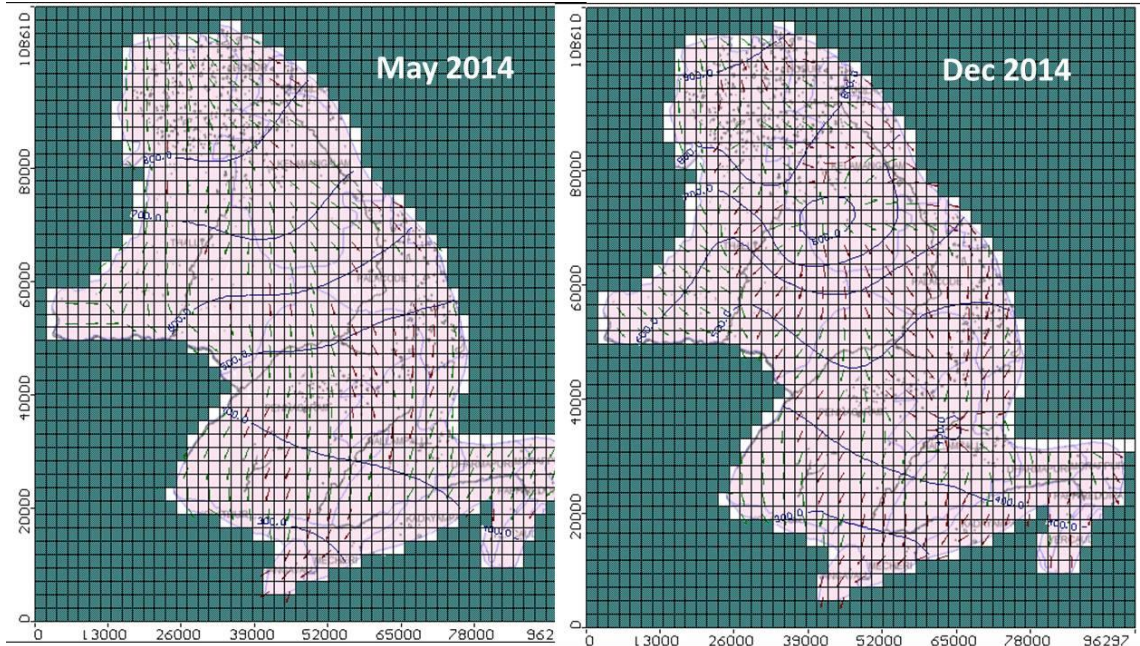


Figure 5.7a & b Groundwater flow vectors during May & December 2014

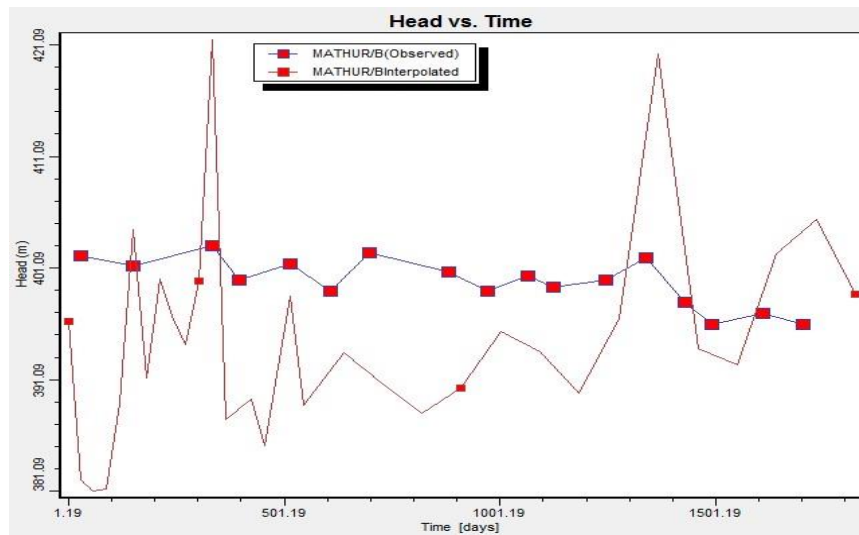


Figure.5.8a Times series analysis of Computed and observed at Kelamangalam

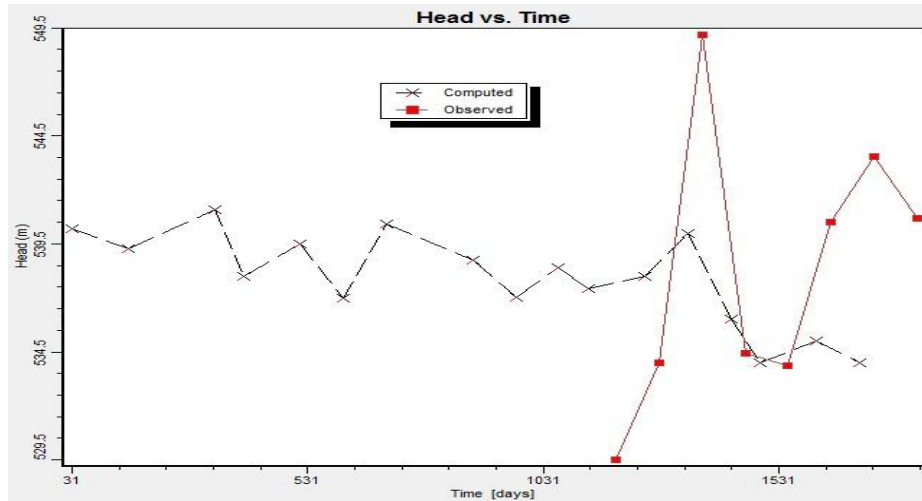


Figure.5.8b Times series analysis of Computed and observed at Palacodu

5.9. Model Forecast

The aquifer response for different input and output fluxes was studied in order to sustainably manage the aquifer system. The model was run for a further period of 11 years from 2014 to 2025. Before commencement of this simulation, the data of average rainfall (100 years), abstraction, river flow and recharge was provided to the model upto 2025.

Two prediction runs were planned to evolve optimal management schemes.

(1) Normal rainfall condition

The model was run to predict the regional groundwater head in this area until the year 2025. For these runs the monthly average rainfall calculated from 100 years rainfall data was used. The present level of groundwater abstraction was considered for this simulation. The simulated regional groundwater head shows that there is not much increase or decrease in water level. Such observation is made in most of the locations.

(2) Drought year once in four years

Analysis of the past 100 years (1901-2000) rainfall data indicates that in 56 years, the rainfall was less than the average of 816 mm/year. The average of these low rainfall years (drought period) was found to be 696 mm/year. In order to study the effect of drought years in this area, the model was predicted by assuming deficit rainfall once in two years until 2025. The monthly average of deficit rainfall years was calculated and used for this purpose. However, the groundwater level recovers to the level observed during the normal

rainfall within the next year. One good flow in the rivers sees the groundwater levels attaining its normal levels. The contribution of the river to the aquifer system maintains the system in stable condition.

3) Increase in Groundwater withdrawal

The model was run to predict the regional groundwater head in area until the year 2025 with 15% increase in pumping. For these runs the monthly average rainfall calculated from 100 years rainfall data was used. The predicted model indicates that the major portion becomes dry and only central and south eastern portion have groundwater in aquifer I. Model clearly indicates that the groundwater head will decline drastically with increase in pumping. (**Figure.5.9**). This clearly indicates that 15% increase in pumping will have devastating impact on the aquifer system.

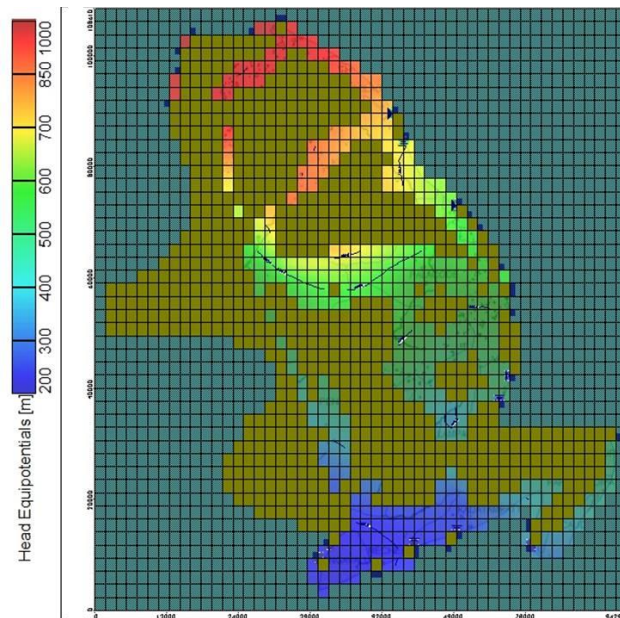


Figure. 5.9. Predicted groundwater head 2025 with 15% increase in pumping.

6.0. GROUND WATER RELATED ISSUES:

Ground water is extensively utilized for irrigation in the entire basin area for the past two decades, especially in the 15 over-exploited firkas out of the 31 firkas of the basin. There is no anthropogenic contamination in the basin as there is no much urbanization. However, excess fluoride in ground water in some pockets causes health hazards by utilizing such ground waters for drinking purpose in the absence of protected drinking water supply.

6.1. Geographical distribution & Resource availability :

In the study basin more than 46% of the area (2103 sq.km) is reeling under over development. All the 15 over-exploited blocks (11 of Dharmapuri district and 4 of Salem district) are falling on eastern side of the basin and mainly on the left of Chinnar river course. Entire Dharmapuri district part of the basin except three firkas viz., Dharmapuri, Nallampalli and Sujalnatham all the other 11 firkas having an area of 1970 sq.km are over-exploited through 35,251 dug wells and 523 bore wells. The development level in these firkas is about 170% to the available annual resource. Whereas, the other 4 over-exploited firkas of the basin fall on Thoppaiar drainage comprising an area of 133 sq.km with a level of development of 151%.

The total irrigation wells in the study basin are in the order of 51,542 out of which 47,662 are dug wells and 3,879 are bore wells. More than 80% of the dug wells (38,312) are located in 15 Over-exploited firkas of the basin, while the rest of 20% dug wells (9,348) located in the other 16 firkas.

The balance resource available for future use is left in the 16 firkas of the basin is in the order of 4,974 ham while there is an over draft of 10,239 ham in the 15 Over-exploited firkas. The average level of development in the 16 safe and semi-critical firkas of the basin is at 63% and accounts for 8,577 ham out of the available resource of 13,551 ham.

So there is ample scope for ground water development in the 16 safe and semi-critical firkas comprising more than 50% of the area of the basin, falling in parts of Krishnagiri, Salem and Dharmapuri districts.

6.2. Ground water quality issues:

High fluoride content in groundwater is the major concern in some isolated pockets of the basin falling in Denkanakottai and Kelamangalam firkas of Krishnagiri district and in Sujalnatham, Pulikarai and Marandahalli firkas of Dharmapuri district.

Highest fluoride levels are recorded in the water samples of bore wells collected from aquifer II at Samanur, Dodda Belur, A Pudur of Marandahalli firka (Dharmapuri district) and at Osatti and Karagondanapalli of Denkanakottai firka (Krishnagiri district).

Some dug well waters recorded more than 2 mg/l of fluoride concentration at Aralagundi of Sujalnatham firka, Samnur, Tadikallu, Elugundur of Marandahalli firka (Dharmapuri district) and at Sandanapalli and Dinnur villages of Denkanakottai firka (Krishnagiri district) which were collected from phreatic zone (Aquifer I).

6.3. Future Demand Scenario and Stress on Aquifer system:

Future demand projected for domestic utilization will have little stress on the aquifer system as the anticipated draft by 2025 and 2030 is not going to increase much in comparison to the present gross draft. However, draft can be regulated through increasing the water efficiency practices in irrigation sector.

Already the dependency on ground water for domestic and drinking needs is decreasing in ground water contaminated areas as the alternative surface/ river sources are being harnessed.

7.0. Management Strategies

The ground water management strategies are inevitable either when there is much demand to the resource than the available quantity or when the quality of resource deteriorates due to contamination in a given geographical unit. In recent years water resources are used extensively both for irrigation and industrial needs. In addition, to meet the domestic requirements of the fast growing urban agglomerations the administrators are compelled to allocate a considerable quantum of resource which otherwise is being used for irrigation purpose. So, the urbanization has a negative impact on the food production as well as grabbing the employment of the agricultural laborers. Hence, it is the need of the hour to formulate sustainable management of the ground water resource in a more rational and scientific way.

The study area is characterized by weathered and fractured system with very heavy abstraction of ground water for irrigation practices. Sustainable management plan for ground water is being proposed after a thorough understanding of the aquifer disposition down to a depth of 200m bgl.

7.1. Sustainable Management Plan

The groundwater resource is over-exploited in 15 firkas of the basin comprising an area of 2103 Sq.km. out of the 4514 sq.km area of the basin. Irrigation draft of 239 MCM is estimated as per the GEC 2011 against the Net availability of the resource of 146.56 MCM. A total of 100 MCM in excess was drawn from the ground water system of the 15 OE firkas. Therefore, the usage of groundwater has to be reduced by 40 percent of the existing draft for the sustainability of the resource. Or else the availability has to be augmented through artificial recharge methods to bridge the gap between draft and availability. The draft can be reduced through application of water efficiency methods in irrigation sector and through changing the irrigation practices from wet to dry cash crops.

7.2. Augmentation Plan

Augmentation of groundwater can be achieved through construction of percolation ponds and recharge shafts where the top soil zone is clayey which does not allow infiltration. Normally it can be achieved through capturing surface runoff. Surface water transfer also can be planned in the absence of surface runoff during droughts. It needs uncommitted runoff from the adjoining localities to transport to the needy areas through diversion channels.

In the study area eastern and southern parts are subjected to Over-exploitation. Normally due to over exploitation of groundwater the water levels are depleting in this zone. The natural rainfall recharge is insufficient to recoup the extracted groundwater. Artificial Recharge and Water Conservation Plans are proposed in the OE firkas of the basin through utilizing the uncommitted surface runoff of 218 MCM.

7.2.1. Artificial Recharge Plan

Based on the water level monitoring in different seasons across the basin, as well as after having better understanding of the disposition and extent of the aquifer system through exploratory drilling, pumping tests etc., the potential volume of void space available within the

weathered zone of first aquifer of the basin has been estimated as 463 MCM and tabulated in **Annexure - 6**. But the annual uncommitted runoff is only 218MCM which is less than 50% of required water to fill the available void space of aquifer I. Artificial recharge and Water conservation plan is prepared for the over exploited firkas of the basin area through harnessing just less than 40% of the annual uncommitted runoff of 37.7 MCM only with a total out lay of 142 Crore rupees.

The suggested Artificial recharge structures are mainly Nala bunds, Check Dams and Recharge Shafts in addition to removal of silt in the surface tanks. Selection of the site locations of these structures are based on the critical analysis of the hydrogeological, geophysical and exploration data of the basin. Particularly geomorphological and drainage aspects are being given more weightage in selection of the Artificial Recharge structures.

A total number of 174 check dams, 234 nala bunds and 99 recharge shafts are proposed in the OE firkas of the basin. A total number of 272 Recharge Rejuvenation ponds are selected for desilting followed by construction of recharge shafts within the tanks. The expected recharge through these artificial recharge structures is in the order of 30.479 MCM.

The expected average water level rise in the 15 OE firka area will be in the order of 2.28m/year

The firkawise details are discussed in Part II of the report.

7.2.2. Water Conservation Plan

Low pressure water distribution system is being proposed in 1391 Ha of cropped area which otherwise is under irrigation through earth channels. The expected savings of water through this method is expected to be 3.573 MCM./ yr. A total number of 1362 Farm ponds are proposed which will act as storage tanks in farm as well as augment groundwater recharge and the expected annual groundwater recharge through these ponds is in the order of 7.355 MCM.

7.3.Demand side Management Plan

Demand side management can be accomplished through irrigation water scheduling, soil moisture management and practicing agronomic measures such as deep ploughing, straw mulching, and the use of improved strains/ seeds and drought resistant agents. Change in crop type and land use i.e., practicing higher-value crops under green house cultivation or returning

a proportion of the wet crop area to dry land cultivation of drought-resistant crops, will lead to a considerable savings of groundwater extraction. It is essential that the savings in groundwater are not spared to expand the irrigated area or to divert to other industrial uses but to leave it to restore the depleted water levels to rise and to build the aquifer storage. This can be achieved through clear incentives for farmers to act in the collective interest of resource conservation.

7.4. Future Demand Stress Aspects

In views of rapid urbanization the domestic water needs are increasing multifold. In this urbanization process the water wastage component is increasing mainly because of leakages through distributor system. Whereas in the agricultural irrigation sector the water demand mainly due to the enthusiasm of the farmers to increase the crop irrigation area.

Hence the policy makers at higher administrative level and rural development authorities at block level should educate the farmers in their jurisdiction in such a way that they should not venture to increase the farm irrigation area. Rather these authorities have to suggest high yielding crop varieties and high-value crops to grow with minimum water requirement with the technical guidance of local agricultural/ agronomic experts.

7.5.Strategies to overcome the future stresses

If the sustainable management is taken up in a true spirit in consultation with local village level bodies the groundwater depletion will not occur in future. However, it is very difficult to overcome gluttonous user attitude thrives for fullest use of the resource to get maximum output. In this process the vital resource is lost. Therefore a thorough understanding of the consequences of indiscriminate usage of the water should be propagated among users mainly among farmers as they are bulk users of the resource in the study area.

The demand side strategies to overcome future stresses are mainly

- Promoting Crop Change
- Reducing Irrigated Area
- Agronomic Water Conservation
- Reducing Water use reduction in Urban areas

Annexure-1

Details of Key Well established

Sl No.	Name of the Village	Co-Ordinates		May 14 DTW (mbgl)	Feb 15 DTW (mbgl)	water level Fluctuation	water table elevation (pre)	water table elevation (post)
		Latitude	Longitude					
1	Rayakottai	12°31'05"	78°01'58"	19.98	19.4	0.58	719.02	719.6
2	Nagamangalam	12°34'31"	77°56'38"	9.85	7.1	2.75	742.15	744.9
3	Nagadunai	12°33'49"	77°54'45"	8.62	8.17	0.45	671.38	671.83
4	Anusonal	12°34'00"	77°54'00"	7.71	6.05	1.66	780.29	781.95
5	Kelamangalam	12°36'17"	77°51'23"	3.25	1.95	1.3	799.75	801.05
6	D.Tamandrapalli	12°37'20"	77°51'09"	19.08	12.25	6.83	809.92	816.75
7	Virupakshanagara	12°35'37"	77°52'05"	4.25	2.25	2	800.75	802.75
8	Muddampatti	12°32'24"	77°59'06"	12.1	12.3	-0.2	706.9	706.7
9	Suligunta	12°32'59"	78°04'04"	7.95	7.4	0.55	603.05	603.6
10	Balanur Kottai	12°30'54"	78°03'07"	14.52	15.1	-0.58	633.48	632.9
11	Muddampatti(Deep)	12°32'49"	78°58'30"	18.35	14.9	3.45	711.65	715.1
12	Lakshmpuram	12°32'35"	77°52'47"	4.35	3.55	0.8	740.65	741.45
13	Bevanattam	12°30'51"	77°52'10"	7.48	6.2	1.28	770.52	771.8
14	Kowthalam	12°34'2"	77°49'56"	12.58	10.33	2.25	796.42	798.67
15	T.Pudur	12°35'19"	77°48'52"	8.3	4.05	4.25	806.7	810.95
16	Jarakalatti	12°29'39"	77°49'27"	4.64	2.45	2.19	875.36	877.55
17	Govindapally	12°28'35"	77°53'08"	8.74	6.38	2.36	771.26	773.62
18	Tippasandiram	12°28'31"	77°50'58"	4.92	2.82	2.1	818.08	820.18
19	Nemileri	12°26'10"	77°50'47"	5.38	4.82	0.56	820.62	821.18
20	Sandanapalli	12°27'53"	77°49'30"	8.3	6.1	2.2	874.7	876.9
21	Geddahalli	12°25'12"	77°51'12"	5.35	5.25	0.1	891.65	891.75
22	Chapranahalli	12°30'03"	77°48'12."	7.17	4.1	3.07	875.83	878.9
24	Medhatti	12°27'08"	77°46'37"	12.5	12	0.5	846.5	847
25	Kuthanpalli	12°33'59"	77°56'51"	10.5	8.9	1.6	743.5	745.1

26	Kandaganapalli	12°30'41"	77°44'09"	11.57	10.21	1.36	910.43	911.79
27	Kottai Uliamangalam	12°31'57"	77°45'46"	20.1	20.7	-0.6	902.9	902.3
28	C.K.Halli	12° 28'19.3"	78°01'55"	7.1	12.45	-5.35	693.9	688.55
29	Varaganapalli	12° 33 '47"	77°55'09"	5.5	5.3	0.2	763.5	763.7
30	Dinnur	12° 30 '35"	77°43'40"	8.4	8.2	0.2	928.6	928.8
31	Alahalli	12° 27 '52"	77°47'21"	4.65	4.5	0.15	842.35	842.5
32	Melur	12° 24 '37"	77°50'58"	2.85	1.95	0.9	922.15	923.05
33	Tadikallu	12° 28 '20"	77°49'59"	3.15	3.05	0.1	809.85	809.95
34	Sattankallu	12° 29 '8"	77°53'56"	9.4	8.75	0.65	776.6	777.25
35	Mangarai	12°05'23.5"	77°59'29"	6.98	7.5	-0.52	488.02	487.5
36	Dasampatti	12°11'29"	77°56'49"	18.05	19.9	-1.85	344.95	343.1
37	Halayapuram	12°06'34"	77°52'43"	7.13	5.95	1.18	505.87	507.05
38	Halayapuram(A)	12°06'34"	77°52'43"	7.45	6.05	1.4	521.55	522.95
39	Naganur	12°05'27"	77°53'29"	8.58	6.31	2.27	472.42	474.69
40	Jakkampatti	12°06'3.5"	77°51'34"	12.74	10.97	1.77	509.26	511.03
41	PeriaVittlapuram	12°03'30"	77°49'32"	7.9	4.4	3.5	369.1	372.6
42	Eriyur	12°00'56"	77°48'6"	8.55	4.2	4.35	315.45	319.8
43	Neruppur	11°57'49.5"	77°47'0"	6.09	2.79	3.3	269.91	273.21
44	Ramakondahalli	11°58'5.1"	77°48'27"	9.44	2.45	6.99	284.56	291.55
45	Puchchur	11°55'58.9"	77°51'8"	7.73	7.22	0.51	255.27	255.78
46	Aralgundi	11°57'12.5"	77°53'15"	17.45	10.83	6.62	363.55	370.17
47	Malaiyanur	11°59'28"	77°49'10"	7.5	4.43	3.07	302.5	305.57
48	Manikarankottai	12°01'16"	77°51'33"	6.32	8.99	-2.67	348.68	346.01
49	Mutugampatti	12°03'4"	77°53'44"	6.42	5.37	1.05	396.58	397.63
50	Kadamadai	12°03'23"	77°56'12"	8.85	4.81	4.04	461.15	465.19
51	Koppalur	12°02'6"	77°56'11"	7.66	3.41	4.25	469.34	473.59
52	Chinnampalli	12°00'26"	77°58'01"	6.4	4.42	1.98	331.6	333.58
53	Perumbalai	11°57'52"	77°56'13"	14.45	8.7	5.75	291.55	297.3
54	Ayamaranapatti	11°54'53"	77°55'36"	15.95	12.48	3.47	261.05	264.52

