केंद्रीय भूमि जल बोर्ड

जल संसाधन, नदी विकास और गंगा संरक्षण

विभाग, जल शक्ति मंत्रालय

भारत सरकार

Central Ground Water Board

Department of Water Resources, River Development and Ganga Rejuvenation,

Ministry of Jal Shakti

Government of India

AQUIFER MAPPING AND MANAGEMENT OF GROUND WATER RESOURCES

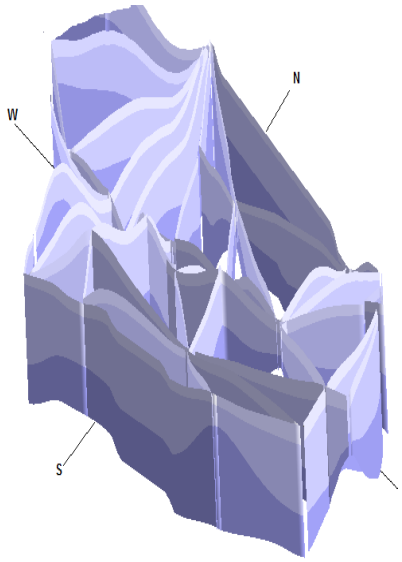
PARAMBIKULAM ALIYAR AQUIFER SYSTEM, Tamil Nadu

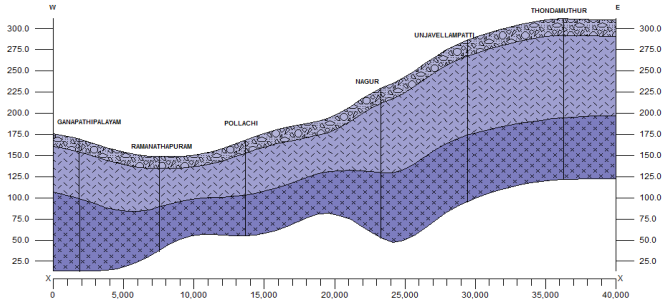
दक्षिण पूर्वी तटीय क्षेत्र, चेन्नई

South Eastern Coastal Region, Chennai

सरकारी उपयोग के लिए

REPORT ON AQUIFER MAPPING AND AQUIFER MANAGEMENT PLAN FOR THE PARAMBIKULAM ALIYAR AQUIFER SYSTEM, TAMIL NADU





भारत सरकार
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दक्षिण पूर्वी तटीय क्षेत्र
चेन्नई

GOVERNMENT OF INDIA
MINISTRY OF JAL SHAKTI
DEPARTMENT OF WATER RESOURCES
RIVER DEVELOPMENT AND GANGA REJUVENATION
CENTRAL GROUND WATER BOARD
SOUTH EASTERN COASTAL REGION
CHENNAI

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. In India out of 6607 groundwater assessment units (Blocks/ mandals/taluks/firkas etc.), 1071 units are over-exploited and 914 units are critical. These units have withdrawal of groundwater is more than the recharge (over exploited) and more 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 300m in soft rocks areas and 200m in hard rock areas. The extent of aquifers, their potential, resource availability, chemical quality and its sustainable management options will be addressed by National Aquifer Mapping (NAQUIM). The NAQUIM programme will also facilitate participatory management of groundwater to provide long-term sustenance for the benefit of farmers. Currently, focus is on groundwater stressed areas of nine 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 (SECR), CGWB, 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 Parambikulam Aliyar aquifer system covering an area of 2406.38 sq.km. The basin comprises of water stressed Coimbatore and Tiruppur districts with 11 firkas categorised as Over exploited all falling in Coimbatore district which are mainly dependent on groundwater (85%) for its drinking water needs. The major issues in the basin include declining groundwater levels, massive and poor yielding aquifer and groundwater quality issues in pocket. Aquifer units have been deciphered firkas-wise and regions of high yielding zone and low yielding zone have been demarcated for the different aquifers in the Parambikulam Aliyar aquifer system. The area is mainly comprised of Charnokite & Khondalite group of rocks, and Gniessic group of rocks which form two aquifer units namely Aquifer unit-I (weathered rock) and Aquifer Unit –II (fractured/Jointed zone). In order to arrest the declining groundwater levels and increase the sustainability of wells, firka wise groundwater management plans in supply and demand side have been formulated.

I hope this report will be useful for the district administrators, water managers, stakeholders including farmers in knowing the aquifer and managing it resources effectively in the Parambikulam Aliyar aquifer system.

Dr A Asokan
Regional Director

EXECUTIVE SUMMARY

Integrated hydrogeological studies were conducted in the Parambikulam – Aliyar aquifer system wherein large number of existing data pertinent to geology, geophysics, hydrogeology, hydrology, hydrochemistry were collected, synthesised and analysed to bring out this report. This report mainly comprises the lateral and vertical extents of the aquifers with their geometry, aquifer properties of the study area which are considered to be measuring scales for groundwater availability and potentiality. Keeping these parameters in view a sustainable management plan has been suggested through which the groundwater needs can be fulfilled in a rational way.

The Parambikulam – Aliyar aquifer system experiences semi-arid climate with 899.81 mm annual normal rainfall covering 2406.38 km^2 area in Coimbatore and Tiruppur districts of Tamil Nadu. About 79% of the geographical area is under agricultural activity of which 70% is groundwater irrigation. The main crops irrigated are- Coconut, paddy, sugarcane, groundnut, maize, cotton, ragi and other minor crops such as turmeric, vegetables and flowers.

Main aquifer units that exist in the study area, namely 1. Weathered zone at the top followed by a discrete anisotropic fractured/fissured zone at the bottom in the western and southern parts of the study area. Groundwater occurs under unconfined condition in the weathered zone and in the alluvial formation and unconfined to semi-confined conditions in the conglomerates and fractured/fissured zone. The predominant water levels are in the range of 3.5 to 35 m bgl during pre-monsoon season and 2.2 to 30 mbgl during post-monsoon season of 2020. The net annual ground water availability is 41009 Ha m and the gross groundwater draft is 37666 Ha m and the stage of groundwater development is 92%.

The major issues in the aquifer systems are decline in groundwater levels and low sustainability, groundwater contamination by industries, urbanisation and huge demand for groundwater to cater growing population and low yielding aquifer units.

In hard rock regions aquifer systems can be conceptualized as weathered zone down to ~30m with average thickness of 18 m and fractured zone between 30 to 165 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 4 and 32.3 m^2/day and specific yield of 0.5 and 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 3.5 and 45.2 m^2/day and storativity varies from 0.002 to 0.01. In alluvial regions the first aquifer unit comprising of sand, gravel has thickness ranging from 5 to 50 m with yields ranging from 68 to 140 m^3/hr and transmissivity values ranging from 1271 to 4180 m^2/day.

Demand side intervention would save 235 ham of water annually. By carrying out both supply and demand side interventions the stage of groundwater development would be lowered from 92 to 74%.

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 is to be conducted among user groups and valid suggestions may be incorporated in the regulatory acts.

REPORT ON
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CONTRIBUTORS' PAGE

Principal Author

Dr. M. Panneer, Scientist - B

Groundwater Exploration		
Dr. M. Panneer	:	Scientist – B
Aquifer Disposition		
Dr Sk. Md. Sartaj Basha	:	Assistant Hydrogeologist
Groundwater management plan		
Dr. M. Panneer	:	Scientist - B
GIS layers & Maps preparation		
Dr. M. Panneer	:	Scientist - B
Mrs. M. Navaneetham	:	Draughtsman
Geophysical studies		
Dr. V. Arulprakasam	:	Scientist - D
Scrutiny of the report		
Smt. Mini Chandran	:	Scientist - D

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1.0 INTRODUCTION

National Project on Aquifer Mapping (NAQUIM) initiated by Ministry of Jal Shakti, Department 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.