55	Pudupatti	12°02'54"	77°57'27"	11.65	6.1	5.55	470.35	475.9
56	Thallapallam	12°01'33"	77°53'09"	5.1	2.48	2.62	353.9	356.52
57	Perithota pudur	12°04'36"	77°54'48"	3.9	3	0.9	454.1	455
58	Kariyampatti	12°05'56"	77°54'55"	10.85	6.8	4.05	471.15	475.2
59	Pennagaran	12°07'30"	77°54'00"	12.44	7.69	4.75	500.56	505.31
60	Hogenikalfalls	12°07'09"	77°46'52"	5.8	3.19	2.61	265.2	267.81
61	Banijagarahalli	12°08'27"	77°57'25"	11.07	10.56	0.51	490.93	491.44
62	Solappadi	12°00'10"	77°48'59"	8.5	7.2	1.3	292.5	293.8
63	Sidumanahalli	12°00'45"	77°49'56"	5.9	4.4	1.5	319.1	320.6
64	Sidumanahalli colony	12°01'06"	77°50'08"	6.95	6.1	0.85	321.05	321.9
65	Kuttandahalli	12°28'27"	77°58'14"	16.4	18	-1.6	623.6	622
66	Panchapalli	12°27'37"	77°56'51"	16.52	2.65	13.87	612.48	626.35
67	Elugundur	12°26'07"	77°57'29"	13.52	9.37	4.15	597.48	601.63
68	Attimutlu	12°24'16"	77°58'42"	11.57	9.85	1.72	582.43	584.15
69	Sanmanur	12°24'38"	77°59'27"	8.06	5.54	2.52	589.94	592.46
70	Bennihalli	12°22'38"	77°57'59"	10.44	3.24	7.2	601.56	608.76
71	Sandirapuram	12°22'25"	77°59'56"	10.53	3.07	7.46	575.47	582.93
72	Doddabavalli	12°20'40"	78°00'00"	4.51	4.11	0.4	569.49	569.89
73	Belamaranahalli	12°19'18"	77°59'19"	10.76	5.93	4.83	557.24	562.07
74	Belluranahalli	12°18'32.5"	77°58'0.3"	6.44	5.68	0.76	568.56	569.32
75	Belluhalli	12°18'46"	77°57'17"	11.2	4.82	6.38	577.8	584.18
76	Siriyanaahalli	12°17'49"	77°59'44"	10.1	8.56	1.54	534.9	536.44
77	Gummanur	12°26'40.5"	78°00'58.6"	11.1	11.73	-0.63	625.9	625.27
78	Pudur	12° 23 '06.3"	78° 01' 39.1"	4.75	5	-0.25	579.25	579
79	Belarahalli	12° 17 '35.2"	78° 05' 51.8"	10.85	14	-3.15	500.15	497
80	Timmampatti	12° 19 '4.9"	78° 04' 31.9"	7.15	8.75	-1.6	492.85	491.25
81	Marandahalli	12° 23 '16.6"	78° 00' 25.7"	5.33	3.77	1.56	582.67	584.23
82	Mallapuram	12° 21 '11.7"	78° 00' 44.4"	7.55	7.45	0.1	563.45	563.55
83	Gowdanur	12° 20 '03"	78° 02' 26.7"	7.4	7.65	-0.25	536.6	536.35

84	Boppadi	12° 18 '07.5"	78° 01' 25.3"	5.16	5.7	-0.54	526.84	526.3
85	Tirumalavadi	12° 15 '25.7"	78° 03' 37.3"	11.6	8.6	3	506.4	509.4
86	Somanahalli	12° 14 '32"	78° 05' 56.2"	15.15	14.5	0.65	461.85	462.5
87	Chittampatti	12° 16 '1.8"	78° 08' 35"	13.2	10.2	3	463.8	466.8
88	Nagadasampatti	12°08'8.5"	77°59'26"	11.41	6.86	4.55	460.59	465.14
89	Belanaganahalli	12°06'59"	77°55'00"	4.82	3.97	0.85	484.18	485.03
90	Karibalayanahalli	12°05'23.5"	77°59'29"	14.37	10.76	3.61	455.63	459.24
91	Vellakkal	11°59'52"	78°04'01"	21.55	10.95	10.6	475.45	486.05
92	Jarugu	11°59'59"	78°01'41"	17.25	13.75	3.5	449.75	453.25
93	Melisalpatti	11°58'21"	78°01'43"	14.75	14.4	0.35	501.25	501.6
94	V.R.Kottai	11°57'58"	78°00'43"	14.58	13.95	0.63	467.42	468.05
95	Sekkarapatti	11°57'13"	78°05'31"	13.09	13.42	-0.33	351.91	351.58
96	Thoppaiar Dam	11°57'28"	78°06'10"	12.5	10.55	1.95	351.5	353.45
97	C.Pudur	12°07'31"	77°58'18"	13.9	12.05	1.85	465.1	466.95
98	Thoppur	11°56'36"	78°02'53"	11	9.55	1.45	322	323.45

Groundwater Quality for Aquifer I

Sl.No	Village/ Location	Block	District	Lat	Long	pH	EC (μ S/cm)	TH	Ca	Mg	Na	K	CO3	HCO3	Cl	SO4	NO3	F
								mg/l										
1	C.K.Halli	Kelamangalam	Krishnagiri	12.472	78.032	7.66	1040	350	50	55	76	6	NIL	317	99	86	38	0.92
2	Nagamangalam	Kelamangalam	Krishnagiri	12.575	77.944	7.76	1150	315	52	45	117	4	Nil	488	57	38	65	0.8
3	Nagadunai	Kelamangalam	Krishnagiri	12.564	77.913	8	869	235	38	34	92	8	Nil	366	53	48	20	1.3
4	Kelamangalam	Kelamangalam	Krishnagiri	12.605	77.856	7.3	2410	750	124	107	242	4	Nil	427	454	226	74	1.02
5	D.Thamanrapalli	Kelamangalam	Krishnagiri	12.622	77.853	7.4	1780	705	188	57	76	20	Nil	366	181	278	61	0.8
6	Viruppakshinagar	Kelamangalam	Krishnagiri	12.594	77.868	7.6	1010	270	60	29	104	8	Nil	61	163	158	74	0.64
7	Mudampatti/	Kelamangalam	Krishnagiri	12.54	77.985	7.45	1430	475	120	43	108	4	Nil	360	131	149	99	0.31
8	Suligunta	Kelamangalam	Krishnagiri	12.552	78.06	7.63	1520	525	104	64	104	12	Nil	519	96	173	25	1.4
9	Balanur kothai	Kelamangalam	Krishnagiri	12.515	78.052	7.79	1820	325	56	45	271	4	Nil	580	234	67	50	1.02
10	Mudampatti	Kelamangalam	Krishnagiri	12.547	78.975	7.82	1020	255	60	26	115	5	Nil	73	60	288	68	0.96
11	Lakshnipuram	Kelamangalam	Krishnagiri	12.543	77.88	7.75	1700	485	116	47	170	7	Nil	427	152	274	19	0.92
12	Bevanatham	Kelamangalam	Krishnagiri	12.514	77.869	7.79	1510	410	80	51	159	2	Nil	311	199	182	35	0.92
13	T.Pudur	Kelamangalam	Krishnagiri	12.589	77.814	7.89	1500	300	64	34	202	12	Nil	366	96	240	87	1.5
14	Jarkkalatti	Kelamangalam	Krishnagiri	12.494	77.824	7.72	1200	300	76	27	138	4	Nil	323	135	101	56	1.02
15	Varaganapalli	Kelamangalam	Krishnagiri	12.563	77.919	7.34	893	140	45	95	300	5.5	NIL	250	95	25	75	0.9
16	Bommathattanu	Kelamangalam	Krishnagiri	12.565	77.891	7.3	699	120	61.5	58.5	215	10	NIL	210	20	50	60	1.5
17	puvanapalli	Kelamangalam	Krishnagiri	12.561	77.85	7.25	1420	195	75	120	510	15	NIL	290	50	320	67	1.8
18	Dinnnr	Kelamangalam	Krishnagiri	12.51	77.728	7.2	381	105	55	50	80	5	NIL	100	10	50	28	1.6
19	Kadaganapalli	Kelamangalam	Krishnagiri	12.511	77.736	7.25	484	145	100	45	90	15	NIL	100	50	70	25	1.7
20	Medhatti	Kelamangalam	Krishnagiri	12.452	77.777	7.37	867	200	110	90	200	20	NIL	300	40	60	30	1.3
21	Allahalli	Kelamangalam	Krishnagiri	12.464	77.789	7.33	749	135	65	70	235	2	NIL	250	35	65	35	1.4
22	Nemileri	Kelamangalam	Krishnagiri	12.436	77.846	7.42	556	95	55	40	170	6	NIL	170	60	35	15	0.6
23	Geddahalli	Kelamangalam	Krishnagiri	12.42	77.853	7.44	613	110	50	60	190	7.5	NIL	200	60	40	10	1.1
24	Melur	Kelamangalam	Krishnagiri	12.41	77.849	7.25	650	150	120	30	150	20	NIL	150	55	100	30	0.6
25	Tadikallu	Kelamangalam	Krishnagiri	12.472	77.87	7.41	706	125	50	75	230	1.5	NIL	250	25	45	25	2.1
26	Karibalayamhalli	Nallampalli	Krishnagiri	12.09	77.991	7.7	1960	600	100	85	175	8	Nil	421	209	211	161	1.1

27	Vallakkal	Nallampalli	Krishnagiri	11.998	78.067	7.5	1250	320	50	47	140	4	Nil	500	99	29	62	0.78
28	Jarugu	Nallampalli	Krishnagiri	12	78.028	7.63	1190	310	30	57	129	8	Nil	397	67	158	25	0.41
29	Thoppaiardam	Nallampalli	Krishnagiri	11.958	78.103	7.84	1740	480	60	80	179	8	Nil	433	124	230	143	1.2
30	Marandahalli	Palacode	Dharmapuri	12.388	78.063	8.02	2070	490	44	92	253	3	NIL	647	269	64	65	1.7
31	Mallapuram	Palacode	Dharmapuri	12.353	78.032	7.98	2460	590	72	100	299	23	NIL	647	333	148	155	0.82
32	Gowdanur	Palacode	Dharmapuri	12.334	78.016	8.06	820	240	58	23	74	1	NIL	268	78	23	59	0.82
33	Boppadi	Palacode	Dharmapuri	12.302	78.249	8.01	400	55	10	7	67	1	NIL	195	14	11	7	0.76
34	Gummanur	Palacode	Dharmapuri	12.444	78.016	8	1690	410	70	57	196	7	NIL	610	113	90	124	1.5
35	Pudur	Palacode	Dharmapuri	12.385	78.249	7.6	2360	480	108	51	322	42	NIL	549	319	168	193	0.62
36	Kuttanahalli	palacode	Krishnagiri	12.474	77.971	7.8	1200	165	18	29	200	4	Nil	366	99	149	19	1.45
37	Panchapalli	palacode	Krishnagiri	12.46	77.948	7.86	859	235	46	29	90	2	Nil	378	50	48	9	1.32
38	Tipasandiram	palacode	Krishnagiri	12.475	77.849	7.78	1020	300	66	33	92	12	Nil	366	71	82	43	1.4
39	Sandana palli	palacode	Krishnagiri	12.465	77.825	7.89	418	140	34	13	30	2	Nil	165	28	22	14	1.8
40	Sapranahalli	palacode	Krishnagiri	12.501	77.803	7.6	1270	335	40	57	138	8	Nil	537	106	34	19	1.69
41	Attimutlu	palacode	Krishnagiri	12.404	77.978	7.55	1500	365	44	62	177	4	Nil	580	128	67	33	1.5
42	Bennahallu	palacode	Krishnagiri	12.377	77.966	7.48	1580	380	72	49	186	4	Nil	287	124	302	74	1.4
43	Doddabavahalli	palacode	Krishnagiri	12.344	78	7.54	3320	710	168	70	437	31	Nil	543	518	418	105	0.82
44	Belamaranahalli	palacode	Krishnagiri	12.322	77.989	7.83	2390	800	120	122	186	16	Nil	500	227	374	124	0.59
45	Belluhalli	palacode	Krishnagiri	12.313	77.955	7.84	1870	400	40	73	246	4	Nil	586	195	125	68	1.3
46	Panchapalli Dan	palacode	Dharmapuri	12.47	77.938	7.18	720	135	65	70	229.5	10	NIL	200	35	40	100	1.5
47	Ramanakottai	palacode	Dharmapuri	12.441	77.953	7.34	864	100	50	50	315	10	NIL	225	20	70	105	1.2
48	Elugundur	palacode	Dharmapuri	12.435	77.958	7.3	706	145	50	95	200	5	NIL	300	40	-40	50	2
49	Samanur	palacode	Dharmapuri	12.411	77.991	7.31	2480	520	55	465	750	10	NIL	250	270	678	82	2.6
50	Mangaraiu	Pennagaram	Krishnagiri	12.115	77.929	7.71	3010	900	150	128	308	16	Nil	354	432	562	136	0.82
51	Dasampatti	Pennagaram	Krishnagiri	12.191	77.947	7.69	1880	580	80	92	163	12	Nil	555	121	245	93	0.93
52	Eriyur	Pennagaram	Krishnagiri	12.016	77.802	7.69	3160	1200	280	122	179	8	Nil	500	496	322	192	0.92
53	Neruppur	Pennagaram	Krishnagiri	11.964	77.783	7.86	1970	670	160	66	138	16	Nil	372	195	278	149	1.03
54	Manikarankattai	Pennagaram	Krishnagiri	12.021	77.859	7.94	2330	700	90	115	225	8	Nil	427	227	379	167	1.4
55	Kadamadai	Pennagaram	Krishnagiri	12.056	77.937	8	1140	325	50	49	113	5	Nil	488	82	38	25	0.32
56	Chinnampalli	Pennagaram	Krishnagiri	12.007	77.967	7.93	2920	630	40	129	393	12	Nil	384	383	523	130	0.92

57	Ayamaramapatti	Pennagaram	Krishnagiri	11.915	77.927	7.59	1550	440	60	70	129	10	Nil	366	85	211	112	0.32
58	Banijigarahalli	Pennagaram	Dharmapuri	12.141	77.957	7.5	3120	1110	295	815	490	15	NIL	615	345	600	50	1
59	Halapuram	Pennagaram	Dharmapuri	12.109	77.879	7.02	2120	700	170	530	400	15	NIL	300	230	550	6	0.45
60	Periyavittalapur	Pennagaram	Dharmapuri	12.058	77.826	7.52	2150	300	155	145	800	15	NIL	375	175	550	10	1.3
61	Ramakondahall	Pennagaram	Dharmapuri	11.968	77.808	7.51	1716	315	150	165	520	18	NIL	365	100	380	5	1.4
62	Aralagundi	Pennagaram	Dharmapuri	11.954	77.888	7.54	1189	220	80	140	365	15.5	NIL	300	50	231	20	2.1
63	Malaiyanur	Pennagaram	Dharmapuri	11.991	77.819	7.44	1545	300	140	160	450	10	NIL	115	125	500	30	1.4
64	Thallampallam	Pennagaram	Dharmapuri	12.026	77.886	7.55	1131	175	100	75	400	5	NIL	230	60	270	25	1.5
65	Periya Thotapudur	Pennagaram	Dharmapuri	12.077	77.913	7.51	470	80	30	50	145	10	NIL	135	25	65	10	1

Groundwater quality for Aquifer II

SlNo	Village/ Location	Block	District	Lat	Long	pH	EC (μ S/cm)	TH	Ca	Mg	Na	K	CO3	HCO3	Cl	SO4	NO3	F
1	Kelamangalam	Kelamangalam	Krishnagiri	12.603	77.864	8.4	838	175	66	2	127	1	24	354	53			
2	Rayakottai ew	Kelamangalam	Krishnagiri	12.519	78.022	7.61	2180	730	80	129	176	16	0	439	405	144	36	0.24
3	Rayakottai Pz	Kelamangalam	Krishnagiri	12.519	78.022	7.53	1550	580	48	112	97	16	0	439	256	76	74	0.94
4	Kalamangalam	Kelamangalam	Krishnagiri	12.603	77.864	7.74	1030	140	40	10	166	12	Nil	366	113	43	12	1.02
5	Pachchappanatti	Kelamangalam	Krishnagiri	12.553	77.853	7.63	1520	345	104	21	186	12	Nil	458	50	254	64	0.74
6	T.Pudur	Kelamangalam	Krishnagiri	12.589	77.818	7.63	1060	300	76	27	106	2	Nil	488	50	43	19	1.7
7	Kottur	Kelamangalam	Krishnagiri	12.628	77.824	7.7	1950	480	110	50	230	4	Nil	574	128	240	112	1.8
8	Kamandur	Kelamangalam	Krishnagiri	12.449	77.82	7.8	990	320	54	45	78	10	Nil	378	71	58	43	1.9
9	Royakottai	Kelamangalam	Krishnagiri	12.515	78.028	7.35	2090	700	46	142	168	8	Nil	433	284	250	68	0.92
10	Nammandahalli	Kelamangalam	Krishnagiri	12.474	77.971	7.56	2350	750	34	162	198	16	Nil	665	248	197	118	1.4
11	Namari	Kelamangalam	Krishnagiri	12.436	77.846	7.8	947	250	60	24	104	2	Nil	299	50	101	68	1.9
12	Unsetti	Kelamangalam	Krishnagiri	12.428	77.853	7.7	1090	385	66	53	69	12	Nil	323	96	120	37	1.5
13	Tavaraikarai	Kelamangalam	Krishnagiri	12.507	77.761	7.14	2230	1050	114	186	41	8	Nil	354	170	576	19	1.02
14	Melur	Kelamangalam	Krishnagiri	12.448	77.78	7.85	1270	460	100	51	81	2	Nil	311	96	178	74	0.44
15	Suligunta	Kelamangalam	Krishnagiri	12.552	78.06	7.19	1246	240	85	155	360	10	NIL	250	60	50	253	1.2
16	Sajjalapatti	Kelamangalam	Krishnagiri	12.534	78.024	7.6	1230	285	165	120	315	20	NIL	185	160	35	245	1.4
17	Kothapalli	Kelamangalam	Krishnagiri	12.566	77.948	7.29	975	170	55	115	310	5	NIL	240	100	10	132	1.6
18	krishnapuram	Kelamangalam	Krishnagiri	12.536	77.879	7.47	542	80	55	25	185	9	NIL	155	70	25	30	1.2
19	Shankarapuram	Kelamangalam	Krishnagiri	12.626	77.843	7.16	887	175	100	75	245	20	NIL	160	25	130	110	1.4
20	Karagondanapa	Kelamangalam	Krishnagiri	12.657	77.865	7.03	1485	300	155	145	325	7	NIL	175	65	297	95	2.1
21	D,Kohapalli	Kelamangalam	Krishnagiri	12.628	77.859	7.11	1418	315	205	110	390	15	NIL	140	80	415	93	1.4
22	A.pudur	Kelamangalam	Krishnagiri	12.588	77.844	7.1	1419	295	175	120	400	11.5	NIL	205	95	310	89	2.1

23	Dodda belur	Kelamangalam	Krishnagiri	12.583	77.825	7.41	1355	160	175	-15	500	18	NIL	265	100	258	55	2
24	Girisettyalli	Kelamangalam	Krishnagiri	12.543	77.854	7.24	768	160	65	95	200	10	NIL	210	60	55	40	1.6
25	D.Kothanur	Kelamangalam	Krishnagiri	12.542	77.833	7.26	994	165	60	105	315	24	NIL	290	65	100	55	1.5
26	Kottai uliyaman	Kelamangalam	Krishnagiri	12.533	77.763	7.12	1048	225	110	115	274.5	25	NIL	350	110	40	26	1.1
27	osatti	Kelamangalam	Krishnagiri	12.519	77.763	7.13	1049	255	140	115	228.5	20	NIL	160	40	250	48	2.1
28	kandakanahalli	Kelamangalam	Krishnagiri	12.515	77.74	7.07	1084	245	150	95	275	11.5	NIL	165	100	225	29	1.9
29	Dinnur	Kelamangalam	Krishnagiri	12.511	77.73	7.26	536	130	70	60	132	10	NIL	160	25	40	44	1.5
30	Oddarapalyam	Kelamangalam	Krishnagiri	12.459	77.778	7.49	820	145	65	80	250	7	NIL	295	25	40	40	1.6
31	Maniyambadi	Kelamangalam	Krishnagiri	12.43	77.767	7.26	1208	225	110	115	375	14	NIL	225	85	292	12	0.8
32	giriyanahalli	Kelamangalam	Krishnagiri	12.465	77.797	7.18	1231	250	50	200	369.5	12.5	NIL	290	115	189	38	1.1
33	Sandanapalli	Kelamangalam	Krishnagiri	12.466	77.818	7.3	310	100	50	50	50	2.5	NIL	70	60	20	3	1.4
34	Sigutte	Kelamangalam	Krishnagiri	12.458	77.817	7.09	885	200	75	125	240	3	NIL	230	25	159	29	1.5
35	Irudukottai	Kelamangalam	Krishnagiri	12.458	77.829	7.39	301	75	55	20	71.5	5	NIL	115	10	24	3	1.1
36	Hosahalli	Kelamangalam	Krishnagiri	12.448	77.839	7.33	628	95	45	50	220	4.5	NIL	250	25	35	10	1.5
37	Melur	Kelamangalam	Krishnagiri	12.404	77.848	7.24	607	150	75	75	150	6.5	NIL	235	30	43	2	1.1
38	Hanumanthapur	Kelamangalam	Krishnagiri	12.45	77.836	7.69	584	100	50	50	180	9	NIL	150	45	10	85	0.9
39	S.kurobatti	Kelamangalam	Krishnagiri	12.477	77.825	7.49	604	185	75	110	119.5	6	NIL	150	20	50	80	0.85
40	Saprnahalli	Kelamangalam	Krishnagiri	12.501	77.803	7.5	802	115	50	65	290	6	NIL	200	35	100	75	1.6
41	muthur	Kelamangalam	Krishnagiri	12.492	77.833	7.46	443	100	50	50	125	3.5	NIL	100	25	85	20	1.2
42	Govindapalli	Kelamangalam	Krishnagiri	12.476	77.883	7.2	987	175	75	100	290	20	NIL	215	55	150	65	1.2
43	Sattankallu	Kelamangalam	Krishnagiri	12.506	77.898	7.29	666	155	100	55	180	1.5	NIL	135	30	100	65	1.2
44	Mugulur	Kelamangam	Krishnagiri	12.544	78.02	7.3	1350	435	100	49	106	10	Nil	427	131	77	74	1.1
45	Magamangalam	Kelamangam	Krishnagiri	12.565	77.942	7.4	960	350	64	46	55	8	Nil	397	60	53	17	1.0
46	Maniyambadi	Kelamangam	Krishnagiri	12.45	77.785	7.4	830	300	64	34	48	8	Nil	366	46	43	2	0.9
47	Geddahalli	Kelamangam	Krishnagiri	12.42	77.853	8	490	175	20	30	44	3	Nil	256	28	17	7	0.9
48	Kargur	Palacode	Dharmapuri	12.288	77.94		1289								170			
49	Kandiyampatti	Palacode	Krishnagiri	12.367	77.972	7.56	1830	655	204	35	113	12	Nil	299	82	504	37	1.5
50	Belluhalli	Palacode	Krishnagiri	12.314	77.949	7.89	1340	275	34	46	175	20	Nil	543	103	67	25	0.84
51	Kalegoundanur	Palacode	Krishnagiri	12.094	77.968	8.05	1280	335	86	29	140	5	Nil	195	39	403	12	1.03
52	Erikarai	Palacode	Krishnagiri	12.176	77.919	7.85	1450	515	90	70	92	12	Nil	366	266	24	37	1.6

53	Mallapuram	Palacode	Krishnagiri	12.103	77.885	7.2	2170	610	136	66	223	4	Nil	415	99	514	112	1.8	
54	Aralgundi	Palacode	Krishnagiri	11.954	77.888	7.89	1270	180	30	26	202	12	Nil	323	96	206	25	1.12	
55	Pattabinagar	Palacode	Dharmapuri	12.464	77.951	7.07	898	210	90	120	230	4.5	NIL	240	40	60	100	1.4	
56	Samanur	Palacode	Dharmapuri	12.411	77.991	7.4	1732	245	45	200	620	5	NIL	600	115	65	75	2.3	
57	Bannihalli	Palacode	Dharmapuri	12.381	77.97	7.45	1022	135	45	90	365	15	NIL	375	20	30	80	1.5	
58	Kunddankuttai	Palacode	Dharmapuri	12.371	77.981	7.29	1360	265	55	210	405	10	NIL	290	125	195	75	1.3	
59	Sandirapuram	Palacode	Dharmapuri	12.371	77.998	7.37	1026	150	45	105	360	4	NIL	350	70	20	65	1.5	
60	Siriyalli	Palacode	Dharmapuri	12.297	77.996	7.33	2650	540	210	330	800	20	NIL	450	265	600	45	0.65	
61	Bevuhalli	Pennagaram	Dharmapuri	12.288	77.94		1289								170				
62	Konangihalli	Pennagaram	Dharmapuri	12.134	77.969	8.9	850	235	28	40	85	5	30	201	58				
63	Chinnaparamnu	Pennagaram	Dharmapuri	12.297	77.929	7.14	1159	255	100	155	315	1	NIL	210	105	175	80	0.65	
64	Gettur	Pennagaram	Dharmapuri	12.141	77.964	7.09	1320	280	130	150	390	2.5	NIL	175	170	286	55	0.65	
65	Roadside HP	Pennagaram	Dharmapuri	12.152	77.958	7.74	529	135	60	75	125	2	NIL	275	60	-	113	40	0.65
66	Naganur	Pennagaram	Dharmapuri	12.091	77.891	7.31	2910	1050	410	640	400	21	NIL	400	285	729	57	0.46	
67	Jakkampatti	Pennagaram	Dharmapuri	12.101	77.859	7.53	1368	245	100	145	425	10	NIL	275	105	195	90	0.68	
68	Puchchur	Pennagaram	Dharmapuri	11.932	77.855	7.59	967	220	110	110	250	10	NIL	250	50	168	12	0.92	