The water demand for domestic, irrigation, industries, livestock, power generation and other uses is governed by socio-economic and agricultural factors, including the present and future population size, income level, urbanization, market facilities, remunerative prices, cropping patterns, etc. The rationale of choosing a river basin as the unit for the planning is to optimize the use of water resources in that basin, matching with supply and demand. An analysis of the water balance, water utilisation and allocation plan for different competing water users form the core of a river basin plan. As groundwater continues to play an important role in the development of the human civilization, there arises a strong need for protecting groundwater from increasing threat of over extraction and contamination. The development activities over the years have adversely affected the ground water regime in many parts of the country. Hence, it is important to understand the aquifer system and its hydrodynamics so as to properly manage the groundwater resources. There is a need for scientific planning in development of groundwater under different hydrogeological situations and to evolve effective management practices with involvement of community for better groundwater governance.

Aquifer Mapping has been taken up in the Parambikulam – Aliyar Aquifer system in a view to formulate strategies for sustainable management plan for the aquifer system in accordance with the nature of the aquifer, the stress on the groundwater resource and prevailing groundwater quality which will help in drinking water security and improved irrigation facility. It will also result in better management of groundwater resources and vulnerable areas.

1.1 Objectives

The objectives of the aquifer mapping project in the Parambikulam – Aliyar aquifer system can broadly be stated as

- To define the aquifer geometry, type of aquifers and their lateral and vertical extents
- To determine the groundwater regime scenario
- To determine the hydrogeochemical characteristics of the aquifer units
- To estimate the availability of groundwater resources in the aquifer system
- To develop a sustainable groundwater management plan for the aquifer system.

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 Tamil Nadu Water supply and Drainage Board (TWAD), Public Works Department (PWD) and Agricultural Engineering Department (AED). In order to bridge the data gap, data generation programme has been formulated in an organised way in the basin. Groundwater exploration work has been carried out in different segments of the regions 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 second, after generation of data at identified gaps. The resultant maps generated are more realistic aided with dense data points.

1.2 a. Issues

During aquifer mapping studies in the Parambikulam – Aliyar aquifer system, the major groundwater issues/threat identified (**Figure 1.1**) in the aquifer system are

i. Highly compact – Low yielding aquifer units.
ii. High EC values
iii. Nitrate Contamination
iv. Fluoride contamination in shallow aquifers

Highly compact - Low yielding aquifer units

Low yielding aquifers, due to absence of primary, secondary porosity and compactness in Migmatites, Granite and Limestones. Very less discharge observed in both weathered and fractured aquifers. The transmissivity values of weathered and fractured aquifers are in the range 0.1 to 2.0 m^2/day. The specific yield values of weathered and fractured aquifers ranges between 0.01 to 0.1.

High EC values

High values of electrical values are identified in the shallow aquifers Parambikula – Aliyar aquifer system, domestic demand of water met alternate source. Few pockets are identified and marked in the Figure 1.1.

Nitrate Contamination

The source of Nitrate in groundwater includes surface leaching from wastewater and N-based fertilizers. Isolated pockets of Nitrate contamination above 45 mg/l are observed. The source of Nitrate contamination in this pocket is due to applied fertilizers in agricultural field.

Fluoride contamination in shallow aquifers

Very high concentration of Fluoride identified in the tune of 4 mg/l in shallow aquifers of Parambikulam – Aliyar aquifer system.