Basic details of Exploratory borewells constructed by Central Ground Water Board

Sl. No.	Location, Well number , Co-ordinates, Toposheet Number and R.L. of G.L (mamsl).	Year of Drilling	Depth drilled Casing Pipe Lowered (mbgl)	Lithology	Fracture zones encountered (mbgl) / Discharge(lps)	Type of preliminary Test & Results (*)	Results of aquifer performance test							
							SWL (mbgl) Date	Discharge (lps) Draw down (m)	Specific capacity (lpm/ m of Draw down)	T (m ² / day)	S	EC	Cl	F
1	KELAMANGALAM(EW)	1988	249	Charnockite	16.65-17.65 / 0.021	--	11.25	1.65	5.18	8.58	2.6 x10 ⁻³	838	53	
	(12° 36' 10";77° 51' 50"-57 H/11)		9.7	and	40.51-44.51 / 0.136		--	19.19		Average				
				Granite	85.23-89.23 / 0.250									
				Gneiss	109.09-111.09 / 0.49									
					185.20-187.29 / 0.631									
					215.77-219.77 / 2.17									
	788.29				249.25 - 249.30 4.029									
	KELAMANGALAM(OW-I)	1988	199.53	Sand with	91.85-95.05 / 1.50	--	4.98	1.76	26.59	12.14	2.6 x10 ⁻³	--	--	
	12° 08' 38"; 77° 52' 33" 57 H/11		10.3	Kankar,	118.70-119.70 / 1.89		18.1.88	3.97						
				Granite										
	788.29			Gneiss										

	KELAMANGALAM(OW-II)	1988	249.4	Sand with	85.00-86.00 / 0.20	--		1.65	5.89	--	1.4 x10-3	--	--	
			11	Kankar,	98.00-99.00 / 1.50			16.78						
				Granite	208.00-209.00 / 2.00									
	788.19			Gneiss	219.00-220.00 / 3.80									
2	ANJATTI(EW)	1990	300	Granite	143.00-145.00 / 0.780	Slug Test		11.2	--	--	--	--	--	--
	12° 20' 00" ;77° 43'00" 57 H/11		1.5	Charnockite		T=1.40		2.2.90						
	574.32													
3	DENKANIKOTTAI (EW)	2004	222.6	Granite	82.00-82.50/0.215	--		5.8	2.11	1.56	--	--	647	57
	12°22'37";77°47'10" 57H/11		12		188.00-188.50/3.36			21.12.04	81					
4	PENNAGARAM (EW)	1988	300.00	Charnockite	129.95-131.95 / 1.00	--		8.96	--	--	--	--	--	--
	12° 08' 00";77° 53' 30" 58 H/16		8.75					--						
	510.780													
5	MARANDAHALLI(EW)	1989	230.03	Granitic	9.43-12.43 / 0.261	Air Test		1.31	--	--	--	--	2849	702
	(12°22' 13" ;77° 59'57"-57 L/15)		5.38	Gneiss	46.03-48.03 / 0.316	T=1.97		4.10.89						
					139.53-140.53 / 0.44	DD=0.675								
	604.300				210.73-211.73 / 0.73									
6	KONAGIHALLI(EW)	1990	181.18	Granite	46.03-47.03 / Moist	Slug Test		--	--	--	--	--	--	--
	(12° 08' 01" ;77° 58'10"-57 L/16)			Gneiss	110.08-112.08 / 0.25	T=0.193								

	482.095													
7	PAPPARAPATTI (EW)	2005	160.00	Granite gneiss	10.5-14.5			16.00	--	--	--	--	--	--
	12°13'40";78°03'35"-57L/4				20.12-21.12									
					90.72-92.32									
8	PAPPARAPATTI (OW)	2005	168.52	Granite gneiss	20.65-21.65/0.32		4.1	5.53	88.24	--	--	--	--	--
	12°13'40";78°03'35"-57L/4				82.8-83.8/1.79			3.76						
					119.18-120.18-2.90									
					165-166.7-5.53									
9	BEVUHALLI (EW)	2004	300	Granite	32.50-33.00/0.078	--	14.60	3.34	5.402	--	--	1289	170	
	KARGUR		11.50		52.00-52.50/1.79		09.12.04	37.1						
	(12°17'17";77°56'24"-57H/15)													
10	DIVATTIPATTI (EW)	1990	195.48	Gneiss	51.08-52.08 / 0.40	--	30.2	--	--	--	--	--	--	
	(11° 53' 00" ;78° 05' 20"-58 I/1)		11.5		145.58-146.68 / 0.166		--							
11	KUMARANAPALLI	2004	170	Granite Gneiss	45.5-46/ 0.214		43.66	3.00	9.83	1.8	--			
	(12°41'15";77°45'00")		36.00		152-152.5/ 5.50		25.03.04	18.31						
	57 H/10													
12	KONAGIHALLI(EW)	1990	181.18	Granite	46.03-47.03 / Moist	Slug Test	--	--	--	--	--	--	--	
	(12° 08' 01" ;77° 58'10"-57 L/16)			Gneiss	110.08-112.08 / 0.25	T=0.193								
	482.095													
13	BAIRANATHAM (EW)	2005	16.12	Granite gneiss	154.28-155.28/1.79									
	11°49'30";78°21'00"-57I/5				243.10-244.10/2.50									
14	SORANGAPPANPUDUR	2004	318	Granite gneiss	142-143/0.73		-	0.73	-	--	--	-	-	No test
	(12°01'20";78°03'05"-57L/4)		12.00					-						

	(12°37'45";77°48'42"-57H/11)													
	MADAGONDANAPALLI		40		21.12,22.74,36.36		13.01	1				546	28	
23	THALLI		235	Granitic gneiss	11.50,22.74,55.22,231.48		20.12	8.4				282	42	
	(12°34'50";77°39'11")													
	THALLI		20		28.74,42.98		19.62	0.5				529	32	
24	GUMMANUR(Ew)		159	G.Gneiss	70.46-71.46	T=3.1	54.8	2.5		11.3	0.0016	1130	71	
	(12°26'40";78°00'58")		6		154.28-155.28	Q=6.3		40.65						
	Gummanur(ow)		165		153.28-154.28,	Q=6.5						1380	92	
			6					40.1						
25	ODAYANDAHALLIU(Pz)		100		45.10-46.0	Q=0.3	9.2							
	(12°29'15";78°01'24")		3			T=0.93								
26	RAYAKOTTAI(EW)	2007	145.66	G.Gneiss	16.12,92.32,122.80,140.04		19.52	16				2180	405	
	(12°31'10";78°01'19")		39											
	RAYAKOTTAI(OW)				16.12,24.74		24.12					1050	256	
	(12°31'10";78°01'19")		39											
27	MUGULUR(EW)	2015	176.1	Migmatite		Slug test	71.4			1.2		1350	131	
	12°32'40":78°01'11"		5.65											
28	NAGAMANGALAM(EW)		200	G.Gneiss	50.6-51.6		>125					960	60	No test
	12°33'53":77°56'30"		8.5		124.8-125.8									
29	MANIYAMBADI(EW)		200	Charnockite	85.7-86.7		24.03			0.42		830	46	
	12°27'00":77°47'06"		5.65											

30	GEDDAHALLI(EW)		200	G.Gneiss	61.84-62.46		5.14			4.5		490	28
	12°25'12":77°51'12"		9		160.9-161.9								
31	PANCHAPALLI	2015	194.5	G.Gneiss	77.08-77.6/ 0.43 , 138.04-39.00/ 0.75 , 182.7-183.5/ 4.3	Q=3.5	33.06						
	12°27'55":77°56'56"		12.5										
32	JARUGU	2015	185.14	Charnockite	37.36-38.00 /0.8 , 88.5-89.00/ 0.22	Q=0.15	5.74						
	11°59'56":78°01'34"		12										
33	VELLAR	1998	49.5	G.Gneiss	26.0- 26.1,33.0-33.1	Q=0.441	4.1					1130	
	11°53'00":77°50'30"		5.5										
34	KULATHUR		65.5	G.Gneiss	47.0-47.5	Q=0.014	26.6					860	
	11°50'50":77°44'50"		3.5										
35	KADAYAMPATTI		62.35	G.Gneiss	55.6- 55.8,56.5-56.6	Q=1.0	17.5					2620	
	11°51'15":78°05'00"		8.7										
36	NANGAVALLI		65.4	G.Gneiss	45.0-45.3	Q=0.014	11.1					600	
	11°45'30":77°53'45"		5.5										

Basic details of Exploratory borewells constructed by State Government

Sl.no.	Location	Block	latitude	Longitude	Depth (mbgl)	Casing depth (m)	Fractured depth(m)				Discharge (lps)	SWL (mbgl)
1	Gopasandiram cross road	Kelamangalam	12.54	77.82	154	26	32,100,147,	32	100	147	1.8	
2	Kommepalli melkottai	Kelamangalam	12.55	77.88	182	18	19,100,124,	19	100	124	1.2	
3	Rajiv Gandhi cross road,Doddametri	Kelamangalam	12.58	77.98	162	18	72,100,160,	72	100	160	1.8	
4	Chinnakanavayur medu	Kelamangalam	12.56	78.07	102	18	18,42,52,	18	42	52	3.3	
5	Erudukottai Laxmipuram	Kelamangalam	12.45	77.83	182	18	32,90,176,	32	90	176	1.2	
6	Muthurayankottai	Kelamangalam	12.46	77.82	220	18	32,140,210	32	140	190	1.8	
7	Hanumanthapuram Laxmipuram	Kelamangalam	12.43	77.85	176	24	100,147,190,	100	147	190	0.1	
8	Ayyur New colony	Kelamangalam	12.43	77.87	91	24	22,60,90,	22	60	90	2.45	
9	Thimmanur	Kelamangalam	12.42	77.89	76	24	30,60,85,	30	60	85	3.3	
10	Kavakuttai Badankuttai	Kelamangalam	12.42	77.89	202	18	20,100,180,	20	100	180	1.2	
11	Kuchuvadi SC colony	Kelamangalam	12.45	77.90	150	24	30,100,150	30	100	150	1.2	
12	Devarulli Mangalam New ADC Colony	Thally	12.55	77.73	196	24	30,70,185,	30	70	185	0.1	
13	Chinna Chandiram New colony	Thally	12.55	77.72	136	24	30,75,140,	30	75	140	1.8	
14	Thally Kotanur New ADC	Thally	12.57	77.70	132	18	27,70,140,	27	70	140	1.8	
15	Bettapalli AD colony	Thally	12.55	77.67	182	18	40,90,110,	40	90	110	0.22	
16	N.Agraharam New ADC	Thally	12.56	77.62	138	12	30,100,150,	30	100	150	1.8	
17	ChudaChandram NewADC	Thally	12.58	77.63	190	30	42,80,190	42	80	190	0.22	
18	Uliveeranpalli New colony	Thally	12.65	77.75	194	6	30,90,172,	30	90	105	1.2	
19	Vamamangalam New ADC96	Thally	12.61	77.01	105	24	62,90,105	62	90	105	3.3	
20	Mel Samayapuram colony	Thally	0.00	0.00	182	18	25,72,172,	25	72	172	0.4	
21	Gummalapuram	Thally	12.63	77.66	200	33	42,200,	42	200		0.04	
22	Mel Samayapuram colony	Thally	0.00	0.00	156	24	40,72,140,	40	72	140	2.54	
23	Devarulli Mangalam ADC Colony	Thally	12.55	77.72	150	30	42,90,130,	42	90	130	2.54	

24	Bettapalli Adcolony	Thally	12.55	77.67	162	18	72,160,172,	72	190	172	0.05	
25	Chudasandiram Adcolony	Thally	12.58	77.62	182	48	47,72,180,	47	72	180	2.54	
26	Belalam AD colony	Thally	12.43	77.65	90	30	38,58,70,	38	58	70	2.6	
27	Kalukondapalli New colony	Thally	12.47	77.75	158	42	98,170,194,	98	170	194	2.5	
28	Kumaranapalli AD colony	Thally	12.28	77.61	158	42	97,142,192,	97	142	192	0.05	
29	Erikadu	Pennagaram	12.01	77.90	180	14	40,90,175,	40	90	175	2.25	20
30	Kullikadu	Pennagaram	11.95	77.88	58	17	20,48,	20	48		4.6	5
31	Vanniyar nagar,Nagamarai	Pennagaram	11.94	77.77	188	36	105,160,	105	160		0.15	10
32	Semmurugoundar Kottai,Manjarahalli	Pennagaram	11.93	77.80	180	18	40,100,170,	40	100	170	0.82	15
33	Erkodalpatty Bathrahalli Kombai,Manjarahalli	Pennagaram	11.93	77.85	160	13	22,120,150,	22	120	150	2.25	10
34	Kadamadai periyar nagar	Pennagaram	12.05	77.94	230	7.6	63,143,230	63	143	230	1.42	6
35	Avvai nagar,Majanaikanahalli	Pennagaram	12.04	77.95	220	9	79,213,	79	213		0.15	20
36	Kariyankattu Valavu	Pennagaram	12.01	77.97	154	16	25,68,140,	25	68	140	1.42	10
37	Tholur Combai	Pennagaram	12.02	77.98	98	20	30,95,	30	95		4.6	20
38	Bodampatty colony	Pennagaram	11.95	77.93	190	21	92,172,	92	172		0.5	20
39	Thallihalli AR colony	Pennagaram	12.03	77.94	200	11.4	100,160,	100	160		0.15	20
40	Kothapaddy Ar colony	Pennagaram	12.12	77.88	190	16	80,100,180,	80	100	180	1.42	25
41	Avvai nagar,Paruvathanahalli	Pennagaram	12.13	77.92	189	12	115,185,	115	185		0.82	20
42	Gettukottai,Paruvathanahalli	Pennagaram	12.13	77.92	200	14	15,90,190,	15	90	190	1.42	5
43	Annanagar mal colony,Paruvathanahalli	Pennagaram	12.13	77.92	180	13	30,70,175	30	70	175	0.82	20
44	Ammam palayam,Koothapadi	Pennagaram	12.12	77.95	197	9	30,125,190	30	125	190	2.25	10
45	Thadiyankuttai,veppilahalli	Pennagaram	12.22	78.04	164.5	22	30,110,160,	30	110	160	0.82	10
46	Uppavapuram,Vettuvanahalli	Pennagaram	12.20	77.97	220	20.6	43,146,210,	43	146	210	0.82	10
47	B.Kodupatty,Vattuvanahalli	Pennagaram	12.19	77.92	202	30	110	110			0.25	30
48	Nagadasampatty AD colony,Piliyanur	Pennagaram	12.13	77.99	201	20	40,140,195,	40	140	195	0.25	49
49	Nagadasampatty Boyen colony,Piliyanur	Pennagaram	12.13	77.99	170	12	30,140,170,	30	140	170	0.32	35
50	Vannathipatty Pallakottai,Mangarai	Pennagaram	12.11	77.93	193	19	110,180,	110	180		0.82	
51	Gundankattukuzhi,Anjehalli	Pennagaram	12.14	77.98	200	13	60	60			0.03	10
52	Anmmasi kottai,Ramagondahalli	Pennagaram	11.97	77.81	183	21.4	60,128,165,	60	128	165	2.25	10

53	Erigolpatty,Manjarahalli	Pennagaram	11.95	77.85	188	12.25	35,90,170,	35	90	170	0.82	15
54	Sellamudi Mel street,Manjarahalli	Pennagaram	11.95	77.84	129	15.4	35,78,115,	35	78	115	2.25	10
55	Vadaku Kombai,Manjarahalli	Pennagaram	11.94	77.84	171	19	20,49,160,	20	49	160	1.25	60
56	Mahalingamkottai,Gendiganahalli	Pennagaram	11.92	77.92	160	24	60,120,152,	60	120	152	2.25	10
57	Naikanoor Senkuttai,Kutentamarahalli	Pennagaram	12.09	77.92	147	10.6	40,145,	40	145		2.25	20
58	Nallampalli Vannar street,Manjarai	Pennagaram	12.13	77.95	186	7	112,185,	112	185		0.82	15
59	Sakamarathukottai,THONAKUTALAHALLI	Pennagaram	12.00	77.88	190	12	50,180,	50	180		0.82	15
60	Rajarikottai,Koothapadi	Pennagaram	12.13	77.87	123	12	15,100,120,	15	100	120	3.3	15
61	Deepavalikunav,Nallur,	Palacode	12.33	78.01	190	7	47,123,187,	47	123	187	0.38	9
62	Panchiyappankottai,Soodanur	Palacode	12.47	78.01	150	3	30,70,145,	30	70	145	1.42	6
63	Puliyanthoppu colony,Panchapally	Palacode	12.46	77.94	198	6	39	39			3.3	6
64	J.J.Nagar,Belmarahalli	Palacode	12.32	77.93	198	18	60,120,195	60	120	195	0.53	11
65	Thirumalavadi colony,Ganapathy	Palacode	12.31	77.90	194	9	50,150,190,	50	150	190	0.53	9
66	Vattaganapattylruvar colony,A.Mallapuram	Palacode	12.35	78.02	180	12	100,150,165,	100	150	165	0.82	6
67	Ekkandahalli colony,Gummanur	Palacode	12.45	78.02	170	18	90,152,	90	152		3.3	60
68	Thodda Badaganahalli colony,Semanoor	Palacode	12.43	78.00	198	16.6	60,150,190,	60	150	190	0.82	7
69	Kattumanithankottai,Belmarahalli	Palacode	12.34	77.92	200	14.32	60,148,183,	60	148	183	0.82	20
70	Puliyanthppu colony,Errahalli	Palacode	12.28	78.08	89	10.5	30,60,85,	30	60	85	2.25	35
71	Kaveriyappankottai,Errahalli	Palacode	12.27	78.06	188	6.8	80,92,170,	80	92	170	1.42	40
72	Karagur Jyothy nagar,Barsehalli	Palacode	12.28	77.99	190	6	73,178,	73	178		0.38	10
73	Gundan Tharisu,Gummanur	Palacode	12.44	77.02	190	6	70,180,	70	180		0.82	9
74	Indiranagar,Samanoor	Palacode	12.41	77.99	182	6	32,141,178,	32	141	178	2.25	6
75	Manthrigoundankottai,Koravandahalli	Palacode	12.42	78.01	206	12.3	102,190,	102	190		0.82	25
76	Kulankottai,Bedarahalli	Nallampalli	12.17	78.04	170	10.4	60,110,160,	60	110	160	2.25	12
77	Kuttampatty colony,Echchanalli	Nallampalli	12.11	77.99	185	24	120	120			1.25	13
78	Siddurankottai,D.B.Halli	Nallampalli	11.99	78.04	220	24	90,200,	90	200		0.15	8
79	Moorkottai,D.B.Halli	Nallampalli	12.03	78.08	200	18	100,195,	100	195		0.15	18
80	Marigoundankottai,D.B.Halli	Nallampalli	12.02	78.07	220	12	110,210,	110	210		0.15	25

81	Sevanthankottai,D.B.Halli	Nallampalli	12.01	78.07	210	13	205	205			0.25	12
82	Kaligoundankottai,D.B.Halli	Nallampalli	12.01	78.07	200	18	70,150,195,	70	150	195	2.25	20
83	Mottukollakottai,Indur	Nallampalli	12.12	78.05	160	14	60,80,155,	60	80	155	1.15	15
84	Kurumpattykottai,Bagalahalli	Nallampalli	12.04	78.10	190	17.4	20,108,187,	20	108	187	1.15	8
85	Driveres colony,A.Jettyhalli	Nallampalli	12.08	78.11	190	12	70,130,185,	70	130	185	0.45	15
86	Periyar nagar,A.Jettyhalli	Nallampalli	12.08	78.11	70	30	70	70			2.15	12

Resource Estimation of Firkas falling in the Upper Cauvery Basin (Ham)

Sl.No	Firka	District	Area of the Firka (km ²)	Area of the Firka suitable for GW recharge (km ²)	Area of the Firka falling in the Basin (km ²)	Area considered for Resource Estimation	Percentage of the Firka falling in the Basin	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 (11+12)	Provision for domestic and industrial requirement supply to 2025	Net Ground Water Availability for future irrigation development (10-11-14)	Stage of Ground Water Development $\{(13/10)*100\}$ %	Category
1	Bommidi	Dharmapuri	148.79	137.64	110.20	110.20	0.80	1689.95	2338.06	75.22	2413.28	85.47	-733.58	143	Over Exploited
2	Dharmapuri	Dharmapuri	195.11	121.37	94.73	94.73	0.78	1573.14	1117.36	113.02	1230.38	128.44	327.33	78	Semi Critical
3	Indur	Dharmapuri	142.13	124.69	137.70	124.69	1.00	1181.81	2411.45	81.74	2493.19	92.91	-1322.55	211	Over Exploited
4	Kadathur	Dharmapuri	157.32	113.39	4.49	4.49	0.04	59.18	102.66	1.93	104.59	2.19	-45.68	177	Over Exploited
5	Marandahalli	Dharmapuri	132.69	77.69	95.47	77.69	1.00	1174.92	2357.65	53.57	2411.21	60.88	-1243.61	205	Over Exploited
6	Nallampalli	Dharmapuri	91.01	81.75	63.54	63.54	0.78	911.95	729.35	70.19	799.54	79.78	102.82	88	Semi Critical
7	Palacode	Dharmapuri	190.15	122.66	174.90	122.66	1.00	2235.50	3112.65	89.34	3201.99	101.54	-978.69	143	Over Exploited
8	Palayam	Dharmapuri	144.00	116.69	275.30	116.69	1.00	1110.01	2247.30	75.32	2322.62	85.61	-1222.90	209	Over Exploited
9	Papparapatty	Dharmapuri	135.50	117.28	297.30	117.28	1.00	1401.29	2071.20	84.47	2155.67	95.96	-765.88	154	Over Exploited
10	Pennagaram	Dharmapuri	123.48	115.04	374.00	115.04	1.00	1241.84	1992.25	75.01	2067.26	85.25	-835.67	166	Over Exploited
11	Perumbalai	Dharmapuri	160.20	112.46	177.50	112.46	1.00	512.75	1290.30	45.37	1335.67	51.57	-829.12	260	Over Exploited

12	Pulikarai	Dharmapuri	123.63	123.61	305.70	123.61	1.00	2006.88	3245.90	75.74	3321.64	86.08	-1325.10	166	Over Exploited
13	Sunjalnatham	Dharmapuri	225.67	154.20	225.67	154.20	1.00	1545.07	1240.25	79.97	1320.22	87.40	217.43	85	Semi Critical
14	Vellichandai	Dharmapuri	160.41	114.46	17.61	17.61	0.15	240.21	330.74	14.10	344.84	16.03	-106.55	144	Over Exploited
			2130.10	1632.94	2354.11	1354.91		16884	24587	935	25522	1059	-8762	151	Over Exploited
15	Andevanapalli	Krishnagiri	127.05	116.05	161.40	116.05	1.00	1253.75	369.90	45.24	415.14	51.42	832.43	33	Safe
16	Anjetti	Krishnagiri	176.07	128.21	774.00	128.21	1.00	652.55	188.13	47.32	235.45	53.79	410.64	36	Safe
17	Denkanikotta	Krishnagiri	168.96	120.45	368.70	120.45	1.00	1033.50	551.50	40.43	591.93	45.96	436.04	57	Safe
18	Kakkadasam	Krishnagiri	171.95	160.04	225.70	160.04	1.00	1265.79	709.68	56.19	765.86	63.86	492.25	61	Safe
19	Kelamangalam	Krishnagiri	116.49	86.14	93.91	86.14	1.00	1484.32	1003.40	43.41	1046.81	49.35	431.57	71	Semi Critical
20	Mathigiri	Krishnagiri	128.46	125.93	50.49	50.49	0.40	456.39	288.90	9.61	298.51	29.36	138.13	65	Safe
21	Rayakottai	Krishnagiri	160.20	112.11	31.21	31.21	0.28	470.00	348.77	18.15	366.93	20.63	100.59	78	Semi Critical
22	Thally	Krishnagiri	149.99	146.27	166.80	146.27	1.00	1293.05	835.08	58.97	894.05	92.21	365.76	69	Safe
			1199.18	995.20	1872.21	838.86		7909	4295	319	4615	407	3207	58	Safe
23	Kadayampatti	Salem	142.95	140.82	81.97	81.97	0.58	1157.17	1493.46	186.32	1679.78	49.20	-385.49	145	Over Exploited
24	Kolathur	Salem	188.51	188.40	1.50	1.50	0.01	22.01	18.52	0.56	19.09	0.64	2.84	87	Semi Critical
25	Mecheri	Salem	90.28	90.28	31.97	31.97	0.35	384.59	436.56	112.20	548.76	24.55	-76.51	143	Over Exploited
26	Mettur	Salem	98.71	98.71	39.90	39.90	0.40	530.64	0.00	21.30	21.30	24.21	506.43	4	Safe
27	Nangavalli	Salem	87.85	87.85	1.85	1.85	0.02	19.55	29.98	4.68	34.66	1.54	-11.97	177	Over Exploited
28	Pottaneri	Salem	101.42	97.91	71.79	71.79	0.73	649.03	504.17	45.78	549.95	52.03	92.83	85	Semi Critical

29	Semmandappatt i	Salem	95.06	95.06	16.94	16.94	0.18	240.60	443.37	16.86	460.23	19.16	-221.93	191	Over Exploited
30	Vellakkadai	Salem	53.32	53.30	19.53	19.53	0.37	193.84	0.00	5.76	5.76	6.55	187.29	3	Safe
31	Yercaud	Salem	45.70	45.70	21.83	21.83	0.48	216.29	0.00	15.72	15.72	17.87	198.42	7	Safe
			903.81	898.04	287.28	287.28		3414	2926	409	3335	196	292	98	CRITICAL
	Total		4233.09	3526.18	4513.60	2481.04		28208	31809	1664	33472	1661	-5262	119	OVER EXPLOITED

Firka wise Management plan Calculations- Upper Cauvery Basin

Name of Firka	Marandahalli	Indur	Pulikarai	Kadathur	Pennagaram	Vellichandai
District	Dharmapuri	Dharmapuri	Dharmapuri	Dharmapuri	Dharmapuri	Dharmapuri
Area of Firka (in Sq.km)	95.47	137.7	305.7	4.49	374	17.61
Monsoon Rainfall (m)	0.653	0.502	0.766	0.796	0.664	0.728
Uncommitted run-off (MCM)	9.3512865	10.36881	35.12493	0.536106	37.2504	1.923012
Area suitable for recharge (Sq.km)	66.0365	112.221	111.42075	4.041	103.536	15.849
Sy (as per in the GEC- 2011)	0.015	0.015	0.015	0.015	0.015	0.015
Weathering thickness (m)	8	8	8	8	8	8
Total volume of weathered zone (MCM)	11.4564	16.524	36.684	0.5388	44.88	2.1132
Deepest water level in post monsoon season (m bgl)	14.6	16.3	14.6	13	20	18
Total available potential aquifer volume for groundwater recharge (MCM)	16.61178	27.47115	53.1918	0.6735	95.37	3.96225
Ground water draft for irrigation in MCM	23.57	24.11	32.45	1.02	19.92	3.3
Water efficiency						
Area proposed for Minor irrigation (Ha)	100	100	150	4	150	10
MI cost @ 0.6 lakh (in lakhs)	60	60	90	2.4	90	6
Improving water efficiency in MCM	0.15000	0.15000	0.45000	0.01200	0.45000	0.03000
Groundwater recharge						
Proposed Check Dams	10	15	20	2	20	2
Cost of CD (Rs in Lakhs)	150	225	300	30	300	30
Expected Volume of recharge from above CDs (cu.m)	7200	10800	14400	1440	14400	1440
Proposed Nala Bunds	15	15	25	2	30	5
Cost of Nalla Bund (Rs in Lakhs)	30	30	50	4	60	10

Expected Volume of recharge from above Nala Bunds (cu.m)	5400	5400	9000	720	10800	1800
Rejuvenation of Recharge (RR) ponds with recharge shaft (RS)						
Proposed number of RR cum RSs	20	30	30	3	30	3
Proposed number of exclusive RSs (in bigger tanks and canal beds)	10	10	10	1	10	1
Cost of RR & RSs (Rs in Lakhs)	560	840	840	84	840	84
Cost of only RSs (Rs in Lakhs)	50	50	50	5	50	5
Expected Volume of recharge from above RR & RSs (cu.m)	1800000	1800000	2700000	0	3600000	360000
Expected Volume of recharge from above exclusive RSs (cu.m)	600000	900000	600000	0	600000	90000
Total expected annual GW recharge from the above schemes (MCM)	2.4126	2.7162	3.3234	0.00216	4.2252	0.45324
WATER CONSERVATION						
Farm ponds						
Proposed number of farm ponds (Units)	100	150	150	5	150	10
Expected annual GW recharge due farm ponds (cu.m)	540000	810000	810000	27000	810000	54000
Cost of Farm pond (Rs in Lakhs)	100	150	150	5	150	10
sub total of Artificial Recharge Cost (Rs in Lakhs)	950	1355	1480	130.4	1490	145
O & M	47.5	67.75	74	6.52	74.5	7.25
Number of PZ proposed	9	12	12	1	12	2
Cost of PZ (@ 0.6 Lakhs) In lakhs	5.4	7.2	7.2	0.6	7.2	1.2
Total Cost of Project (Rs in Crores)	10.0290	14.2995	15.612	1.3752	15.717	1.5345
Total expected annual GW recharge (MCM)	2.9526	3.5262	4.1334	0.02916	5.0352	0.50724
Expected raise in water level (m)	2.98	2.09	2.47	0.48	3.24	2.13

Firka wise Management plan Calculations- Upper Cauvery Basin

Name of Firka	Palacode	Palayam	Papparapatty	Perumbalai	Bhommidi	
District	Dharmapuri	Dharmapuri	Dharmapuri	Dharmapuri	Dharmapuri	Dharmapuri (11 firkas)
Area of Firka (in Sq.km)	174.9	275.3	297.3	177.5	110.2	1970
Monsoon Rainfall (m)	0.766	0.837	0.766	0.285	0.753	0.683

Uncommitted run-off (MCM)	20.09601	34.563915	34.15977	7.588125	12.44709	203.409
Area suitable for recharge (Sq.km)	116.5365	110.85645	105.5565	106.837	130.587	983.478
Sy (as per in the GEC- 2011)	0.015	0.015	0.015	0.015	0.015	0.015
Weathering thickness (m)	8	8	8	8	8	8.000
Total volume of weathered zone (MCM)	20.988	33.036	35.676	21.3	13.224	236.420
Deepest water level in post monsoon season (m bgl)	18	15	20	20	22	17.409
Total available potential aquifer volume for groundwater recharge (MCM)	39.3525	49.554	75.8115	45.2625	31.407	438.668
Ground water draft for irrigation in MCM	31.12	22.47	20.71	12.9	23.38	214.950
Water efficiency						0.000
Area proposed for Minor irrigation (Ha)	150	150	150	150	100	1214
MI cost @ 0.6 lakh (in lakhs)	90	90	90	90	60	728.40
Improving water efficiency in MCM	0.45000	0.45000	0.45000	0.45000	0.15000	3.192
Groundwater recharge						
Proposed Check Dams	20	20	20	20	10	159
Cost of CD (Rs in Lakhs)	300	300	300	300	150	2385
Expected Volume of recharge from above CDs (cu.m)	14400	14400	14400	14400	7200	114480
Proposed Nala Bunds	30	30	25	26	20	223
Cost of Nalla Bund (Rs in Lakhs)	60	60	50	52	40	446
Expected Volume of recharge from above Nala Bunds (cu.m)	10800	10800	9000	9360	7200	80280
Rejuvenation of Recharge (RR) ponds with recharge shaft (RS)						0
Proposed number of RR cum RSs	30	30	30	30	20	256
Proposed number of exclusive RSs (in bigger tanks and canal beds)	10	10	10	10	10	92
Cost of RR & RSs (Rs in Lakhs)	840	840	840	840	600	7208
Cost of only RSs (Rs in Lakhs)	50	50	50	50	50	460
Expected Volume of recharge from above RR & RSs (cu.m)	1980000	1800000	1800000	2700000	4500000	23040000
Expected Volume of recharge from above exclusive RSs (cu.m)	600000	600000	600000	600000	0	5190000
Total expected annual GW recharge from the above schemes (MCM)	2.6052	2.4252	2.4234	3.32376	4.5144	28.425

WATER CONSERVATION						0
Farm ponds						0
Proposed number of farm ponds (Units)	150	150	150	150	100	1265
Expected annaul GW recharge due farm ponds (cu.m)	810000	810000	810000	810000	540000	6831000
Cost of Farm pond (Rs in Lakhs)	150	150	150	150	100	1265
sub total of Artificial Recharge Cost (Rs in Lakhs)	1490	1490	1480	1482	1000	12492.40
O & M	74.5	74.5	74	74.1	50	624.62
Number of PZ propsoed	12	12	12	11	14	109.00
Cos tof PZ (@ 0.6 Lakhs) In laksh	7.2	7.2	7.2	6.6	8.4	65.40
Total Cost of Project (Rs in Crores)	15.717	15.717	15.612	15.627	10.584	131.824
Total expected annaul GW recharge (MCM)	3.4152	3.2352	3.2334	4.13376	5.0544	35.256
Expected raise in water level (m)	1.95	1.95	2.04	2.58	2.58	2.39

Firka wise Management plan Calculations- Upper Cauvery Basin

Name of Firka	Semmandapatti	Mecheri	Kadayampatti	Nangavalli		Total
District	Salem	Salem	Salem	Salem	Salem (4 firkas)	Total Basin (15 Firkas)
Area of Firka (in Sq.km)	16.94	31.97	81.97	1.85	132.73	2103
Monsoon Rainfall (m)	0.756	0.793	0.756	0.793	0.7745	0.708
Uncommitted run-off (MCM)	1.920996	3.8028315	9.295398	0.2200575	15.239283	218.649
Area suitable for recharge (Sq.km)	15.246	30.3715	73.773	1.665	121.0555	1105
Sy (as per in the GEC- 2011)	0.015	0.015	0.015	0.015	0.015	0.015
Weathering thickness (m)	8	8	8	8	8	8
Total volume of weathered zone (MCM)	2.0328	3.8364	9.8364	0.222	15.9276	252.348
Deepest water level in post monsoon season (m bgl)	15	15	15	15	15	16.77
Total available potential aquifer volume for groundwater recharge (MCM)	3.0492	5.7546	14.7546	0.333	23.8914	462.559
Ground water draft for irrigation in MCM	4.43	4.37	14.93	0.3	24.03	238.98

Water efficiency					0	0
Area proposed for Minor irrigation (Ha)	25	50	100	2	177	1391
MI cost @ 0.6 lakh (in lakhs)	15	30	60	1.2	106.2	834.6
Improving water efficiency in MCM	0.07500	0.15000	0.15000	0.00600	0.381	3.573
Groundwater recharge						
Proposed Check Dams	2	2	10	1	15	174
Cost of CD (Rs in Lakhs)	30	30	150	15	225	2610
Expected Volume of recharge from above CDs (cu.m)	1440	1440	7200	720	10800	125280
Proposed Nala Bunds	2	2	5	2	11	234
Cost of Nalla Bund (Rs in Lakhs)	4	4	10	4	22	468
Expected Volume of recharge from above Nala Bunds (cu.m)	720	720	1800	720	3960	84240
Rejuvenation of Recharge (RR) ponds with recharge shaft (RS)					0	0
Proposed number of RR cum RSs	3	3	10	0	16	272
Proposed number of exclusive RSs (in bigger tanks and canal beds)	1	1	5	0	7	99
Cost of RR & RSs (Rs in Lakhs)	90	90	300	0	480	7688
Cost of only RSs (Rs in Lakhs)	5	5	25	0	35	495
Expected Volume of recharge from above RR & RSs (cu.m)	0	180000	1800000	0	1980000	25020000
Expected Volume of recharge from above exclusive RSs (cu.m)	0	0	60000	0	60000	5250000
Total expected annual GW recharge from the above schemes (MCM)	0.00216	0.18216	1.869	0.00144	2.05476	30.47952
WATER CONSERVATION					0	0
Farm ponds					0	0
Proposed number of farm ponds (Units)	10	15	70	2	97	1362
Expected annual GW recharge due farm ponds (cu.m)	54000	81000	378000	10800	523800	7354800
Cost of Farm pond (Rs in Lakhs)	10	15	70	2	97	1362
sub total of Artificial Recharge Cost (Rs in Lakhs)	154	174	615	22.2	965.2	13457.6
O & M	7.7	8.7	30.75	1.11	48.26	672.88
Number of PZ proposed	2	2	8	0	12	121

Cos tof PZ (@ 0.6 Lakhs) In laksh	1.2	1.2	4.8	0	7.2	72.6
Total Cost of Project (Rs in Crores)	1.629	1.839	6.5055	0.2331	10.2066	142.03
Total expected annaul GW recharge (MCM)	0.05616	0.26316	2.247	0.01224	2.57856	37.834
Expected raise in water level (m)	0.25	0.58	2.03	0.49	1.42	2.28

Tentative Location of Artificial recharge structures proposed in Amaravathi Aquifer System

S. No	TYPE	LONGITUDE	LATITUDE	VILLAGE	FIRKA	DISTRICT
1	CHECKDAM	77.910757000	12.531666000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
2	CHECKDAM	77.916551000	12.528461000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
3	CHECKDAM	77.948993000	12.508100000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
4	CHECKDAM	77.939916000	12.524880000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
5	CHECKDAM	77.951504000	12.497731000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
6	CHECKDAM	77.968690000	12.477557000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
7	CHECKDAM	77.974484000	12.461343000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
8	CHECKDAM	77.941076000	12.487549000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
9	CHECKDAM	77.964440000	12.401734000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
10	CHECKDAM	77.995533000	12.447391000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
11	CHECKDAM	77.987229000	12.414963000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
12	CHECKDAM	78.019866000	12.393658000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
13	CHECKDAM	77.937020000	12.513756000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
14	CHECKDAM	77.978925000	12.439281000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
15	NALABUND	77.961142000	12.377861000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
16	NALABUND	77.995533000	12.426082000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
17	NALABUND	77.993988000	12.437584000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
18	NALABUND	77.952445000	12.401845000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
19	NALABUND	77.973132000	12.444749000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
20	NALABUND	77.977766000	12.463793000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
21	NALABUND	77.974677000	12.471335000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
22	NALABUND	77.960579000	12.471712000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
23	NALABUND	77.950731000	12.493585000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
24	NALABUND	77.954979000	12.500750000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
25	NALABUND	77.937406000	12.501504000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI

26	NALABUND	77.936633000	12.488305000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
27	NALABUND	77.944165000	12.516023000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
28	NALABUND	77.968304000	12.488494000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
29	NALABUND	78.019701000	12.404979000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
30	NALABUND	77.936633000	12.532993000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
31	NALABUND	77.923309000	12.529411000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
32	NALABUND	77.933350000	12.518663000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
33	NALABUND	77.961545000	12.511875000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
34	NALABUND	77.911722000	12.523754000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
35	RECHARGE SHAFT	77.934020000	12.536035000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
36	RECHARGE SHAFT	77.992620000	12.403927000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
37	RECHARGE SHAFT	77.970591000	12.422048000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
38	RECHARGE SHAFT	77.951650000	12.505483000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
39	PIEZOMETER	77.937740000	12.515855000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
40	PIEZOMETER	77.908953000	12.533206000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
41	PIEZOMETER	77.940444000	12.489830000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
42	PIEZOMETER	77.960344000	12.490584000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
43	PIEZOMETER	77.966139000	12.406508000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
44	PIEZOMETER	77.973095000	12.463804000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
45	PIEZOMETER	77.976674000	12.440774000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
46	PIEZOMETER	77.985950000	12.417004000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
47	PIEZOMETER	78.017255000	12.398135000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
48	CHECKDAM	78.046724000	12.109096000	Pangunatham A/b	INDUR	DHARMAPURI
49	CHECKDAM	78.030105000	12.144625000	Pangunatham A/b	INDUR	DHARMAPURI
50	CHECKDAM	78.058705000	12.145759000	Pangunatham A/b	INDUR	DHARMAPURI
51	CHECKDAM	78.035129000	12.110985000	Pangunatham A/b	INDUR	DHARMAPURI
52	CHECKDAM	78.039381000	12.087174000	Pangunatham A/b	INDUR	DHARMAPURI
53	CHECKDAM	77.989138000	12.086039000	Pangunatham A/b	INDUR	DHARMAPURI
54	CHECKDAM	78.010008000	12.072432000	Pangunatham A/b	INDUR	DHARMAPURI
55	CHECKDAM	78.063343000	12.098890000	Pangunatham A/b	INDUR	DHARMAPURI

56	CHECKDAM	78.042859000	12.167303000	Pangunatham A/b	INDUR	DHARMAPURI
57	CHECKDAM	78.062957000	12.131774000	Pangunatham A/b	INDUR	DHARMAPURI
58	CHECKDAM	78.040540000	12.120057000	Pangunatham A/b	INDUR	DHARMAPURI
59	CHECKDAM	78.026627000	12.094355000	Pangunatham A/b	INDUR	DHARMAPURI
60	CHECKDAM	77.991071000	12.069031000	Pangunatham A/b	INDUR	DHARMAPURI
61	CHECKDAM	77.970974000	12.066763000	Pangunatham A/b	INDUR	DHARMAPURI
62	CHECKDAM	78.025467000	12.062605000	Pangunatham A/b	INDUR	DHARMAPURI
63	CHECKDAM	77.960925000	12.083394000	Pangunatham A/b	INDUR	DHARMAPURI
64	CHECKDAM	77.985660000	12.114765000	Pangunatham A/b	INDUR	DHARMAPURI
65	CHECKDAM	78.065661000	12.180910000	Pangunatham A/b	INDUR	DHARMAPURI
66	CHECKDAM	78.028173000	12.079236000	Pangunatham A/b	INDUR	DHARMAPURI
67	CHECKDAM	77.941988000	12.084906000	Pangunatham A/b	INDUR	DHARMAPURI
68	NALABUND	77.995708000	12.111363000	Pangunatham A/b	INDUR	DHARMAPURI
69	NALABUND	78.052135000	12.156342000	Pangunatham A/b	INDUR	DHARMAPURI
70	NALABUND	78.026240000	12.155208000	Pangunatham A/b	INDUR	DHARMAPURI
71	NALABUND	78.068753000	12.147271000	Pangunatham A/b	INDUR	DHARMAPURI
72	NALABUND	78.068367000	12.138199000	Pangunatham A/b	INDUR	DHARMAPURI
73	NALABUND	78.027013000	12.131396000	Pangunatham A/b	INDUR	DHARMAPURI
74	NALABUND	78.016578000	12.135553000	Pangunatham A/b	INDUR	DHARMAPURI
75	NALABUND	78.047110000	12.120813000	Pangunatham A/b	INDUR	DHARMAPURI
76	NALABUND	78.068753000	12.123836000	Pangunatham A/b	INDUR	DHARMAPURI
77	NALABUND	77.967109000	12.117789000	Pangunatham A/b	INDUR	DHARMAPURI
78	NALABUND	78.050975000	12.188469000	Pangunatham A/b	INDUR	DHARMAPURI
79	NALABUND	78.064115000	12.116277000	Pangunatham A/b	INDUR	DHARMAPURI
80	NALABUND	78.038221000	12.124970000	Pangunatham A/b	INDUR	DHARMAPURI
81	NALABUND	78.025854000	12.114765000	Pangunatham A/b	INDUR	DHARMAPURI
82	NALABUND	78.054453000	12.103048000	Pangunatham A/b	INDUR	DHARMAPURI
83	NALABUND	78.018124000	12.093599000	Pangunatham A/b	INDUR	DHARMAPURI
84	NALABUND	78.048270000	12.084149000	Pangunatham A/b	INDUR	DHARMAPURI
85	NALABUND	78.055613000	12.090953000	Pangunatham A/b	INDUR	DHARMAPURI

86	NALABUND	77.965563000	12.094355000	Pangunatham A/b	INDUR	DHARMAPURI
87	NALABUND	77.988365000	12.077724000	Pangunatham A/b	INDUR	DHARMAPURI
88	NALABUND	77.999960000	12.081126000	Pangunatham A/b	INDUR	DHARMAPURI
89	NALABUND	78.007303000	12.078858000	Pangunatham A/b	INDUR	DHARMAPURI
90	NALABUND	78.020443000	12.072433000	Pangunatham A/b	INDUR	DHARMAPURI
91	NALABUND	77.955128000	12.076968000	Pangunatham A/b	INDUR	DHARMAPURI
92	NALABUND	77.963244000	12.073944000	Pangunatham A/b	INDUR	DHARMAPURI
93	NALABUND	77.999960000	12.068653000	Pangunatham A/b	INDUR	DHARMAPURI
94	NALABUND	78.038994000	12.076212000	Pangunatham A/b	INDUR	DHARMAPURI
95	NALABUND	78.030105000	12.069409000	Pangunatham A/b	INDUR	DHARMAPURI
96	NALABUND	77.933485000	12.087173000	Pangunatham A/b	INDUR	DHARMAPURI
97	NALABUND	77.977930000	12.064495000	Pangunatham A/b	INDUR	DHARMAPURI
98	CHECKDAM	77.926529000	12.525241000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
99	CHECKDAM	77.941988000	12.502941000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
100	CHECKDAM	77.974452000	12.454183000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
101	CHECKDAM	77.924983000	12.499161000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
102	CHECKDAM	77.970201000	12.383880000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
103	CHECKDAM	78.015805000	12.420543000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
104	NALABUND	77.938123000	12.543006000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
105	NALABUND	77.916867000	12.532045000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
106	NALABUND	77.954355000	12.514280000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
107	NALABUND	77.964790000	12.502941000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
108	NALABUND	77.949717000	12.487444000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
109	NALABUND	77.970587000	12.470813000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
110	NALABUND	78.006530000	12.434906000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
111	NALABUND	78.006530000	12.415252000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
112	NALABUND	78.004598000	12.403157000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
113	NALABUND	78.012327000	12.384636000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
114	RECHARGE SHAFT	77.995322000	12.402401000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
115	RECHARGE SHAFT	77.992230000	12.401267000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI

116	RECHARGE SHAFT	78.010395000	12.400889000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
117	RECHARGE SHAFT	78.011554000	12.394085000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
118	RECHARGE SHAFT	77.936577000	12.530911000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
119	RECHARGE SHAFT	77.937350000	12.535068000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
120	RECHARGE SHAFT	77.953585000	12.404683000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
121	RECHARGE SHAFT	77.967882000	12.399755000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
122	RECHARGE SHAFT	78.005757000	12.404668000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
123	RECHARGE SHAFT	78.006917000	12.413740000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
124	RECHARGE SHAFT	78.009239000	12.429251000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
125	RECHARGE SHAFT	78.019283000	12.393329000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
126	RECHARGE SHAFT	78.016192000	12.420543000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
127	RECHARGE SHAFT	77.987592000	12.414874000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
128	RECHARGE SHAFT	77.978703000	12.377833000	Belamaranahalli	PALACODE	DHARMAPURI
129	RECHARGE SHAFT	78.006920000	12.385028000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
130	RECHARGE SHAFT	78.013101000	12.383502000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
131	RECHARGE SHAFT	77.958606000	12.484420000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
132	RECHARGE SHAFT	77.956674000	12.479507000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
133	RECHARGE SHAFT	77.978703000	12.439820000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
134	RECHARGE SHAFT	77.996095000	12.447001000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
135	RECHARGE SHAFT	77.973679000	12.452671000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
136	RECHARGE SHAFT	77.974066000	12.460230000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
137	RECHARGE SHAFT	77.969428000	12.476483000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
138	RECHARGE SHAFT	77.962085000	12.487066000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
139	RECHARGE SHAFT	77.941601000	12.486310000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
140	RECHARGE SHAFT	77.941601000	12.486310000	Ulimangalam	DENKANIKOTTA	DHARMAPURI
141	RECHARGE SHAFT	77.952036000	12.495759000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
142	RECHARGE SHAFT	77.937350000	12.513524000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
143	RECHARGE SHAFT	77.940442000	12.523351000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
144	RECHARGE SHAFT	77.926529000	12.525241000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
145	RECHARGE SHAFT	77.916480000	12.527887000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI