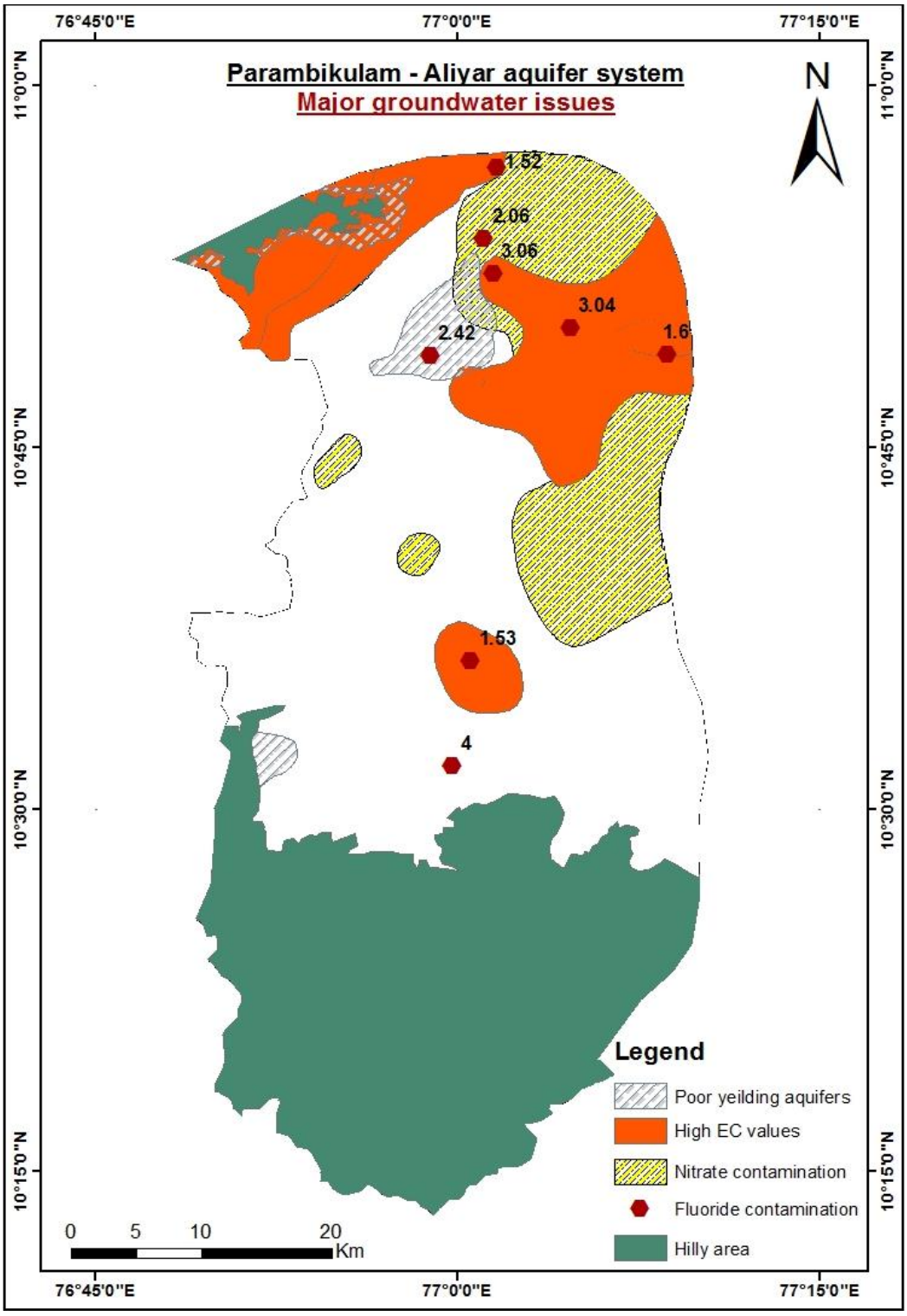


Figure.1.1. Issues pertaining to the Parambikulam – Aliyar aquifer system

1.3 Approach & Methodology

Integrated multi-disciplinary approach involving geological, geophysical, hydrological, hydrogeological and hydrogeochemical components were taken up in 1:50000 scale 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 resistivity have been interpreted in corroboration with the litho-stratigraphy of the observation wells and exploratory wells down to depths of 200 and 300 m bgl for hard rock & soft rock respectively. Hydrological and hydrometerological data has been collected from state PWD and Indian Meteorological Department (IMD). Drainage, Soil and Geomorphology of the sub basin was prepared based on the IRS –IC data, obtained from Institute of Remote Sensing, Anna University, Chennai.

Based on the data gap analysis, data generation process has been planned through establishing key observation wells, pinpointing exploratory sites for drilling through in-house and outsourcing, collecting groundwater 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. Based on the above studies management strategies both on the supply side through augmentation of groundwater through artificial recharge and water conservation and on demand side through change in irrigation pattern have been formulated for sustainable management of the groundwater resource.