146	RECHARGE SHAFT	77.910683000	12.530155000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
147	RECHARGE SHAFT	77.936577000	12.533934000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
148	RECHARGE SHAFT	77.967882000	12.486688000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
149	RECHARGE SHAFT	77.972133000	12.470435000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
150	RECHARGE SHAFT	78.019284000	12.405802000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
151	RECHARGE SHAFT	77.993780000	12.437566000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
152	RECHARGE SHAFT	77.996481000	12.425079000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
153	RECHARGE SHAFT	78.006530000	12.435284000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
154	RECHARGE SHAFT	77.960152000	12.473459000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
155	RECHARGE SHAFT	77.936964000	12.501429000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
156	RECHARGE SHAFT	77.965563000	12.502941000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
157	RECHARGE SHAFT	77.954742000	12.513524000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
158	RECHARGE SHAFT	77.961312000	12.510878000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
159	RECHARGE SHAFT	77.924983000	12.497649000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
160	RECHARGE SHAFT	77.941601000	12.504075000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
161	RECHARGE SHAFT	77.964017000	12.402401000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
162	RECHARGE SHAFT	77.944307000	12.518060000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
163	RECHARGE SHAFT	77.969431000	12.383894000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
164	RECHARGE SHAFT	77.935418000	12.489334000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
165	RECHARGE SHAFT	77.998027000	12.416764000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
166	RECHARGE SHAFT	77.974066000	12.407692000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
167	RECHARGE SHAFT	78.021606000	12.378981000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
168	RECHARGE SHAFT	77.958606000	12.417142000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
169	RECHARGE SHAFT	77.960152000	12.378589000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
170	RECHARGE SHAFT	77.978703000	12.428859000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
171	RECHARGE SHAFT	77.999187000	12.394085000	Marandahalli A/b	MARANDAHALLI	DHARMAPURI
172	RECHARGE SHAFT	77.984501000	12.138577000	Pangunatham A/b	INDUR	DHARMAPURI
173	RECHARGE SHAFT	77.965563000	12.131396000	Pangunatham A/b	INDUR	DHARMAPURI
174	RECHARGE SHAFT	77.960539000	12.134420000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
175	RECHARGE SHAFT	77.956288000	12.129506000	Pangunatham A/b	INDUR	DHARMAPURI

176	RECHARGE SHAFT	78.022762000	12.128372000	Pangunatham A/b	INDUR	DHARMAPURI
177	RECHARGE SHAFT	78.030492000	12.179020000	Pangunatham A/b	INDUR	DHARMAPURI
178	RECHARGE SHAFT	78.037448000	12.178264000	Pangunatham A/b	INDUR	DHARMAPURI
179	RECHARGE SHAFT	78.045178000	12.161255000	Pangunatham A/b	INDUR	DHARMAPURI
180	RECHARGE SHAFT	78.044791000	12.167303000	Pangunatham A/b	INDUR	DHARMAPURI
181	RECHARGE SHAFT	78.064115000	12.141979000	Pangunatham A/b	INDUR	DHARMAPURI
182	RECHARGE SHAFT	78.058705000	12.139333000	Pangunatham A/b	INDUR	DHARMAPURI
183	RECHARGE SHAFT	78.008848000	12.112497000	Pangunatham A/b	INDUR	DHARMAPURI
184	RECHARGE SHAFT	78.035129000	12.140467000	Pangunatham A/b	INDUR	DHARMAPURI
185	RECHARGE SHAFT	77.989138000	12.093221000	Pangunatham A/b	INDUR	DHARMAPURI
186	RECHARGE SHAFT	77.980636000	12.076968000	Pangunatham A/b	INDUR	DHARMAPURI
187	RECHARGE SHAFT	78.042473000	12.086795000	Pangunatham A/b	INDUR	DHARMAPURI
188	RECHARGE SHAFT	77.980636000	12.089441000	Pangunatham A/b	INDUR	DHARMAPURI
189	RECHARGE SHAFT	77.970974000	12.119301000	Pangunatham A/b	INDUR	DHARMAPURI
190	RECHARGE SHAFT	78.063343000	12.129128000	Pangunatham A/b	INDUR	DHARMAPURI
191	RECHARGE SHAFT	77.981795000	12.122702000	Pangunatham A/b	INDUR	DHARMAPURI
192	RECHARGE SHAFT	78.044018000	12.135553000	Pangunatham A/b	INDUR	DHARMAPURI
193	RECHARGE SHAFT	77.972906000	12.130640000	Pangunatham A/b	INDUR	DHARMAPURI
194	RECHARGE SHAFT	77.971360000	12.128372000	Pangunatham A/b	INDUR	DHARMAPURI
195	RECHARGE SHAFT	77.997641000	12.133286000	Pangunatham A/b	INDUR	DHARMAPURI
196	RECHARGE SHAFT	77.991071000	12.116277000	Pangunatham A/b	INDUR	DHARMAPURI
197	RECHARGE SHAFT	78.007303000	12.120057000	Pangunatham A/b	INDUR	DHARMAPURI
198	RECHARGE SHAFT	78.048657000	12.153696000	Pangunatham A/b	INDUR	DHARMAPURI
199	RECHARGE SHAFT	78.046724000	12.149538000	Pangunatham A/b	INDUR	DHARMAPURI
200	RECHARGE SHAFT	78.059478000	12.177508000	Pangunatham A/b	INDUR	DHARMAPURI
201	RECHARGE SHAFT	78.064115000	12.175618000	Pangunatham A/b	INDUR	DHARMAPURI
202	RECHARGE SHAFT	78.033197000	12.173351000	Pangunatham A/b	INDUR	DHARMAPURI
203	PIEZOMETER	77.983341000	12.131018000	Pangunatham A/b	INDUR	DHARMAPURI
204	PIEZOMETER	77.960152000	12.080748000	Pangunatham A/b	INDUR	DHARMAPURI
205	PIEZOMETER	77.984114000	12.083394000	Pangunatham A/b	INDUR	DHARMAPURI

206	PIEZOMETER	78.030105000	12.075835000	Pangunatham A/b	INDUR	DHARMAPURI
207	PIEZOMETER	78.025467000	12.098134000	Pangunatham A/b	INDUR	DHARMAPURI
208	PIEZOMETER	78.038221000	12.115143000	Pangunatham A/b	INDUR	DHARMAPURI
209	PIEZOMETER	78.022762000	12.144625000	Pangunatham A/b	INDUR	DHARMAPURI
210	PIEZOMETER	78.066434000	12.132152000	Pangunatham A/b	INDUR	DHARMAPURI
211	PIEZOMETER	78.050589000	12.098512000	Pangunatham A/b	INDUR	DHARMAPURI
212	PIEZOMETER	78.046337000	12.170705000	Pangunatham A/b	INDUR	DHARMAPURI
213	PIEZOMETER	78.066434000	12.185446000	Pangunatham A/b	INDUR	DHARMAPURI
214	PIEZOMETER	78.014646000	12.117033000	Pangunatham A/b	INDUR	DHARMAPURI
215	CHECKDAM	77.958220000	12.060337000	Kadamdai	PERUMBALAI	DHARMAPURI
216	CHECKDAM	77.981795000	12.050510000	Kadamdai	PERUMBALAI	DHARMAPURI
217	CHECKDAM	77.990298000	12.036525000	Kadamdai	PERUMBALAI	DHARMAPURI
218	CHECKDAM	77.915707000	12.061849000	Kadamdai	PERUMBALAI	DHARMAPURI
219	CHECKDAM	77.899475000	12.029722000	Kadamdai	PERUMBALAI	DHARMAPURI
220	CHECKDAM	77.920731000	12.043329000	Kadamdai	PERUMBALAI	DHARMAPURI
221	CHECKDAM	77.960152000	12.024808000	Kadamdai	PERUMBALAI	DHARMAPURI
222	CHECKDAM	77.899861000	12.019894000	Kadamdai	PERUMBALAI	DHARMAPURI
223	CHECKDAM	77.965950000	12.012335000	Kadamdai	PERUMBALAI	DHARMAPURI
224	CHECKDAM	77.915321000	11.982097000	Kadamdai	PERUMBALAI	DHARMAPURI
225	CHECKDAM	77.883243000	11.965845000	Kadamdai	PERUMBALAI	DHARMAPURI
226	CHECKDAM	77.893291000	11.954506000	Kadamdai	PERUMBALAI	DHARMAPURI
227	CHECKDAM	77.930393000	12.013091000	Kadamdai	PERUMBALAI	DHARMAPURI
228	CHECKDAM	77.948172000	11.992680000	Kadamdai	PERUMBALAI	DHARMAPURI
229	CHECKDAM	77.938896000	11.971892000	Kadamdai	PERUMBALAI	DHARMAPURI
230	CHECKDAM	77.897543000	11.932583000	Kadamdai	PERUMBALAI	DHARMAPURI
231	CHECKDAM	77.882083000	11.928048000	Kadamdai	PERUMBALAI	DHARMAPURI
232	CHECKDAM	77.869330000	11.936741000	Kadamdai	PERUMBALAI	DHARMAPURI
233	CHECKDAM	77.843049000	11.996460000	Kadamdai	PERUMBALAI	DHARMAPURI
234	CHECKDAM	77.882856000	11.986255000	Kadamdai	PERUMBALAI	DHARMAPURI
235	NALABUND	77.993004000	12.047864000	Kadamdai	PERUMBALAI	DHARMAPURI

236	NALABUND	78.002279000	12.048242000	Kadamdai	PERUMBALAI	DHARMAPURI
237	NALABUND	78.012714000	12.066007000	Kadamdai	PERUMBALAI	DHARMAPURI
238	NALABUND	77.969814000	12.057314000	Kadamdai	PERUMBALAI	DHARMAPURI
239	NALABUND	77.941215000	12.075078000	Kadamdai	PERUMBALAI	DHARMAPURI
240	NALABUND	77.946239000	12.061849000	Kadamdai	PERUMBALAI	DHARMAPURI
241	NALABUND	77.929235000	12.068653000	Kadamdai	PERUMBALAI	DHARMAPURI
242	NALABUND	77.964017000	12.042573000	Kadamdai	PERUMBALAI	DHARMAPURI
243	NALABUND	77.951650000	12.032368000	Kadamdai	PERUMBALAI	DHARMAPURI
244	NALABUND	77.922664000	12.053534000	Kadamdai	PERUMBALAI	DHARMAPURI
245	NALABUND	77.979476000	12.035013000	Kadamdai	PERUMBALAI	DHARMAPURI
246	NALABUND	77.946240000	12.021028000	Kadamdai	PERUMBALAI	DHARMAPURI
247	NALABUND	77.913388000	12.034257000	Kadamdai	PERUMBALAI	DHARMAPURI
248	NALABUND	77.940442000	12.011957000	Kadamdai	PERUMBALAI	DHARMAPURI
249	NALABUND	77.972520000	12.027076000	Kadamdai	PERUMBALAI	DHARMAPURI
250	NALABUND	77.925756000	11.991169000	Kadamdai	PERUMBALAI	DHARMAPURI
251	NALABUND	77.910683000	12.005532000	Kadamdai	PERUMBALAI	DHARMAPURI
252	NALABUND	77.902953000	11.993059000	Kadamdai	PERUMBALAI	DHARMAPURI
253	NALABUND	77.892905000	11.975672000	Kadamdai	PERUMBALAI	DHARMAPURI
254	NALABUND	77.944307000	11.981341000	Kadamdai	PERUMBALAI	DHARMAPURI
255	NALABUND	77.916094000	11.957907000	Kadamdai	PERUMBALAI	DHARMAPURI
256	NALABUND	77.914161000	11.939009000	Kadamdai	PERUMBALAI	DHARMAPURI
257	NALABUND	77.892132000	11.940143000	Kadamdai	PERUMBALAI	DHARMAPURI
258	NALABUND	77.879765000	11.950726000	Kadamdai	PERUMBALAI	DHARMAPURI
259	NALABUND	77.851551000	12.008933000	Kadamdai	PERUMBALAI	DHARMAPURI
260	NALABUND	77.860054000	12.001374000	Kadamdai	PERUMBALAI	DHARMAPURI
261	NALABUND	77.870875000	11.994192000	Kadamdai	PERUMBALAI	DHARMAPURI
262	RECHARGE SHAFT	77.948171000	12.042951000	Kadamdai	PERUMBALAI	DHARMAPURI
263	RECHARGE SHAFT	77.958993000	12.061849000	Kadamdai	PERUMBALAI	DHARMAPURI
264	RECHARGE SHAFT	77.938123000	12.037281000	Kadamdai	PERUMBALAI	DHARMAPURI
265	RECHARGE SHAFT	77.931166000	12.029344000	Kadamdai	PERUMBALAI	DHARMAPURI

266	RECHARGE SHAFT	77.960925000	12.008177000	Kadamdai	PERUMBALAI	DHARMAPURI
267	RECHARGE SHAFT	77.938896000	12.045596000	Kadamdai	PERUMBALAI	DHARMAPURI
268	RECHARGE SHAFT	77.919185000	11.967735000	Kadamdai	PERUMBALAI	DHARMAPURI
269	RECHARGE SHAFT	77.932712000	11.965089000	Kadamdai	PERUMBALAI	DHARMAPURI
270	RECHARGE SHAFT	77.937737000	11.965845000	Kadamdai	PERUMBALAI	DHARMAPURI
271	RECHARGE SHAFT	77.983341000	12.052022000	Kadamdai	PERUMBALAI	DHARMAPURI
272	RECHARGE SHAFT	77.990298000	12.037659000	Kadamdai	PERUMBALAI	DHARMAPURI
273	RECHARGE SHAFT	77.916094000	12.063739000	Kadamdai	PERUMBALAI	DHARMAPURI
274	RECHARGE SHAFT	77.960539000	12.027454000	Kadamdai	PERUMBALAI	DHARMAPURI
275	RECHARGE SHAFT	77.967495000	12.014225000	Kadamdai	PERUMBALAI	DHARMAPURI
276	RECHARGE SHAFT	77.898702000	12.032368000	Kadamdai	PERUMBALAI	DHARMAPURI
277	RECHARGE SHAFT	77.899475000	12.022540000	Kadamdai	PERUMBALAI	DHARMAPURI
278	RECHARGE SHAFT	77.930007000	12.015359000	Kadamdai	PERUMBALAI	DHARMAPURI
279	RECHARGE SHAFT	77.919958000	12.044841000	Kadamdai	PERUMBALAI	DHARMAPURI
280	RECHARGE SHAFT	77.948171000	11.994948000	Kadamdai	PERUMBALAI	DHARMAPURI
281	RECHARGE SHAFT	77.843822000	11.997594000	Kadamdai	PERUMBALAI	DHARMAPURI
282	RECHARGE SHAFT	77.882083000	11.988523000	Kadamdai	PERUMBALAI	DHARMAPURI
283	RECHARGE SHAFT	77.914548000	11.985121000	Kadamdai	PERUMBALAI	DHARMAPURI
284	RECHARGE SHAFT	77.893291000	11.956395000	Kadamdai	PERUMBALAI	DHARMAPURI
285	RECHARGE SHAFT	77.882470000	11.966979000	Kadamdai	PERUMBALAI	DHARMAPURI
286	RECHARGE SHAFT	77.900247000	11.934095000	Kadamdai	PERUMBALAI	DHARMAPURI
287	RECHARGE SHAFT	77.870103000	11.938253000	Kadamdai	PERUMBALAI	DHARMAPURI
288	RECHARGE SHAFT	77.882083000	11.929937000	Kadamdai	PERUMBALAI	DHARMAPURI
289	RECHARGE SHAFT	77.947785000	12.063361000	Kadamdai	PERUMBALAI	DHARMAPURI
290	RECHARGE SHAFT	77.941601000	12.078102000	Kadamdai	PERUMBALAI	DHARMAPURI
291	RECHARGE SHAFT	77.931939000	12.069787000	Kadamdai	PERUMBALAI	DHARMAPURI
292	RECHARGE SHAFT	77.972519000	12.056936000	Kadamdai	PERUMBALAI	DHARMAPURI
293	RECHARGE SHAFT	77.991844000	12.050132000	Kadamdai	PERUMBALAI	DHARMAPURI
294	RECHARGE SHAFT	78.003052000	12.048620000	Kadamdai	PERUMBALAI	DHARMAPURI
295	RECHARGE SHAFT	78.014259000	12.066007000	Kadamdai	PERUMBALAI	DHARMAPURI

296	RECHARGE SHAFT	77.965563000	12.043707000	Kadamdai	PERUMBALAI	DHARMAPURI
297	RECHARGE SHAFT	77.952036000	12.033501000	Kadamdai	PERUMBALAI	DHARMAPURI
298	RECHARGE SHAFT	77.914161000	12.035769000	Kadamdai	PERUMBALAI	DHARMAPURI
299	RECHARGE SHAFT	77.946626000	12.020650000	Kadamdai	PERUMBALAI	DHARMAPURI
300	RECHARGE SHAFT	77.941215000	12.012335000	Kadamdai	PERUMBALAI	DHARMAPURI
301	RECHARGE SHAFT	77.908750000	12.005532000	Kadamdai	PERUMBALAI	DHARMAPURI
302	RECHARGE SHAFT	77.906045000	11.996460000	Kadamdai	PERUMBALAI	DHARMAPURI
303	RECHARGE SHAFT	77.926529000	11.991925000	Kadamdai	PERUMBALAI	DHARMAPURI
304	RECHARGE SHAFT	77.945080000	11.981719000	Kadamdai	PERUMBALAI	DHARMAPURI
305	RECHARGE SHAFT	77.972906000	12.028588000	Kadamdai	PERUMBALAI	DHARMAPURI
306	RECHARGE SHAFT	77.978317000	12.036903000	Kadamdai	PERUMBALAI	DHARMAPURI
307	RECHARGE SHAFT	77.894064000	11.977184000	Kadamdai	PERUMBALAI	DHARMAPURI
308	RECHARGE SHAFT	77.870103000	11.996460000	Kadamdai	PERUMBALAI	DHARMAPURI
309	RECHARGE SHAFT	77.861600000	12.002130000	Kadamdai	PERUMBALAI	DHARMAPURI
310	RECHARGE SHAFT	77.853870000	12.008555000	Kadamdai	PERUMBALAI	DHARMAPURI
311	RECHARGE SHAFT	77.879765000	11.950348000	Kadamdai	PERUMBALAI	DHARMAPURI
312	RECHARGE SHAFT	77.892905000	11.940899000	Kadamdai	PERUMBALAI	DHARMAPURI
313	RECHARGE SHAFT	77.916480000	11.959041000	Kadamdai	PERUMBALAI	DHARMAPURI
314	RECHARGE SHAFT	77.913774000	11.939765000	Kadamdai	PERUMBALAI	DHARMAPURI
315	RECHARGE SHAFT	77.938509000	11.972648000	Kadamdai	PERUMBALAI	DHARMAPURI
316	RECHARGE SHAFT	77.946239000	12.041817000	Kadamdai	PERUMBALAI	DHARMAPURI
317	RECHARGE SHAFT	77.935804000	12.059959000	Kadamdai	PERUMBALAI	DHARMAPURI
318	RECHARGE SHAFT	77.922277000	12.007799000	Kadamdai	PERUMBALAI	DHARMAPURI
319	RECHARGE SHAFT	77.938509000	12.001752000	Kadamdai	PERUMBALAI	DHARMAPURI
320	RECHARGE SHAFT	77.957061000	12.001374000	Kadamdai	PERUMBALAI	DHARMAPURI
321	RECHARGE SHAFT	77.903726000	11.979830000	Kadamdai	PERUMBALAI	DHARMAPURI
322	RECHARGE SHAFT	77.890972000	11.988901000	Kadamdai	PERUMBALAI	DHARMAPURI
323	RECHARGE SHAFT	77.904113000	11.968113000	Kadamdai	PERUMBALAI	DHARMAPURI
324	RECHARGE SHAFT	77.904885000	11.951104000	Kadamdai	PERUMBALAI	DHARMAPURI
325	RECHARGE SHAFT	77.915707000	11.950348000	Kadamdai	PERUMBALAI	DHARMAPURI

326	RECHARGE SHAFT	77.918026000	12.022918000	Kadamdai	PERUMBALAI	DHARMAPURI
327	RECHARGE SHAFT	77.905271000	12.049376000	Kadamdai	PERUMBALAI	DHARMAPURI
328	RECHARGE SHAFT	77.898316000	11.921244000	Kadamdai	PERUMBALAI	DHARMAPURI
329	RECHARGE SHAFT	77.855803000	11.934851000	Kadamdai	PERUMBALAI	DHARMAPURI
330	RECHARGE SHAFT	77.909137000	11.923512000	Kadamdai	PERUMBALAI	DHARMAPURI
331	PIEZOMETER	77.959379000	12.057314000	Kadamdai	PERUMBALAI	DHARMAPURI
332	PIEZOMETER	77.982955000	12.048620000	Kadamdai	PERUMBALAI	DHARMAPURI
333	PIEZOMETER	77.988752000	12.034635000	Kadamdai	PERUMBALAI	DHARMAPURI
334	PIEZOMETER	77.922664000	12.042195000	Kadamdai	PERUMBALAI	DHARMAPURI
335	PIEZOMETER	77.898702000	12.027454000	Kadamdai	PERUMBALAI	DHARMAPURI
336	PIEZOMETER	77.931166000	12.010445000	Kadamdai	PERUMBALAI	DHARMAPURI
337	PIEZOMETER	77.960152000	12.022918000	Kadamdai	PERUMBALAI	DHARMAPURI
338	PIEZOMETER	77.946239000	11.990413000	Kadamdai	PERUMBALAI	DHARMAPURI
339	PIEZOMETER	77.917640000	11.979074000	Kadamdai	PERUMBALAI	DHARMAPURI
340	PIEZOMETER	77.894451000	11.945812000	Kadamdai	PERUMBALAI	DHARMAPURI
341	PIEZOMETER	77.885562000	11.976428000	Kadamdai	PERUMBALAI	DHARMAPURI
342	PIEZOMETER	77.848073000	11.998728000	Kadamdai	PERUMBALAI	DHARMAPURI
343	CHECKDAM	78.032038000	12.044463000	Kammampatti	PALAYAM	DHARMAPURI
344	CHECKDAM	78.053681000	12.055046000	Kammampatti	PALAYAM	DHARMAPURI
345	CHECKDAM	78.042086000	12.018005000	Kammampatti	PALAYAM	DHARMAPURI
346	CHECKDAM	78.105082000	11.989657000	Kammampatti	PALAYAM	DHARMAPURI
347	CHECKDAM	78.081121000	11.990413000	Kammampatti	PALAYAM	DHARMAPURI
348	CHECKDAM	77.978703000	11.982476000	Kammampatti	PALAYAM	DHARMAPURI
349	CHECKDAM	78.031651000	11.987011000	Kammampatti	PALAYAM	DHARMAPURI
350	CHECKDAM	78.079961000	11.960175000	Kammampatti	PALAYAM	DHARMAPURI
351	CHECKDAM	78.108947000	11.963199000	Kammampatti	PALAYAM	DHARMAPURI
352	CHECKDAM	78.135614000	11.971136000	Kammampatti	PALAYAM	DHARMAPURI
353	CHECKDAM	78.049429000	11.952616000	Kammampatti	PALAYAM	DHARMAPURI
354	CHECKDAM	77.965950000	11.965846000	Kammampatti	PALAYAM	DHARMAPURI
355	CHECKDAM	77.926142000	11.912930000	Kammampatti	PALAYAM	DHARMAPURI