1.4. Study area

Parambikulam Aliyar aquifer system, the area falling under this basin is surrounded by ridges /water divide, and the rivers draining in this basin are west flowing, hence cannot be appended with the adjacent Cauvery river basin of Tamil Nadu. Thus it become one among the 17 river basins of Tamil Nadu. The basin is Inter State in nature. Total geographical area of the Parambikulam - Aliyar basin (Tamil Nadu part) is 2406.38 sq.km and located in between N. Latitude 10° 12’ 50” - 10° 57’ 45” and E. Longitude 76° 42’ 30” - 77° 12’ 40”. The basin falls in Survey of India Topographic sheets " 58 / B9, B13, B14, B15, B16 and 58 / F1, F2, F3, F4 on 1:50,000 scale. Parambikulam - Aliyar basin is bounded by the Cauvery river basin in the east and north, Kerala State in the west and south **(Figure 1.2).** The Parambikulam Aliyar basin is further delineated into four sub basins namely, Walayar, Palar, Aliyar and Sholaiyar. Walayar is the largest sub basin among the four sub basins with an area of 875.13 sq.km. The northern and eastern sides bounded by Cauvery basin and the western part bounded by Kerala State. The southern part bounded by Aliyar and Palar sub basins. Palar sub basin having an area of 520.60 sq.km, which is bounded by Walayar sub basin in the north, Aliyar sub basin in the west and Cauvery basin in the east and south. The Aliyar sub basin is bounded by Walayar sub basin in the north, and Palar Sub basin in the east, Kerala State and Sholaiyar in south and Kerala State in the west. The total geographical area of the sub basin is 564.55 sq.km. Sholaiyar sub basin is the smallest among the four, having an aerial extent of 446.11sq.km which is bounded by Aliyar sub basin in the north, Kerala State in the east, west and in the south.

1.5 Administrative Setup

An area of 44.85 percent of Coimbatore district and 5.48 percent of Tiruppur district fall in the Parambikulam Aliyar basin. Podanur, Madukkarai, Anamalai, Valparai and Pollachi are the important towns located in the basin. Eight taluks namely Perur, Madukkarai, Sulur, Kinathukadavu, Pollachi, Anaimalai, Valparai and Udumalaipet are spread over in this basin. Totally 19 Firkas are falling in this basin partially / fully. The Parambikulam Aliyar basin has

247 Revenue villages, out of which, 226 villages are in Coimbatore district and 21 villages are in Tiruppur district. The details of districts and blocks falling in the basin are given in **Table 1.1.**

The Parambikulam Aliyar basin area is well connected with roads and railway lines **(Figure 1.3).** All the towns and villages are connected with village roads, district roads, State Highways and National Highways. The National Highway - NH 49 is passing from Udumalaipet to Muthalamada and Challakudi of Kerala State through Anaimalai. National Highways - NH 544 is passing from Podanur to Palakkad. National Highways - NH 209 passes from Udumalaipet to Coimbatore via Pollachi. National Highways passing through this basin are inter connected with State highway SH 19 from Vadakkanchery, Pollachi and Palladam stretch. The State Highway - SH 78, from Pollachi to Valparai is a ghat road with 40 hair pin bends.

Table 1.1. Districts and Firkas of the Parambikulam - Aliyar aquifer system

Sl. No.	District	Area (sq.km.)	No. of Firkas	No. of OE and Critical Firkas
1	Coimbatore	2122.33	17	
2	Tiruppur	284.05	2	
Total		**2406.38**	**19**	

Population

44.85 % of total area of Coimbatore District (2122.33 sq.km out of 4732 sq.km) and 5.48 % of total area of Tiruppur District (284.05 sq.km out of 5187 sq.km), covers the Parambikulam Aliyar River Basin and population of districts covered in Parambikulam Aliyar River Basin within the Basin as per census 2011 is given below in **Table 1.2**

Table 1.2. District wise population details of Parambikulam Aliyar River Basin (in million)