356	CHECKDAM	77.950877000	11.921244000	Kammampatti	PALAYAM	DHARMAPURI
357	CHECKDAM	77.965177000	11.915197000	Kammampatti	PALAYAM	DHARMAPURI
358	CHECKDAM	77.991844000	11.947702000	Kammampatti	PALAYAM	DHARMAPURI
359	CHECKDAM	78.023149000	11.934473000	Kammampatti	PALAYAM	DHARMAPURI
360	CHECKDAM	78.005757000	11.982853000	Kammampatti	PALAYAM	DHARMAPURI
361	CHECKDAM	78.059091000	11.965845000	Kammampatti	PALAYAM	DHARMAPURI
362	CHECKDAM	77.994163000	11.929937000	Kammampatti	PALAYAM	DHARMAPURI
363	NALABUND	78.042472000	12.030856000	Kammampatti	PALAYAM	DHARMAPURI
364	NALABUND	78.052521000	12.048242000	Kammampatti	PALAYAM	DHARMAPURI
365	NALABUND	78.026627000	12.017627000	Kammampatti	PALAYAM	DHARMAPURI
366	NALABUND	78.076096000	12.039549000	Kammampatti	PALAYAM	DHARMAPURI
367	NALABUND	78.095034000	11.991169000	Kammampatti	PALAYAM	DHARMAPURI
368	NALABUND	78.115904000	11.979074000	Kammampatti	PALAYAM	DHARMAPURI
369	NALABUND	78.136774000	11.978318000	Kammampatti	PALAYAM	DHARMAPURI
370	NALABUND	78.120927000	11.959041000	Kammampatti	PALAYAM	DHARMAPURI
371	NALABUND	78.098125000	11.961687000	Kammampatti	PALAYAM	DHARMAPURI
372	NALABUND	78.078802000	11.976428000	Kammampatti	PALAYAM	DHARMAPURI
373	NALABUND	78.004984000	11.988523000	Kammampatti	PALAYAM	DHARMAPURI
374	NALABUND	78.052135000	12.006288000	Kammampatti	PALAYAM	DHARMAPURI
375	NALABUND	78.052135000	11.971892000	Kammampatti	PALAYAM	DHARMAPURI
376	NALABUND	78.028173000	11.962065000	Kammampatti	PALAYAM	DHARMAPURI
377	NALABUND	78.016192000	11.967735000	Kammampatti	PALAYAM	DHARMAPURI
378	NALABUND	77.992230000	11.982475000	Kammampatti	PALAYAM	DHARMAPURI
379	NALABUND	77.989525000	12.011579000	Kammampatti	PALAYAM	DHARMAPURI
380	NALABUND	77.966336000	11.985499000	Kammampatti	PALAYAM	DHARMAPURI
381	NALABUND	77.961698000	11.950348000	Kammampatti	PALAYAM	DHARMAPURI
382	NALABUND	77.935031000	11.942033000	Kammampatti	PALAYAM	DHARMAPURI
383	NALABUND	77.952809000	11.932583000	Kammampatti	PALAYAM	DHARMAPURI
384	NALABUND	77.941601000	11.902346000	Kammampatti	PALAYAM	DHARMAPURI
385	NALABUND	77.972520000	11.934095000	Kammampatti	PALAYAM	DHARMAPURI

386	NALABUND	78.015419000	11.945434000	Kammampatti	PALAYAM	DHARMAPURI
387	NALABUND	78.033970000	11.948836000	Kammampatti	PALAYAM	DHARMAPURI
388	NALABUND	78.066434000	11.945056000	Kammampatti	PALAYAM	DHARMAPURI
389	NALABUND	78.052135000	11.940521000	Kammampatti	PALAYAM	DHARMAPURI
390	NALABUND	78.008849000	12.014225000	Kammampatti	PALAYAM	DHARMAPURI
391	NALABUND	78.151072000	11.980208000	Kammampatti	PALAYAM	DHARMAPURI
392	NALABUND	78.175422000	11.974160000	Kammampatti	PALAYAM	DHARMAPURI
393	NALABUND	77.978317000	11.920866000	Kammampatti	PALAYAM	DHARMAPURI
394	RECHARGE SHAFT	78.103923000	12.003643000	Kammampatti	PALAYAM	DHARMAPURI
395	RECHARGE SHAFT	78.108174000	12.038793000	Kammampatti	PALAYAM	DHARMAPURI
396	RECHARGE SHAFT	78.084599000	12.030478000	Kammampatti	PALAYAM	DHARMAPURI
397	RECHARGE SHAFT	78.090783000	12.029722000	Kammampatti	PALAYAM	DHARMAPURI
398	RECHARGE SHAFT	78.094647000	12.028966000	Kammampatti	PALAYAM	DHARMAPURI
399	RECHARGE SHAFT	78.088850000	12.020272000	Kammampatti	PALAYAM	DHARMAPURI
400	RECHARGE SHAFT	78.074164000	12.016494000	Kammampatti	PALAYAM	DHARMAPURI
401	RECHARGE SHAFT	78.078415000	12.018383000	Kammampatti	PALAYAM	DHARMAPURI
402	RECHARGE SHAFT	78.112812000	12.011201000	Kammampatti	PALAYAM	DHARMAPURI
403	RECHARGE SHAFT	78.098512000	12.006288000	Kammampatti	PALAYAM	DHARMAPURI
404	RECHARGE SHAFT	78.109334000	12.000240000	Kammampatti	PALAYAM	DHARMAPURI
405	RECHARGE SHAFT	78.105082000	12.024430000	Kammampatti	PALAYAM	DHARMAPURI
406	RECHARGE SHAFT	78.108561000	12.033123000	Kammampatti	PALAYAM	DHARMAPURI
407	RECHARGE SHAFT	78.110107000	12.031990000	Kammampatti	PALAYAM	DHARMAPURI
408	RECHARGE SHAFT	78.092329000	12.011579000	Kammampatti	PALAYAM	DHARMAPURI
409	RECHARGE SHAFT	78.071072000	12.002886000	Kammampatti	PALAYAM	DHARMAPURI
410	RECHARGE SHAFT	78.071459000	11.999862000	Kammampatti	PALAYAM	DHARMAPURI
411	RECHARGE SHAFT	78.031265000	12.003264000	Kammampatti	PALAYAM	DHARMAPURI
412	RECHARGE SHAFT	78.026240000	12.001752000	Kammampatti	PALAYAM	DHARMAPURI
413	RECHARGE SHAFT	78.028559000	11.997594000	Kammampatti	PALAYAM	DHARMAPURI
414	RECHARGE SHAFT	78.026240000	11.991169000	Kammampatti	PALAYAM	DHARMAPURI
415	RECHARGE SHAFT	78.106242000	12.005155000	Kammampatti	PALAYAM	DHARMAPURI

416	RECHARGE SHAFT	78.066048000	12.031990000	Kammampatti	PALAYAM	DHARMAPURI
417	RECHARGE SHAFT	78.078802000	12.027832000	Kammampatti	PALAYAM	DHARMAPURI
418	RECHARGE SHAFT	78.080734000	12.025186000	Kammampatti	PALAYAM	DHARMAPURI
419	RECHARGE SHAFT	78.077256000	12.026320000	Kammampatti	PALAYAM	DHARMAPURI
420	RECHARGE SHAFT	78.078802000	12.023674000	Kammampatti	PALAYAM	DHARMAPURI
421	RECHARGE SHAFT	77.970974000	11.994193000	Kammampatti	PALAYAM	DHARMAPURI
422	RECHARGE SHAFT	78.004211000	11.965089000	Kammampatti	PALAYAM	DHARMAPURI
423	RECHARGE SHAFT	78.008462000	11.962821000	Kammampatti	PALAYAM	DHARMAPURI
424	RECHARGE SHAFT	78.055999000	11.995326000	Kammampatti	PALAYAM	DHARMAPURI
425	RECHARGE SHAFT	78.053681000	12.054668000	Kammampatti	PALAYAM	DHARMAPURI
426	RECHARGE SHAFT	78.033970000	12.043329000	Kammampatti	PALAYAM	DHARMAPURI
427	RECHARGE SHAFT	78.040540000	12.019894000	Kammampatti	PALAYAM	DHARMAPURI
428	RECHARGE SHAFT	78.080734000	11.992303000	Kammampatti	PALAYAM	DHARMAPURI
429	RECHARGE SHAFT	78.104696000	11.991169000	Kammampatti	PALAYAM	DHARMAPURI
430	RECHARGE SHAFT	78.137160000	11.973782000	Kammampatti	PALAYAM	DHARMAPURI
431	RECHARGE SHAFT	78.109334000	11.963199000	Kammampatti	PALAYAM	DHARMAPURI
432	RECHARGE SHAFT	78.079961000	11.961309000	Kammampatti	PALAYAM	DHARMAPURI
433	RECHARGE SHAFT	78.058705000	11.968490000	Kammampatti	PALAYAM	DHARMAPURI
434	RECHARGE SHAFT	78.048270000	11.954128000	Kammampatti	PALAYAM	DHARMAPURI
435	RECHARGE SHAFT	78.031651000	11.988523000	Kammampatti	PALAYAM	DHARMAPURI
436	RECHARGE SHAFT	78.006143000	11.983610000	Kammampatti	PALAYAM	DHARMAPURI
437	RECHARGE SHAFT	77.977930000	11.983987000	Kammampatti	PALAYAM	DHARMAPURI
438	RECHARGE SHAFT	77.965177000	11.968113000	Kammampatti	PALAYAM	DHARMAPURI
439	RECHARGE SHAFT	77.991457000	11.949592000	Kammampatti	PALAYAM	DHARMAPURI
440	RECHARGE SHAFT	78.022376000	11.937875000	Kammampatti	PALAYAM	DHARMAPURI
441	RECHARGE SHAFT	77.992617000	11.931449000	Kammampatti	PALAYAM	DHARMAPURI
442	RECHARGE SHAFT	77.965563000	11.916331000	Kammampatti	PALAYAM	DHARMAPURI
443	RECHARGE SHAFT	77.950490000	11.922378000	Kammampatti	PALAYAM	DHARMAPURI
444	RECHARGE SHAFT	77.926915000	11.914819000	Kammampatti	PALAYAM	DHARMAPURI
445	RECHARGE SHAFT	78.042473000	12.031234000	Kammampatti	PALAYAM	DHARMAPURI

446	RECHARGE SHAFT	78.027013000	12.018761000	Kammampatti	PALAYAM	DHARMAPURI
447	RECHARGE SHAFT	78.011555000	12.014981000	Kammampatti	PALAYAM	DHARMAPURI
448	RECHARGE SHAFT	77.991071000	12.010823000	Kammampatti	PALAYAM	DHARMAPURI
449	RECHARGE SHAFT	77.991457000	11.980586000	Kammampatti	PALAYAM	DHARMAPURI
450	RECHARGE SHAFT	77.961698000	11.950726000	Kammampatti	PALAYAM	DHARMAPURI
451	RECHARGE SHAFT	77.974066000	11.933339000	Kammampatti	PALAYAM	DHARMAPURI
452	RECHARGE SHAFT	77.935418000	11.941277000	Kammampatti	PALAYAM	DHARMAPURI
453	RECHARGE SHAFT	77.944307000	11.903102000	Kammampatti	PALAYAM	DHARMAPURI
454	RECHARGE SHAFT	78.068367000	11.946946000	Kammampatti	PALAYAM	DHARMAPURI
455	PIEZOMETER	77.978703000	11.979830000	Kammampatti	PALAYAM	DHARMAPURI
456	PIEZOMETER	78.042086000	12.015359000	Kammampatti	PALAYAM	DHARMAPURI
457	PIEZOMETER	77.925756000	11.911039000	Kammampatti	PALAYAM	DHARMAPURI
458	PIEZOMETER	77.993776000	11.937497000	Kammampatti	PALAYAM	DHARMAPURI
459	PIEZOMETER	78.060637000	11.959797000	Kammampatti	PALAYAM	DHARMAPURI
460	PIEZOMETER	78.092329000	11.992681000	Kammampatti	PALAYAM	DHARMAPURI
461	PIEZOMETER	78.047883000	12.045219000	Kammampatti	PALAYAM	DHARMAPURI
462	PIEZOMETER	78.084212000	12.025186000	Kammampatti	PALAYAM	DHARMAPURI
463	PIEZOMETER	78.134068000	11.978318000	Kammampatti	PALAYAM	DHARMAPURI
464	PIEZOMETER	78.033584000	11.995326000	Kammampatti	PALAYAM	DHARMAPURI
465	PIEZOMETER	78.026627000	11.939765000	Kammampatti	PALAYAM	DHARMAPURI
466	PIEZOMETER	78.023921000	11.972648000	Kammampatti	PALAYAM	DHARMAPURI
467	CHECKDAM	78.082125000	12.174139000	Mallikuttai	PULIKARAI	DHARMAPURI
468	CHECKDAM	78.114596000	12.196427000	Mallikuttai	PULIKARAI	DHARMAPURI
469	CHECKDAM	78.143202000	12.198316000	Mallikuttai	PULIKARAI	DHARMAPURI
470	CHECKDAM	78.090243000	12.174139000	Mallikuttai	PULIKARAI	DHARMAPURI
471	CHECKDAM	78.076327000	12.254982000	Mallikuttai	PULIKARAI	DHARMAPURI
472	CHECKDAM	78.125420000	12.228160000	Mallikuttai	PULIKARAI	DHARMAPURI
473	CHECKDAM	78.133925000	12.231182000	Mallikuttai	PULIKARAI	DHARMAPURI
474	CHECKDAM	78.091016000	12.264048000	Mallikuttai	PULIKARAI	DHARMAPURI
475	CHECKDAM	78.140496000	12.205872000	Mallikuttai	PULIKARAI	DHARMAPURI

476	CHECKDAM	78.080578000	12.218716000	Mallikuttai	PULIKARAI	DHARMAPURI
477	CHECKDAM	78.074780000	12.276892000	Mallikuttai	PULIKARAI	DHARMAPURI
478	CHECKDAM	78.123101000	12.276514000	Mallikuttai	PULIKARAI	DHARMAPURI
479	CHECKDAM	78.073234000	12.261781000	Mallikuttai	PULIKARAI	DHARMAPURI
480	CHECKDAM	78.100680000	12.259137000	Mallikuttai	PULIKARAI	DHARMAPURI
481	CHECKDAM	78.099520000	12.266315000	Mallikuttai	PULIKARAI	DHARMAPURI
482	CHECKDAM	78.115369000	12.290492000	Mallikuttai	PULIKARAI	DHARMAPURI
483	CHECKDAM	78.096428000	12.217960000	Mallikuttai	PULIKARAI	DHARMAPURI
484	CHECKDAM	78.122714000	12.189628000	Mallikuttai	PULIKARAI	DHARMAPURI
485	CHECKDAM	78.087150000	12.166962000	Mallikuttai	PULIKARAI	DHARMAPURI
486	CHECKDAM	78.091016000	12.273114000	Mallikuttai	PULIKARAI	DHARMAPURI
487	NALABUND	78.077099000	12.175650000	Mallikuttai	PULIKARAI	DHARMAPURI
488	NALABUND	78.079805000	12.181317000	Mallikuttai	PULIKARAI	DHARMAPURI
489	NALABUND	78.077872000	12.171117000	Mallikuttai	PULIKARAI	DHARMAPURI
490	NALABUND	78.089083000	12.180939000	Mallikuttai	PULIKARAI	DHARMAPURI
491	NALABUND	78.096428000	12.178295000	Mallikuttai	PULIKARAI	DHARMAPURI
492	NALABUND	78.113437000	12.190005000	Mallikuttai	PULIKARAI	DHARMAPURI
493	NALABUND	78.094108000	12.204361000	Mallikuttai	PULIKARAI	DHARMAPURI
494	NALABUND	78.101453000	12.205116000	Mallikuttai	PULIKARAI	DHARMAPURI
495	NALABUND	78.108025000	12.201338000	Mallikuttai	PULIKARAI	DHARMAPURI
496	NALABUND	78.112277000	12.214183000	Mallikuttai	PULIKARAI	DHARMAPURI
497	NALABUND	78.114983000	12.206249000	Mallikuttai	PULIKARAI	DHARMAPURI
498	NALABUND	78.125420000	12.198316000	Mallikuttai	PULIKARAI	DHARMAPURI
499	NALABUND	78.132765000	12.198316000	Mallikuttai	PULIKARAI	DHARMAPURI
500	NALABUND	78.145522000	12.203983000	Mallikuttai	PULIKARAI	DHARMAPURI
501	NALABUND	78.101066000	12.224005000	Mallikuttai	PULIKARAI	DHARMAPURI
502	NALABUND	78.078259000	12.224760000	Mallikuttai	PULIKARAI	DHARMAPURI
503	NALABUND	78.116529000	12.242137000	Mallikuttai	PULIKARAI	DHARMAPURI
504	NALABUND	78.134698000	12.218338000	Mallikuttai	PULIKARAI	DHARMAPURI
505	NALABUND	78.131605000	12.240626000	Mallikuttai	PULIKARAI	DHARMAPURI

506	NALABUND	78.100679000	12.248937000	Mallikuttai	PULIKARAI	DHARMAPURI
507	NALABUND	78.085217000	12.260648000	Mallikuttai	PULIKARAI	DHARMAPURI
508	NALABUND	78.086763000	12.268959000	Mallikuttai	PULIKARAI	DHARMAPURI
509	NALABUND	78.113823000	12.261781000	Mallikuttai	PULIKARAI	DHARMAPURI
510	NALABUND	78.109184000	12.256115000	Mallikuttai	PULIKARAI	DHARMAPURI
511	NALABUND	78.115369000	12.273492000	Mallikuttai	PULIKARAI	DHARMAPURI
512	NALABUND	78.128126000	12.267448000	Mallikuttai	PULIKARAI	DHARMAPURI
513	NALABUND	78.121168000	12.287092000	Mallikuttai	PULIKARAI	DHARMAPURI
514	NALABUND	78.074780000	12.273114000	Mallikuttai	PULIKARAI	DHARMAPURI
515	NALABUND	78.113823000	12.284448000	Mallikuttai	PULIKARAI	DHARMAPURI
516	NALABUND	78.072074000	12.258004000	Mallikuttai	PULIKARAI	DHARMAPURI
517	RECHARGE SHAFT	78.089469000	12.195294000	Mallikuttai	PULIKARAI	DHARMAPURI
518	RECHARGE SHAFT	78.091016000	12.195294000	Mallikuttai	PULIKARAI	DHARMAPURI
519	RECHARGE SHAFT	78.101066000	12.189628000	Mallikuttai	PULIKARAI	DHARMAPURI
520	RECHARGE SHAFT	78.089083000	12.210027000	Mallikuttai	PULIKARAI	DHARMAPURI
521	RECHARGE SHAFT	78.128899000	12.197561000	Mallikuttai	PULIKARAI	DHARMAPURI
522	RECHARGE SHAFT	78.131219000	12.194916000	Mallikuttai	PULIKARAI	DHARMAPURI
523	RECHARGE SHAFT	78.135471000	12.213427000	Mallikuttai	PULIKARAI	DHARMAPURI
524	RECHARGE SHAFT	78.129672000	12.215316000	Mallikuttai	PULIKARAI	DHARMAPURI
525	RECHARGE SHAFT	78.128513000	12.210027000	Mallikuttai	PULIKARAI	DHARMAPURI
526	RECHARGE SHAFT	78.131605000	12.207761000	Mallikuttai	PULIKARAI	DHARMAPURI
527	RECHARGE SHAFT	78.126966000	12.219094000	Mallikuttai	PULIKARAI	DHARMAPURI
528	RECHARGE SHAFT	78.100680000	12.231560000	Mallikuttai	PULIKARAI	DHARMAPURI
529	RECHARGE SHAFT	78.120395000	12.230049000	Mallikuttai	PULIKARAI	DHARMAPURI
530	RECHARGE SHAFT	78.116143000	12.234960000	Mallikuttai	PULIKARAI	DHARMAPURI
531	RECHARGE SHAFT	78.117302000	12.233071000	Mallikuttai	PULIKARAI	DHARMAPURI
532	RECHARGE SHAFT	78.124647000	12.242137000	Mallikuttai	PULIKARAI	DHARMAPURI
533	RECHARGE SHAFT	78.107251000	12.247048000	Mallikuttai	PULIKARAI	DHARMAPURI
534	RECHARGE SHAFT	78.104932000	12.245915000	Mallikuttai	PULIKARAI	DHARMAPURI
535	RECHARGE SHAFT	78.102999000	12.243649000	Mallikuttai	PULIKARAI	DHARMAPURI

536	RECHARGE SHAFT	78.102226000	12.243648000	Mallikuttai	PULIKARAI	DHARMAPURI
537	RECHARGE SHAFT	78.078259000	12.285959000	Mallikuttai	PULIKARAI	DHARMAPURI
538	RECHARGE SHAFT	78.072847000	12.280670000	Mallikuttai	PULIKARAI	DHARMAPURI
539	RECHARGE SHAFT	78.115756000	12.299558000	Mallikuttai	PULIKARAI	DHARMAPURI
540	RECHARGE SHAFT	78.117689000	12.294647000	Mallikuttai	PULIKARAI	DHARMAPURI
541	RECHARGE SHAFT	78.126193000	12.264048000	Mallikuttai	PULIKARAI	DHARMAPURI
542	RECHARGE SHAFT	78.120395000	12.258004000	Mallikuttai	PULIKARAI	DHARMAPURI
543	RECHARGE SHAFT	78.126580000	12.257248000	Mallikuttai	PULIKARAI	DHARMAPURI
544	RECHARGE SHAFT	78.133925000	12.254226000	Mallikuttai	PULIKARAI	DHARMAPURI
545	RECHARGE SHAFT	78.092948000	12.257626000	Mallikuttai	PULIKARAI	DHARMAPURI
546	RECHARGE SHAFT	78.082511000	12.265937000	Mallikuttai	PULIKARAI	DHARMAPURI
547	RECHARGE SHAFT	78.094108000	12.207761000	Mallikuttai	PULIKARAI	DHARMAPURI
548	RECHARGE SHAFT	78.093335000	12.215694000	Mallikuttai	PULIKARAI	DHARMAPURI
549	RECHARGE SHAFT	78.096814000	12.215316000	Mallikuttai	PULIKARAI	DHARMAPURI
550	RECHARGE SHAFT	78.096041000	12.212294000	Mallikuttai	PULIKARAI	DHARMAPURI
551	RECHARGE SHAFT	78.110731000	12.222116000	Mallikuttai	PULIKARAI	DHARMAPURI
552	RECHARGE SHAFT	78.115756000	12.219849000	Mallikuttai	PULIKARAI	DHARMAPURI
553	RECHARGE SHAFT	78.117689000	12.224760000	Mallikuttai	PULIKARAI	DHARMAPURI
554	RECHARGE SHAFT	78.095268000	12.241382000	Mallikuttai	PULIKARAI	DHARMAPURI
555	RECHARGE SHAFT	78.093335000	12.244782000	Mallikuttai	PULIKARAI	DHARMAPURI
556	RECHARGE SHAFT	78.087923000	12.259515000	Mallikuttai	PULIKARAI	DHARMAPURI
557	RECHARGE SHAFT	78.087923000	12.258382000	Mallikuttai	PULIKARAI	DHARMAPURI
558	RECHARGE SHAFT	78.125033000	12.278025000	Mallikuttai	PULIKARAI	DHARMAPURI
559	RECHARGE SHAFT	78.073234000	12.261781000	Mallikuttai	PULIKARAI	DHARMAPURI
560	RECHARGE SHAFT	78.091402000	12.175650000	Mallikuttai	PULIKARAI	DHARMAPURI
561	RECHARGE SHAFT	78.143202000	12.199827000	Mallikuttai	PULIKARAI	DHARMAPURI
562	RECHARGE SHAFT	78.100680000	12.260648000	Mallikuttai	PULIKARAI	DHARMAPURI
563	RECHARGE SHAFT	78.095654000	12.265937000	Mallikuttai	PULIKARAI	DHARMAPURI
564	RECHARGE SHAFT	78.114210000	12.289736000	Mallikuttai	PULIKARAI	DHARMAPURI
565	RECHARGE SHAFT	78.114596000	12.248560000	Mallikuttai	PULIKARAI	DHARMAPURI

566	RECHARGE SHAFT	78.113823000	12.247426000	Mallikuttai	PULIKARAI	DHARMAPURI
567	RECHARGE SHAFT	78.080578000	12.219471000	Mallikuttai	PULIKARAI	DHARMAPURI
568	PIEZOMETER	78.085604000	12.172628000	Mallikuttai	PULIKARAI	DHARMAPURI
569	PIEZOMETER	78.118848000	12.192272000	Mallikuttai	PULIKARAI	DHARMAPURI
570	PIEZOMETER	78.092562000	12.212672000	Mallikuttai	PULIKARAI	DHARMAPURI
571	PIEZOMETER	78.130832000	12.212294000	Mallikuttai	PULIKARAI	DHARMAPURI
572	PIEZOMETER	78.099907000	12.238738000	Mallikuttai	PULIKARAI	DHARMAPURI
573	PIEZOMETER	78.124647000	12.233071000	Mallikuttai	PULIKARAI	DHARMAPURI
574	PIEZOMETER	78.093335000	12.261026000	Mallikuttai	PULIKARAI	DHARMAPURI
575	PIEZOMETER	78.076326000	12.279537000	Mallikuttai	PULIKARAI	DHARMAPURI
576	PIEZOMETER	78.118075000	12.283314000	Mallikuttai	PULIKARAI	DHARMAPURI
577	PIEZOMETER	78.130059000	12.258004000	Mallikuttai	PULIKARAI	DHARMAPURI
578	PIEZOMETER	78.068595000	12.258759000	Mallikuttai	PULIKARAI	DHARMAPURI
579	PIEZOMETER	78.111891000	12.217205000	Mallikuttai	PULIKARAI	DHARMAPURI
580	CHECKDAM	78.036510000	12.208138000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
581	CHECKDAM	78.014089000	12.184717000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
582	CHECKDAM	77.997080000	12.173006000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
583	CHECKDAM	77.964222000	12.180561000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
584	CHECKDAM	77.934843000	12.195672000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
585	CHECKDAM	77.966928000	12.229293000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
586	CHECKDAM	77.992054000	12.257626000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
587	CHECKDAM	78.051586000	12.224760000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
588	CHECKDAM	78.012156000	12.251204000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
589	CHECKDAM	78.036510000	12.274248000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
590	CHECKDAM	78.060477000	12.281803000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
591	CHECKDAM	77.990508000	12.222494000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
592	CHECKDAM	77.997467000	12.207005000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
593	CHECKDAM	77.942960000	12.233827000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
594	CHECKDAM	77.956104000	12.278781000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
595	CHECKDAM	77.904690000	12.248560000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI

596	CHECKDAM	77.905463000	12.279159000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
597	CHECKDAM	77.944893000	12.309758000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
598	CHECKDAM	77.878017000	12.295781000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
599	NALABUND	78.022980000	12.195294000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
600	NALABUND	78.012542000	12.174139000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
601	NALABUND	77.993601000	12.162428000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
602	NALABUND	77.997853000	12.183206000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
603	NALABUND	77.987029000	12.186983000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
604	NALABUND	77.968087000	12.189628000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
605	NALABUND	78.012929000	12.204738000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
606	NALABUND	77.981617000	12.211916000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
607	NALABUND	78.043467000	12.226271000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
608	NALABUND	78.007517000	12.230804000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
609	NALABUND	78.019887000	12.245537000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
610	NALABUND	78.026845000	12.260270000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
611	NALABUND	78.048880000	12.275759000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
612	NALABUND	78.019501000	12.272737000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
613	NALABUND	77.946053000	12.216071000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
614	NALABUND	77.930977000	12.225138000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
615	NALABUND	77.960356000	12.252715000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
616	NALABUND	77.942187000	12.251204000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
617	NALABUND	77.920153000	12.262915000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
618	NALABUND	77.940254000	12.298425000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
619	NALABUND	77.884202000	12.270470000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
620	NALABUND	77.891933000	12.243649000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
621	NALABUND	77.971566000	12.262915000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
622	NALABUND	77.928657000	12.279537000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
623	NALABUND	78.005584000	12.276514000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
624	NALABUND	77.908169000	12.295781000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
625	NALABUND	77.906623000	12.267070000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI

626	RECHARGE SHAFT	78.038056000	12.188117000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
627	RECHARGE SHAFT	78.060477000	12.268581000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
628	RECHARGE SHAFT	78.062410000	12.253848000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
629	RECHARGE SHAFT	78.077099000	12.251582000	Mallikuttai	PULIKARAI	DHARMAPURI
630	RECHARGE SHAFT	78.064342000	12.243649000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
631	RECHARGE SHAFT	78.073621000	12.241004000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
632	RECHARGE SHAFT	78.058931000	12.242893000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
633	RECHARGE SHAFT	78.080192000	12.239493000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
634	RECHARGE SHAFT	78.074780000	12.231182000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
635	RECHARGE SHAFT	78.065116000	12.218716000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
636	RECHARGE SHAFT	78.072847000	12.214183000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
637	RECHARGE SHAFT	78.073234000	12.210783000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
638	RECHARGE SHAFT	78.072074000	12.203605000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
639	RECHARGE SHAFT	78.055838000	12.226271000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
640	RECHARGE SHAFT	78.060477000	12.229293000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
641	RECHARGE SHAFT	78.063183000	12.227027000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
642	RECHARGE SHAFT	78.060090000	12.226271000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
643	RECHARGE SHAFT	78.058157000	12.216827000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
644	RECHARGE SHAFT	78.056998000	12.213805000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
645	RECHARGE SHAFT	78.046947000	12.214183000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
646	RECHARGE SHAFT	78.064729000	12.198316000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
647	RECHARGE SHAFT	78.063183000	12.196427000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
648	RECHARGE SHAFT	78.053132000	12.197939000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
649	RECHARGE SHAFT	78.056225000	12.237982000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
650	RECHARGE SHAFT	77.993988000	12.150717000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
651	RECHARGE SHAFT	78.002492000	12.142407000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
652	RECHARGE SHAFT	77.947986000	12.189628000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
653	RECHARGE SHAFT	77.953398000	12.188872000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
654	RECHARGE SHAFT	78.060863000	12.283314000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
655	RECHARGE SHAFT	78.037283000	12.276137000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI

656	RECHARGE SHAFT	78.010996000	12.252337000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
657	RECHARGE SHAFT	77.993214000	12.258004000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
658	RECHARGE SHAFT	77.990508000	12.221738000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
659	RECHARGE SHAFT	78.036510000	12.210027000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
660	RECHARGE SHAFT	78.014476000	12.185850000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
661	RECHARGE SHAFT	77.998239000	12.207761000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
662	RECHARGE SHAFT	77.969247000	12.230427000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
663	RECHARGE SHAFT	77.995920000	12.174139000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
664	RECHARGE SHAFT	77.964608000	12.180939000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
665	RECHARGE SHAFT	77.934842000	12.197183000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
666	RECHARGE SHAFT	77.942574000	12.234960000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
667	RECHARGE SHAFT	77.956490000	12.279537000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
668	RECHARGE SHAFT	77.904690000	12.249693000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
669	RECHARGE SHAFT	77.905850000	12.281425000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
670	RECHARGE SHAFT	77.877630000	12.296914000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
671	RECHARGE SHAFT	77.944507000	12.310514000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
672	RECHARGE SHAFT	77.894639000	12.294647000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
673	RECHARGE SHAFT	77.896959000	12.268581000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
674	RECHARGE SHAFT	77.940641000	12.267448000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
675	RECHARGE SHAFT	77.921313000	12.295403000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
676	RECHARGE SHAFT	77.926725000	12.253849000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
677	RECHARGE SHAFT	77.925951000	12.224760000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
678	RECHARGE SHAFT	77.958810000	12.264048000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
679	RECHARGE SHAFT	77.975432000	12.276137000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
680	RECHARGE SHAFT	78.000172000	12.276892000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
681	RECHARGE SHAFT	77.973499000	12.202850000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
682	RECHARGE SHAFT	77.993987000	12.238738000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
683	RECHARGE SHAFT	78.022980000	12.227782000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
684	RECHARGE SHAFT	78.044241000	12.260648000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
685	RECHARGE SHAFT	78.034190000	12.246293000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI

686	RECHARGE SHAFT	78.026072000	12.286336000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
687	RECHARGE SHAFT	77.960742000	12.291625000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
688	RECHARGE SHAFT	78.013702000	12.236848000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
689	PIEZOMETER	78.042308000	12.280292000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
690	PIEZOMETER	77.975432000	12.254603000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
691	PIEZOMETER	78.024140000	12.236471000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
692	PIEZOMETER	78.060090000	12.221361000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
693	PIEZOMETER	78.032257000	12.197939000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
694	PIEZOMETER	77.987415000	12.207761000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
695	PIEZOMETER	77.973113000	12.183961000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
696	PIEZOMETER	77.997080000	12.157140000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
697	PIEZOMETER	77.937162000	12.235715000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
698	PIEZOMETER	77.910875000	12.292003000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
699	PIEZOMETER	77.953011000	12.287469000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
700	PIEZOMETER	77.938322000	12.263293000	Keserkuli R.f.	PAPPARAPATTY	DHARMAPURI
701	CHECKDAM	77.970020000	12.305225000	Belamaranahalli	PALACODE	DHARMAPURI
702	CHECKDAM	78.000173000	12.290492000	Belamaranahalli	PALACODE	DHARMAPURI
703	CHECKDAM	77.954557000	12.322980000	Belamaranahalli	PALACODE	DHARMAPURI
704	CHECKDAM	77.978525000	12.319580000	Belamaranahalli	PALACODE	DHARMAPURI
705	CHECKDAM	77.962289000	12.336580000	Belamaranahalli	PALACODE	DHARMAPURI
706	CHECKDAM	77.968860000	12.369068000	Belamaranahalli	PALACODE	DHARMAPURI
707	CHECKDAM	77.976205000	12.333935000	Belamaranahalli	PALACODE	DHARMAPURI
708	CHECKDAM	77.999786000	12.320713000	Belamaranahalli	PALACODE	DHARMAPURI
709	CHECKDAM	77.988962000	12.376623000	Belamaranahalli	PALACODE	DHARMAPURI
710	CHECKDAM	78.005584000	12.358868000	Belamaranahalli	PALACODE	DHARMAPURI
711	CHECKDAM	78.005198000	12.312402000	Belamaranahalli	PALACODE	DHARMAPURI
712	CHECKDAM	78.050426000	12.354713000	Belamaranahalli	PALACODE	DHARMAPURI
713	CHECKDAM	78.023366000	12.309380000	Belamaranahalli	PALACODE	DHARMAPURI
714	CHECKDAM	78.054679000	12.309003000	Belamaranahalli	PALACODE	DHARMAPURI
715	CHECKDAM	78.080578000	12.307491000	Belamaranahalli	PALACODE	DHARMAPURI

716	CHECKDAM	78.079032000	12.333936000	Belamaranahalli	PALACODE	DHARMAPURI
717	CHECKDAM	78.094495000	12.309758000	Belamaranahalli	PALACODE	DHARMAPURI
718	CHECKDAM	78.053132000	12.330158000	Belamaranahalli	PALACODE	DHARMAPURI
719	CHECKDAM	78.028005000	12.293892000	Belamaranahalli	PALACODE	DHARMAPURI
720	CHECKDAM	77.975432000	12.352446000	Belamaranahalli	PALACODE	DHARMAPURI
721	NALABUND	78.054292000	12.348290000	Belamaranahalli	PALACODE	DHARMAPURI
722	NALABUND	77.956104000	12.343757000	Belamaranahalli	PALACODE	DHARMAPURI
723	NALABUND	77.981230000	12.296914000	Belamaranahalli	PALACODE	DHARMAPURI
724	NALABUND	77.970793000	12.327135000	Belamaranahalli	PALACODE	DHARMAPURI
725	NALABUND	77.988189000	12.323358000	Belamaranahalli	PALACODE	DHARMAPURI
726	NALABUND	77.987029000	12.343002000	Belamaranahalli	PALACODE	DHARMAPURI
727	NALABUND	77.968087000	12.351313000	Belamaranahalli	PALACODE	DHARMAPURI
728	NALABUND	77.959196000	12.360001000	Belamaranahalli	PALACODE	DHARMAPURI
729	NALABUND	77.979685000	12.343379000	Belamaranahalli	PALACODE	DHARMAPURI
730	NALABUND	77.979298000	12.364157000	Belamaranahalli	PALACODE	DHARMAPURI
731	NALABUND	77.997853000	12.355468000	Belamaranahalli	PALACODE	DHARMAPURI
732	NALABUND	77.998239000	12.347157000	Belamaranahalli	PALACODE	DHARMAPURI
733	NALABUND	77.989735000	12.330158000	Belamaranahalli	PALACODE	DHARMAPURI
734	NALABUND	77.998626000	12.363779000	Belamaranahalli	PALACODE	DHARMAPURI
735	NALABUND	77.986256000	12.364913000	Belamaranahalli	PALACODE	DHARMAPURI
736	NALABUND	77.986256000	12.382667000	Belamaranahalli	PALACODE	DHARMAPURI
737	NALABUND	78.050426000	12.369068000	Belamaranahalli	PALACODE	DHARMAPURI
738	NALABUND	78.049267000	12.339225000	Belamaranahalli	PALACODE	DHARMAPURI
739	NALABUND	77.959583000	12.316558000	Belamaranahalli	PALACODE	DHARMAPURI
740	NALABUND	78.076326000	12.347535000	Belamaranahalli	PALACODE	DHARMAPURI
741	NALABUND	78.056611000	12.336957000	Belamaranahalli	PALACODE	DHARMAPURI
742	NALABUND	78.031871000	12.300692000	Belamaranahalli	PALACODE	DHARMAPURI
743	NALABUND	77.989349000	12.282181000	Belamaranahalli	PALACODE	DHARMAPURI
744	NALABUND	78.064729000	12.312025000	Belamaranahalli	PALACODE	DHARMAPURI
745	NALABUND	78.072074000	12.321091000	Belamaranahalli	PALACODE	DHARMAPURI

746	NALABUND	78.104159000	12.317313000	Belamaranahalli	PALACODE	DHARMAPURI
747	NALABUND	78.096814000	12.334691000	Belamaranahalli	PALACODE	DHARMAPURI
748	NALABUND	78.037669000	12.366046000	Belamaranahalli	PALACODE	DHARMAPURI
749	NALABUND	78.032257000	12.353201000	Belamaranahalli	PALACODE	DHARMAPURI
750	NALABUND	78.033804000	12.339980000	Belamaranahalli	PALACODE	DHARMAPURI
751	NALABUND	78.041149000	12.328647000	Belamaranahalli	PALACODE	DHARMAPURI
752	NALABUND	78.021434000	12.318447000	Belamaranahalli	PALACODE	DHARMAPURI
753	NALABUND	78.045401000	12.306358000	Belamaranahalli	PALACODE	DHARMAPURI
754	NALABUND	78.093722000	12.298047000	Belamaranahalli	PALACODE	DHARMAPURI
755	RECHARGE SHAFT	78.063569000	12.298425000	Belamaranahalli	PALACODE	DHARMAPURI
756	RECHARGE SHAFT	78.084057000	12.285959000	Belamaranahalli	PALACODE	DHARMAPURI
757	RECHARGE SHAFT	78.103385000	12.286714000	Belamaranahalli	PALACODE	DHARMAPURI
758	RECHARGE SHAFT	78.098360000	12.298803000	Belamaranahalli	PALACODE	DHARMAPURI
759	RECHARGE SHAFT	78.010996000	12.309003000	Belamaranahalli	PALACODE	DHARMAPURI
760	RECHARGE SHAFT	78.109957000	12.303714000	Belamaranahalli	PALACODE	DHARMAPURI
761	RECHARGE SHAFT	78.113050000	12.302203000	Belamaranahalli	PALACODE	DHARMAPURI
762	RECHARGE SHAFT	78.111117000	12.299558000	Belamaranahalli	PALACODE	DHARMAPURI
763	RECHARGE SHAFT	78.089083000	12.316558000	Belamaranahalli	PALACODE	DHARMAPURI
764	RECHARGE SHAFT	78.086763000	12.317313000	Belamaranahalli	PALACODE	DHARMAPURI
765	RECHARGE SHAFT	78.070528000	12.289359000	Belamaranahalli	PALACODE	DHARMAPURI
766	RECHARGE SHAFT	78.082125000	12.291625000	Belamaranahalli	PALACODE	DHARMAPURI
767	RECHARGE SHAFT	78.085990000	12.294647000	Belamaranahalli	PALACODE	DHARMAPURI
768	RECHARGE SHAFT	78.087923000	12.298425000	Belamaranahalli	PALACODE	DHARMAPURI
769	RECHARGE SHAFT	78.090243000	12.293514000	Belamaranahalli	PALACODE	DHARMAPURI
770	RECHARGE SHAFT	78.082511000	12.327135000	Belamaranahalli	PALACODE	DHARMAPURI
771	RECHARGE SHAFT	78.100680000	12.339224000	Belamaranahalli	PALACODE	DHARMAPURI
772	RECHARGE SHAFT	78.100293000	12.337335000	Belamaranahalli	PALACODE	DHARMAPURI
773	RECHARGE SHAFT	78.079419000	12.344891000	Belamaranahalli	PALACODE	DHARMAPURI
774	RECHARGE SHAFT	78.078259000	12.349802000	Belamaranahalli	PALACODE	DHARMAPURI
775	RECHARGE SHAFT	78.045401000	12.333180000	Belamaranahalli	PALACODE	DHARMAPURI

776	RECHARGE SHAFT	78.057770000	12.331291000	Belamaranahalli	PALACODE	DHARMAPURI
777	RECHARGE SHAFT	78.049677000	12.359372000	Belamaranahalli	PALACODE	DHARMAPURI
778	RECHARGE SHAFT	78.056611000	12.324869000	Belamaranahalli	PALACODE	DHARMAPURI
779	RECHARGE SHAFT	78.060090000	12.321091000	Belamaranahalli	PALACODE	DHARMAPURI
780	RECHARGE SHAFT	78.054292000	12.321847000	Belamaranahalli	PALACODE	DHARMAPURI
781	RECHARGE SHAFT	78.017954000	12.353201000	Belamaranahalli	PALACODE	DHARMAPURI
782	RECHARGE SHAFT	78.017181000	12.336957000	Belamaranahalli	PALACODE	DHARMAPURI
783	RECHARGE SHAFT	78.046947000	12.350935000	Belamaranahalli	PALACODE	DHARMAPURI
784	RECHARGE SHAFT	78.039216000	12.352824000	Belamaranahalli	PALACODE	DHARMAPURI
785	RECHARGE SHAFT	78.042308000	12.352824000	Belamaranahalli	PALACODE	DHARMAPURI
786	RECHARGE SHAFT	78.089856000	12.348290000	Belamaranahalli	PALACODE	DHARMAPURI
787	RECHARGE SHAFT	78.091402000	12.347535000	Belamaranahalli	PALACODE	DHARMAPURI
788	RECHARGE SHAFT	78.029551000	12.372468000	Belamaranahalli	PALACODE	DHARMAPURI
789	RECHARGE SHAFT	78.033030000	12.371334000	Belamaranahalli	PALACODE	DHARMAPURI
790	RECHARGE SHAFT	78.029938000	12.370579000	Belamaranahalli	PALACODE	DHARMAPURI
791	RECHARGE SHAFT	78.004425000	12.296536000	Belamaranahalli	PALACODE	DHARMAPURI
792	RECHARGE SHAFT	78.004038000	12.319202000	Belamaranahalli	PALACODE	DHARMAPURI
793	RECHARGE SHAFT	78.006357000	12.316180000	Belamaranahalli	PALACODE	DHARMAPURI
794	RECHARGE SHAFT	77.999785000	12.336579000	Belamaranahalli	PALACODE	DHARMAPURI
795	RECHARGE SHAFT	77.983550000	12.298803000	Belamaranahalli	PALACODE	DHARMAPURI
796	RECHARGE SHAFT	77.980457000	12.295025000	Belamaranahalli	PALACODE	DHARMAPURI
797	RECHARGE SHAFT	77.981618000	12.316557000	Belamaranahalli	PALACODE	DHARMAPURI
798	RECHARGE SHAFT	77.995533000	12.307114000	Belamaranahalli	PALACODE	DHARMAPURI
799	RECHARGE SHAFT	77.992441000	12.303336000	Belamaranahalli	PALACODE	DHARMAPURI
800	RECHARGE SHAFT	77.969247000	12.306358000	Belamaranahalli	PALACODE	DHARMAPURI
801	RECHARGE SHAFT	77.975432000	12.334691000	Belamaranahalli	PALACODE	DHARMAPURI
802	RECHARGE SHAFT	77.953784000	12.322980000	Belamaranahalli	PALACODE	DHARMAPURI
803	RECHARGE SHAFT	77.961902000	12.336957000	Belamaranahalli	PALACODE	DHARMAPURI
804	RECHARGE SHAFT	77.975432000	12.352824000	Belamaranahalli	PALACODE	DHARMAPURI
805	RECHARGE SHAFT	77.968474000	12.370201000	Belamaranahalli	PALACODE	DHARMAPURI

806	RECHARGE SHAFT	77.989348000	12.377001000	Belamaranahalli	PALACODE	DHARMAPURI
807	RECHARGE SHAFT	78.005198000	12.359624000	Belamaranahalli	PALACODE	DHARMAPURI
808	RECHARGE SHAFT	78.028392000	12.295781000	Belamaranahalli	PALACODE	DHARMAPURI
809	RECHARGE SHAFT	78.053905000	12.310136000	Belamaranahalli	PALACODE	DHARMAPURI
810	PIEZOMETER	78.087923000	12.303714000	Belamaranahalli	PALACODE	DHARMAPURI
811	PIEZOMETER	78.046947000	12.301447000	Belamaranahalli	PALACODE	DHARMAPURI
812	PIEZOMETER	78.084058000	12.342624000	Belamaranahalli	PALACODE	DHARMAPURI
813	PIEZOMETER	78.048107000	12.326002000	Belamaranahalli	PALACODE	DHARMAPURI
814	PIEZOMETER	78.015248000	12.312025000	Belamaranahalli	PALACODE	DHARMAPURI
815	PIEZOMETER	77.990508000	12.296536000	Belamaranahalli	PALACODE	DHARMAPURI
816	PIEZOMETER	77.962675000	12.321091000	Belamaranahalli	PALACODE	DHARMAPURI
817	PIEZOMETER	77.975819000	12.343002000	Belamaranahalli	PALACODE	DHARMAPURI
818	PIEZOMETER	77.981230000	12.375113000	Belamaranahalli	PALACODE	DHARMAPURI
819	PIEZOMETER	78.041922000	12.361135000	Belamaranahalli	PALACODE	DHARMAPURI
820	PIEZOMETER	78.011769000	12.349424000	Belamaranahalli	PALACODE	DHARMAPURI
821	PIEZOMETER	78.004038000	12.328269000	Belamaranahalli	PALACODE	DHARMAPURI
822	CHECKDAM	77.906332000	12.214217000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
823	CHECKDAM	77.960452000	12.163988000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
824	CHECKDAM	77.864584000	12.217238000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
825	CHECKDAM	77.876954000	12.170031000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
826	CHECKDAM	77.844095000	12.154925000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
827	CHECKDAM	77.842936000	12.189670000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
828	CHECKDAM	77.801573000	12.142462000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
829	CHECKDAM	77.827860000	12.120180000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
830	CHECKDAM	77.765236000	12.068819000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
831	CHECKDAM	77.779539000	12.083171000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
832	CHECKDAM	77.857625000	12.037474000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
833	CHECKDAM	77.878500000	12.025767000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
834	CHECKDAM	77.879660000	12.059378000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
835	CHECKDAM	77.899761000	12.060889000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI

836	CHECKDAM	77.914065000	12.074862000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
837	CHECKDAM	77.948855000	12.097143000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
838	CHECKDAM	77.763303000	12.149260000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
839	CHECKDAM	77.855306000	12.065043000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
840	CHECKDAM	77.776060000	12.100920000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
841	CHECKDAM	77.913678000	12.164744000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
842	NALABUND	77.831725000	12.017081000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
843	NALABUND	77.841003000	12.034075000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
844	NALABUND	77.869995000	12.016325000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
845	NALABUND	77.880046000	12.007262000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
846	NALABUND	77.847575000	12.046538000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
847	NALABUND	77.860331000	12.030677000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
848	NALABUND	77.831773000	12.139027000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
849	NALABUND	77.883525000	12.036719000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
850	NALABUND	77.872315000	12.050692000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
851	NALABUND	77.956107000	12.156398000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
852	NALABUND	77.876181000	12.074107000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
853	NALABUND	77.869609000	12.064287000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
854	NALABUND	77.910198000	12.085059000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
855	NALABUND	77.844095000	12.116404000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
856	NALABUND	77.824767000	12.106585000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
857	NALABUND	77.800027000	12.113760000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
858	NALABUND	77.790749000	12.095255000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
859	NALABUND	77.796161000	12.079771000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
860	NALABUND	77.768715000	12.075994000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
861	NALABUND	77.777992000	12.131888000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
862	NALABUND	77.788043000	12.145861000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
863	NALABUND	77.765236000	12.160212000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
864	NALABUND	77.817036000	12.161345000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
865	NALABUND	77.825927000	12.191935000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI

866	NALABUND	77.834818000	12.238009000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
867	NALABUND	77.870382000	12.241408000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
868	NALABUND	77.883525000	12.219504000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
869	NALABUND	77.897055000	12.196089000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
870	NALABUND	77.850463000	12.263753000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
871	NALABUND	77.929983000	12.163969000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
872	NALABUND	77.894846000	12.161704000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
873	RECHARGE SHAFT	77.932299000	12.115646000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
874	RECHARGE SHAFT	77.947358000	12.114891000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
875	RECHARGE SHAFT	77.940022000	12.124329000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
876	RECHARGE SHAFT	77.950833000	12.139807000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
877	RECHARGE SHAFT	77.960486000	12.139807000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
878	RECHARGE SHAFT	77.925349000	12.117911000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
879	RECHARGE SHAFT	77.937705000	12.137542000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
880	RECHARGE SHAFT	77.946585000	12.146981000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
881	RECHARGE SHAFT	77.931527000	12.139052000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
882	RECHARGE SHAFT	77.928824000	12.133767000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
883	RECHARGE SHAFT	77.916855000	12.129237000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
884	RECHARGE SHAFT	77.920330000	12.125839000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
885	RECHARGE SHAFT	77.896777000	12.131502000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
886	RECHARGE SHAFT	77.901410000	12.125084000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
887	RECHARGE SHAFT	77.908360000	12.144338000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
888	RECHARGE SHAFT	77.885966000	12.139052000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
889	RECHARGE SHAFT	77.883649000	12.136787000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
890	RECHARGE SHAFT	77.879788000	12.127349000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
891	RECHARGE SHAFT	77.929210000	12.105830000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
892	RECHARGE SHAFT	77.918399000	12.116401000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
893	RECHARGE SHAFT	77.912994000	12.121686000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
894	RECHARGE SHAFT	77.916083000	12.103187000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
895	RECHARGE SHAFT	77.911449000	12.103942000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI

896	RECHARGE SHAFT	77.900252000	12.108095000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
897	RECHARGE SHAFT	77.903341000	12.096014000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
898	RECHARGE SHAFT	77.924577000	12.091484000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
899	RECHARGE SHAFT	77.919558000	12.090351000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
900	RECHARGE SHAFT	77.909518000	12.091484000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
901	RECHARGE SHAFT	77.889441000	12.101300000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
902	RECHARGE SHAFT	77.887510000	12.097524000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
903	RECHARGE SHAFT	77.883263000	12.103942000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
904	RECHARGE SHAFT	77.883263000	12.109983000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
905	RECHARGE SHAFT	77.878630000	12.113758000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
906	RECHARGE SHAFT	77.874382000	12.107340000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
907	RECHARGE SHAFT	77.871294000	12.113758000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
908	RECHARGE SHAFT	77.790210000	12.087331000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
909	RECHARGE SHAFT	77.795229000	12.083933000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
910	RECHARGE SHAFT	77.836157000	12.020132000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
911	RECHARGE SHAFT	77.845038000	12.023907000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
912	RECHARGE SHAFT	77.850830000	12.023907000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
913	RECHARGE SHAFT	77.818010000	12.156418000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
914	RECHARGE SHAFT	77.868590000	12.121687000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
915	RECHARGE SHAFT	77.896391000	12.122819000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
916	RECHARGE SHAFT	77.901024000	12.119798000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
917	RECHARGE SHAFT	77.953535000	12.137543000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
918	RECHARGE SHAFT	77.912994000	12.166612000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
919	RECHARGE SHAFT	77.877471000	12.169632000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
920	RECHARGE SHAFT	77.863571000	12.219088000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
921	RECHARGE SHAFT	77.907202000	12.214180000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
922	RECHARGE SHAFT	77.843880000	12.155664000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
923	RECHARGE SHAFT	77.844266000	12.190773000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
924	RECHARGE SHAFT	77.846196000	12.249667000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
925	RECHARGE SHAFT	77.829207000	12.121686000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI

926	RECHARGE SHAFT	77.947744000	12.099034000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
927	RECHARGE SHAFT	77.913380000	12.076005000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
928	RECHARGE SHAFT	77.779399000	12.083178000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
929	RECHARGE SHAFT	77.776310000	12.101300000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
930	RECHARGE SHAFT	77.802179000	12.142450000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
931	RECHARGE SHAFT	77.763954000	12.150378000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
932	RECHARGE SHAFT	77.855077000	12.066190000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
933	RECHARGE SHAFT	77.879402000	12.060904000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
934	RECHARGE SHAFT	77.900638000	12.062792000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
935	RECHARGE SHAFT	77.858166000	12.039385000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
936	RECHARGE SHAFT	77.877857000	12.027305000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
937	RECHARGE SHAFT	77.764340000	12.068832000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
938	RECHARGE SHAFT	77.851988000	12.171519000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
939	RECHARGE SHAFT	77.818010000	12.184355000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
940	RECHARGE SHAFT	77.793685000	12.125084000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
941	RECHARGE SHAFT	77.905271000	12.186243000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
942	RECHARGE SHAFT	77.819940000	12.143961000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
943	RECHARGE SHAFT	77.865888000	12.184733000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
944	PIEZOMETER	77.907202000	12.122441000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
945	PIEZOMETER	77.905658000	12.170764000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
946	PIEZOMETER	77.962802000	12.147735000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
947	PIEZOMETER	77.899866000	12.075628000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
948	PIEZOMETER	77.863185000	12.051466000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
949	PIEZOMETER	77.875155000	12.011449000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
950	PIEZOMETER	77.769746000	12.080913000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
951	PIEZOMETER	77.792140000	12.139052000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
952	PIEZOMETER	77.839632000	12.163591000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
953	PIEZOMETER	77.848127000	12.208894000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
954	PIEZOMETER	77.867819000	12.253065000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI
955	PIEZOMETER	77.843107000	12.122819000	Woddapatti R. F.	PENNAGARAM	DHARMAPURI

956	CHECKDAM	77.960871000	11.889908000	Vellar	Mecheri	SALEM
957	CHECKDAM	77.979404000	11.859709000	Vellar	Mecheri	SALEM
958	NALABUND	77.959326000	11.881604000	Vellar	Mecheri	SALEM
959	NALABUND	77.946199000	11.830265000	Vellar	Mecheri	SALEM
960	RECHARGE SHAFT	77.969365000	11.871789000	Vellar	Mecheri	SALEM
961	RECHARGE SHAFT	77.959326000	11.891418000	Vellar	Mecheri	SALEM
962	RECHARGE SHAFT	77.981334000	11.864243000	Vellar	Mecheri	SALEM
963	CHECKDAM	78.019367000	11.874752000	Kongupatti	Semmandapatti	SALEM
964	CHECKDAM	78.027862000	11.869842000	Kongupatti	Semmandapatti	SALEM
965	CHECKDAM	78.009714000	11.873618000	Kongupatti	Semmandapatti	SALEM
966	CHECKDAM	78.054504000	11.870220000	Kongupatti	Semmandapatti	SALEM
967	CHECKDAM	78.002957000	11.868019000	Kongupatti	Semmandapatti	SALEM
968	NALABUND	78.013575000	11.881551000	Kongupatti	Semmandapatti	SALEM
969	NALABUND	78.021297000	11.881551000	Kongupatti	Semmandapatti	SALEM
970	NALABUND	78.028634000	11.864176000	Kongupatti	Semmandapatti	SALEM
971	NALABUND	78.015120000	11.863799000	Kongupatti	Semmandapatti	SALEM
972	RECHARGE SHAFT	78.018209000	11.876641000	Kongupatti	Semmandapatti	SALEM
973	RECHARGE SHAFT	78.009328000	11.873997000	Kongupatti	Semmandapatti	SALEM
974	RECHARGE SHAFT	78.001992000	11.869464000	Kongupatti	Semmandapatti	SALEM
975	RECHARGE SHAFT	78.053345000	11.871353000	Kongupatti	Semmandapatti	SALEM
976	PIEZOMETER	77.968014000	11.886084000	Vellar	Mecheri	SALEM
977	PIEZOMETER	77.943303000	11.850201000	Vellar	Mecheri	SALEM
978	RECHARGE SHAFT	77.966856000	11.865687000	Vellar	Mecheri	SALEM
979	PIEZOMETER	77.968400000	11.846424000	Vellar	Mecheri	SALEM
980	PIEZOMETER	77.964153000	11.868709000	Vellar	Mecheri	SALEM
981	PIEZOMETER	77.997745000	11.861532000	Kongupatti	Semmandapatti	SALEM
982	PIEZOMETER	78.013575000	11.870220000	Kongupatti	Semmandapatti	SALEM
983	PIEZOMETER	78.041762000	11.867576000	Kongupatti	Semmandapatti	SALEM
984	PIEZOMETER	78.017050000	11.887595000	Kongupatti	Semmandapatti	SALEM
985	CHECKDAM	78.034039000	11.897416000	Kodunaickenpatty Pudur	Kadayampatti	SALEM

986	CHECKDAM	78.063770000	11.886462000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
987	CHECKDAM	78.085778000	11.888728000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
988	CHECKDAM	78.105470000	11.896282000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
989	CHECKDAM	78.041762000	11.901570000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
990	CHECKDAM	78.126320000	11.900437000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
991	CHECKDAM	78.138289000	11.945386000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
992	CHECKDAM	78.150645000	11.961250000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
993	CHECKDAM	78.160684000	11.961628000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
994	CHECKDAM	78.198137000	11.966538000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
995	CHECKDAM	78.200839000	11.943119000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
996	CHECKDAM	78.219373000	11.952940000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
997	CHECKDAM	78.197750000	11.898926000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
998	CHECKDAM	78.211264000	11.887595000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
999	CHECKDAM	78.235203000	11.946897000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1000	CHECKDAM	78.217443000	11.967294000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1001	NALABUND	78.139834000	11.956339000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1002	NALABUND	78.085392000	11.938964000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1003	NALABUND	78.066473000	11.928766000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1004	NALABUND	78.074581000	11.931788000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1005	NALABUND	78.122845000	11.948785000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1006	NALABUND	78.133270000	11.939720000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1007	NALABUND	78.150259000	11.953695000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1008	NALABUND	78.155664000	11.954073000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1009	NALABUND	78.168406000	11.957095000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1010	NALABUND	78.177673000	11.958606000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1011	NALABUND	78.185009000	11.963894000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1012	NALABUND	78.194662000	11.954451000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1013	NALABUND	78.205473000	11.951051000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1014	NALABUND	78.215898000	11.938964000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1015	NALABUND	78.208175000	11.934810000	Kodunaickenpatty Pudur	Kadayampatti	SALEM

1016	NALABUND	78.195048000	11.890994000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1017	NALABUND	78.208948000	11.882307000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1018	NALABUND	78.037514000	11.905725000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1019	NALABUND	78.062998000	11.883818000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1020	NALABUND	78.113965000	11.906481000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1021	NALABUND	78.085392000	11.900437000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1022	NALABUND	78.133270000	11.912147000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1023	RECHARGE SHAFT	78.047553000	11.900815000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1024	RECHARGE SHAFT	78.045237000	11.883818000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1025	RECHARGE SHAFT	78.075739000	11.883440000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1026	RECHARGE SHAFT	78.079214000	11.881551000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1027	RECHARGE SHAFT	78.077284000	11.880041000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1028	RECHARGE SHAFT	78.059137000	11.900815000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1029	RECHARGE SHAFT	78.237134000	11.956717000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1030	RECHARGE SHAFT	78.239837000	11.955962000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1031	RECHARGE SHAFT	78.242153000	11.956339000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1032	RECHARGE SHAFT	78.244470000	11.950674000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1033	RECHARGE SHAFT	78.033267000	11.898171000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1034	RECHARGE SHAFT	78.085778000	11.889483000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1035	RECHARGE SHAFT	78.105084000	11.897038000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1036	RECHARGE SHAFT	78.126706000	11.901948000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1037	RECHARGE SHAFT	78.137131000	11.946897000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1038	RECHARGE SHAFT	78.151031000	11.961250000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1039	RECHARGE SHAFT	78.161070000	11.962383000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1040	RECHARGE SHAFT	78.198909000	11.966538000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1041	RECHARGE SHAFT	78.219758000	11.968049000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1042	RECHARGE SHAFT	78.218987000	11.953695000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1043	RECHARGE SHAFT	78.200453000	11.942742000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1044	RECHARGE SHAFT	78.234817000	11.948407000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1045	RECHARGE SHAFT	78.196206000	11.901193000	Kodunaickenpatty Pudur	Kadayampatti	SALEM

1046	RECHARGE SHAFT	78.210878000	11.889483000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1047	PIEZOMETER	78.078828000	11.934432000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1048	PIEZOMETER	78.128250000	11.949918000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1049	PIEZOMETER	78.187712000	11.957850000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1050	PIEZOMETER	78.212423000	11.957850000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1051	PIEZOMETER	78.238292000	11.949918000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1052	PIEZOMETER	78.203156000	11.892127000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1053	PIEZOMETER	78.113964000	11.895149000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1054	PIEZOMETER	78.070334000	11.882685000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1055	PIEZOMETER	78.036356000	11.890239000	Kodunaickenpatty Pudur	Kadayampatti	SALEM
1056	CHECKDAM	78.200839000	11.976737000	Mottankurichi	BOMMIDI	DHARMAPURI
1057	CHECKDAM	78.217828000	11.995246000	Mottankurichi	BOMMIDI	DHARMAPURI
1058	CHECKDAM	78.224006000	12.011866000	Mottankurichi	BOMMIDI	DHARMAPURI
1059	CHECKDAM	78.240995000	12.015643000	Mottankurichi	BOMMIDI	DHARMAPURI
1060	CHECKDAM	78.236362000	12.004311000	Mottankurichi	BOMMIDI	DHARMAPURI
1061	CHECKDAM	78.247945000	11.997134000	Mottankurichi	BOMMIDI	DHARMAPURI
1062	CHECKDAM	78.259142000	12.007333000	Mottankurichi	BOMMIDI	DHARMAPURI
1063	CHECKDAM	78.296981000	12.025842000	Mottankurichi	BOMMIDI	DHARMAPURI
1064	CHECKDAM	78.283853000	12.017532000	Mottankurichi	BOMMIDI	DHARMAPURI
1065	CHECKDAM	78.298526000	12.014887000	Mottankurichi	BOMMIDI	DHARMAPURI
1066	CHECKDAM	78.311267000	12.008466000	Mottankurichi	BOMMIDI	DHARMAPURI
1067	CHECKDAM	78.271498000	12.001667000	Mottankurichi	BOMMIDI	DHARMAPURI
1068	CHECKDAM	78.281537000	11.994112000	Mottankurichi	BOMMIDI	DHARMAPURI
1069	CHECKDAM	78.288487000	11.998645000	Mottankurichi	BOMMIDI	DHARMAPURI
1070	CHECKDAM	78.242926000	11.979381000	Mottankurichi	BOMMIDI	DHARMAPURI
1071	CHECKDAM	78.287328000	11.971448000	Mottankurichi	BOMMIDI	DHARMAPURI
1072	CHECKDAM	78.261459000	11.947274000	Mottankurichi	BOMMIDI	DHARMAPURI
1073	CHECKDAM	78.310881000	11.954828000	Mottankurichi	BOMMIDI	DHARMAPURI
1074	CHECKDAM	78.276903000	11.942741000	Mottankurichi	BOMMIDI	DHARMAPURI
1075	CHECKDAM	78.279606000	11.977870000	Mottankurichi	BOMMIDI	DHARMAPURI

1076	NALABUND	78.195820000	11.984669000	Mottankurichi	BOMMIDI	DHARMAPURI
1077	NALABUND	78.205087000	11.980514000	Mottankurichi	BOMMIDI	DHARMAPURI
1078	NALABUND	78.213967000	11.999400000	Mottankurichi	BOMMIDI	DHARMAPURI
1079	NALABUND	78.217442000	12.003556000	Mottankurichi	BOMMIDI	DHARMAPURI
1080	NALABUND	78.239064000	11.992601000	Mottankurichi	BOMMIDI	DHARMAPURI
1081	NALABUND	78.232887000	11.996757000	Mottankurichi	BOMMIDI	DHARMAPURI
1082	NALABUND	78.231342000	12.022064000	Mottankurichi	BOMMIDI	DHARMAPURI
1083	NALABUND	78.241381000	12.019420000	Mottankurichi	BOMMIDI	DHARMAPURI
1084	NALABUND	78.255281000	12.014510000	Mottankurichi	BOMMIDI	DHARMAPURI
1085	NALABUND	78.253737000	12.028486000	Mottankurichi	BOMMIDI	DHARMAPURI
1086	NALABUND	78.278834000	12.012999000	Mottankurichi	BOMMIDI	DHARMAPURI
1087	NALABUND	78.291576000	12.021309000	Mottankurichi	BOMMIDI	DHARMAPURI
1088	NALABUND	78.292734000	12.006955000	Mottankurichi	BOMMIDI	DHARMAPURI
1089	NALABUND	78.298139000	11.986180000	Mottankurichi	BOMMIDI	DHARMAPURI
1090	NALABUND	78.310495000	12.001289000	Mottankurichi	BOMMIDI	DHARMAPURI
1091	NALABUND	78.316287000	11.972582000	Mottankurichi	BOMMIDI	DHARMAPURI
1092	NALABUND	78.313584000	11.963894000	Mottankurichi	BOMMIDI	DHARMAPURI
1093	NALABUND	78.300456000	11.945763000	Mottankurichi	BOMMIDI	DHARMAPURI
1094	NALABUND	78.277676000	11.938586000	Mottankurichi	BOMMIDI	DHARMAPURI
1095	NALABUND	78.256439000	11.941230000	Mottankurichi	BOMMIDI	DHARMAPURI
1096	NALABUND	78.266092000	11.959739000	Mottankurichi	BOMMIDI	DHARMAPURI
1097	NALABUND	78.254509000	11.972959000	Mottankurichi	BOMMIDI	DHARMAPURI
1098	NALABUND	78.251420000	11.965405000	Mottankurichi	BOMMIDI	DHARMAPURI
1099	NALABUND	78.278834000	11.961627000	Mottankurichi	BOMMIDI	DHARMAPURI
1100	NALABUND	78.254895000	11.989957000	Mottankurichi	BOMMIDI	DHARMAPURI
1101	RECHARGE SHAFT	78.268409000	11.977870000	Mottankurichi	BOMMIDI	DHARMAPURI
1102	RECHARGE SHAFT	78.263776000	11.964649000	Mottankurichi	BOMMIDI	DHARMAPURI
1103	RECHARGE SHAFT	78.272270000	11.949540000	Mottankurichi	BOMMIDI	DHARMAPURI
1104	RECHARGE SHAFT	78.281923000	11.954828000	Mottankurichi	BOMMIDI	DHARMAPURI
1105	RECHARGE SHAFT	78.300456000	11.940474000	Mottankurichi	BOMMIDI	DHARMAPURI

1106	RECHARGE SHAFT	78.309337000	11.950295000	Mottankurichi	BOMMIDI	DHARMAPURI
1107	RECHARGE SHAFT	78.279992000	11.996001000	Mottankurichi	BOMMIDI	DHARMAPURI
1108	RECHARGE SHAFT	78.243312000	12.015643000	Mottankurichi	BOMMIDI	DHARMAPURI
1109	RECHARGE SHAFT	78.268023000	12.018665000	Mottankurichi	BOMMIDI	DHARMAPURI
1110	RECHARGE SHAFT	78.256826000	12.021309000	Mottankurichi	BOMMIDI	DHARMAPURI
1111	RECHARGE SHAFT	78.200839000	11.978248000	Mottankurichi	BOMMIDI	DHARMAPURI
1112	RECHARGE SHAFT	78.216284000	11.997512000	Mottankurichi	BOMMIDI	DHARMAPURI
1113	RECHARGE SHAFT	78.235976000	12.005444000	Mottankurichi	BOMMIDI	DHARMAPURI
1114	RECHARGE SHAFT	78.223234000	12.013377000	Mottankurichi	BOMMIDI	DHARMAPURI
1115	RECHARGE SHAFT	78.258756000	12.009222000	Mottankurichi	BOMMIDI	DHARMAPURI
1116	RECHARGE SHAFT	78.283467000	12.019798000	Mottankurichi	BOMMIDI	DHARMAPURI
1117	RECHARGE SHAFT	78.295823000	12.026975000	Mottankurichi	BOMMIDI	DHARMAPURI
1118	RECHARGE SHAFT	78.247945000	12.000534000	Mottankurichi	BOMMIDI	DHARMAPURI
1119	RECHARGE SHAFT	78.241381000	11.981269000	Mottankurichi	BOMMIDI	DHARMAPURI
1120	RECHARGE SHAFT	78.288487000	12.001289000	Mottankurichi	BOMMIDI	DHARMAPURI
1121	RECHARGE SHAFT	78.271112000	12.003556000	Mottankurichi	BOMMIDI	DHARMAPURI
1122	RECHARGE SHAFT	78.297753000	12.016021000	Mottankurichi	BOMMIDI	DHARMAPURI
1123	RECHARGE SHAFT	78.312425000	12.009600000	Mottankurichi	BOMMIDI	DHARMAPURI
1124	RECHARGE SHAFT	78.278834000	11.978248000	Mottankurichi	BOMMIDI	DHARMAPURI
1125	RECHARGE SHAFT	78.290417000	11.980892000	Mottankurichi	BOMMIDI	DHARMAPURI
1126	RECHARGE SHAFT	78.292734000	11.977870000	Mottankurichi	BOMMIDI	DHARMAPURI
1127	RECHARGE SHAFT	78.310495000	11.955206000	Mottankurichi	BOMMIDI	DHARMAPURI
1128	RECHARGE SHAFT	78.277676000	11.945007000	Mottankurichi	BOMMIDI	DHARMAPURI
1129	RECHARGE SHAFT	78.261073000	11.949162000	Mottankurichi	BOMMIDI	DHARMAPURI
1130	RECHARGE SHAFT	78.257212000	11.973337000	Mottankurichi	BOMMIDI	DHARMAPURI
1131	PIEZOMETER	78.207403000	11.988824000	Mottankurichi	BOMMIDI	DHARMAPURI
1132	PIEZOMETER	78.230570000	12.005445000	Mottankurichi	BOMMIDI	DHARMAPURI
1133	PIEZOMETER	78.249876000	12.016021000	Mottankurichi	BOMMIDI	DHARMAPURI
1134	PIEZOMETER	78.271112000	12.009977000	Mottankurichi	BOMMIDI	DHARMAPURI
1135	PIEZOMETER	78.255282000	11.981269000	Mottankurichi	BOMMIDI	DHARMAPURI

1136	PIEZOMETER	78.264162000	11.954073000	Mottankurichi	BOMMIDI	DHARMAPURI
1137	PIEZOMETER	78.288872000	11.988069000	Mottankurichi	BOMMIDI	DHARMAPURI
1138	PIEZOMETER	78.297367000	11.945763000	Mottankurichi	BOMMIDI	DHARMAPURI
1139	PIEZOMETER	78.308951000	11.988069000	Mottankurichi	BOMMIDI	DHARMAPURI
1140	CHECKDAM	78.079021000	12.365407000	Dandukaranahalli	VELLICHANDAI	DHARMAPURI
1141	CHECKDAM	78.088288000	12.354469000	Dandukaranahalli	VELLICHANDAI	DHARMAPURI
1142	CHECKDAM	78.056627000	12.380870000	Dandukaranahalli	VELLICHANDAI	DHARMAPURI
1143	NALABUND	78.041568000	12.399728000	Dandukaranahalli	VELLICHANDAI	DHARMAPURI
1144	NALABUND	78.055468000	12.387659000	Dandukaranahalli	VELLICHANDAI	DHARMAPURI
1145	NALABUND	78.058557000	12.386905000	Dandukaranahalli	VELLICHANDAI	DHARMAPURI
1146	NALABUND	78.072071000	12.361635000	Dandukaranahalli	VELLICHANDAI	DHARMAPURI
1147	NALABUND	78.081338000	12.357863000	Dandukaranahalli	VELLICHANDAI	DHARMAPURI
1148	RECHARGE SHAFT	78.046589000	12.394071000	Dandukaranahalli	VELLICHANDAI	DHARMAPURI
1149	RECHARGE SHAFT	78.039252000	12.392562000	Dandukaranahalli	VELLICHANDAI	DHARMAPURI
1150	RECHARGE SHAFT	78.051221000	12.388414000	Dandukaranahalli	VELLICHANDAI	DHARMAPURI
1151	RECHARGE SHAFT	78.048518000	12.383510000	Dandukaranahalli	VELLICHANDAI	DHARMAPURI
1152	RECHARGE SHAFT	78.052380000	12.383510000	Dandukaranahalli	VELLICHANDAI	DHARMAPURI
1153	RECHARGE SHAFT	78.074388000	12.369933000	Dandukaranahalli	VELLICHANDAI	DHARMAPURI
1154	RECHARGE SHAFT	78.075160000	12.359372000	Dandukaranahalli	VELLICHANDAI	DHARMAPURI
1155	PIEZOMETER	78.030757000	12.413683000	Dandukaranahalli	VELLICHANDAI	DHARMAPURI
1156	PIEZOMETER	78.045430000	12.389922000	Dandukaranahalli	VELLICHANDAI	DHARMAPURI
1157	PIEZOMETER	78.067438000	12.374459000	Dandukaranahalli	VELLICHANDAI	DHARMAPURI
1158	PIEZOMETER	78.079407000	12.360126000	Dandukaranahalli	VELLICHANDAI	DHARMAPURI