Sl.No.	Name of the District	Population in 2011			Population during 2020		
		Rural	Urban	Total	Rural	Urban	Total
1	Coimbatore	0.474	0.556	1.030	0.518	0.608	1.126
2	Tiruppur	0.035	0.004	0.039	0.039	0.004	0.043
Total		0.509	0.560	1.069	0.557	0.612	1.169

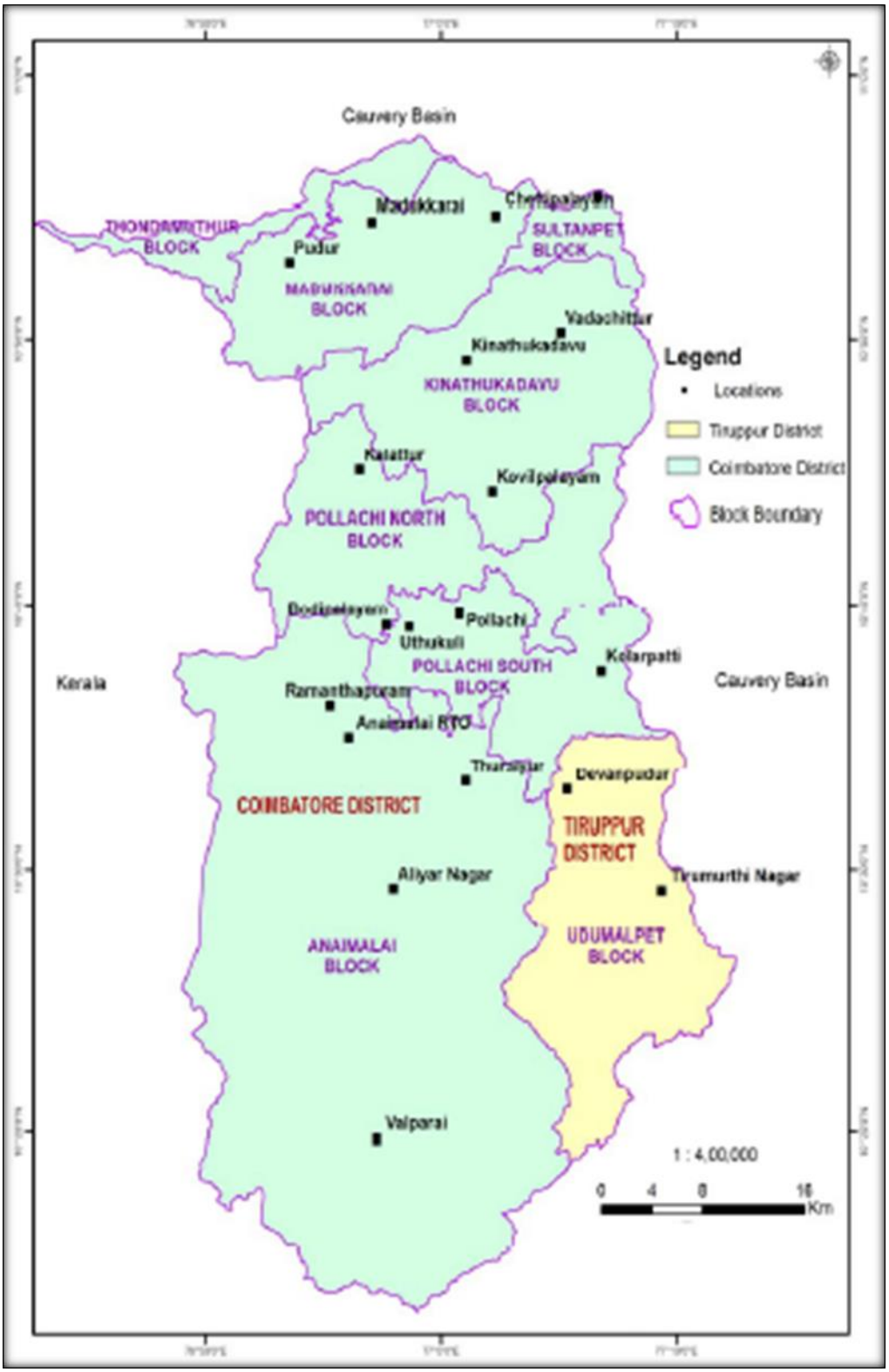


Figure 1.2: Administrative setup of the Parambikulam - AliyarAquifer System

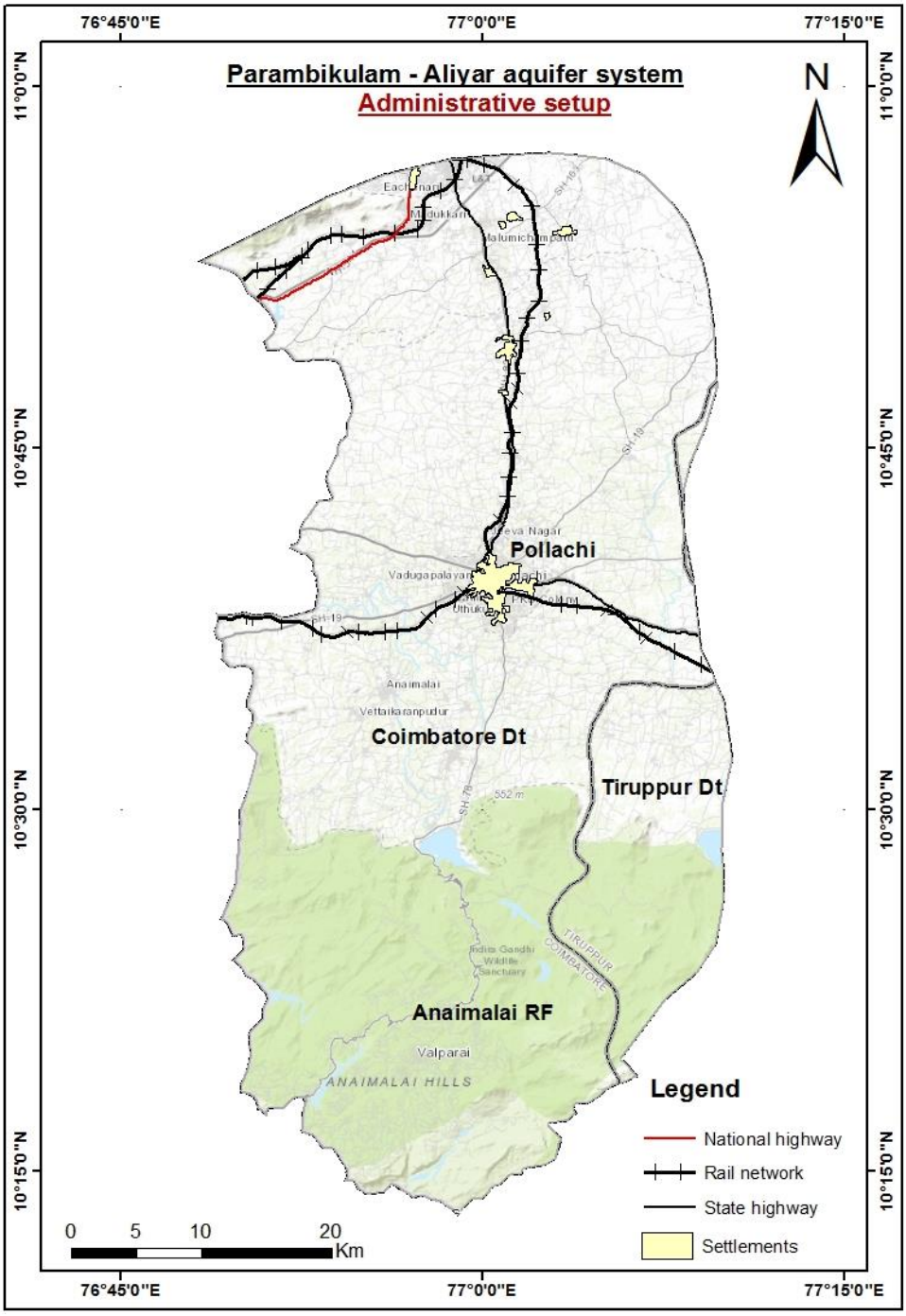
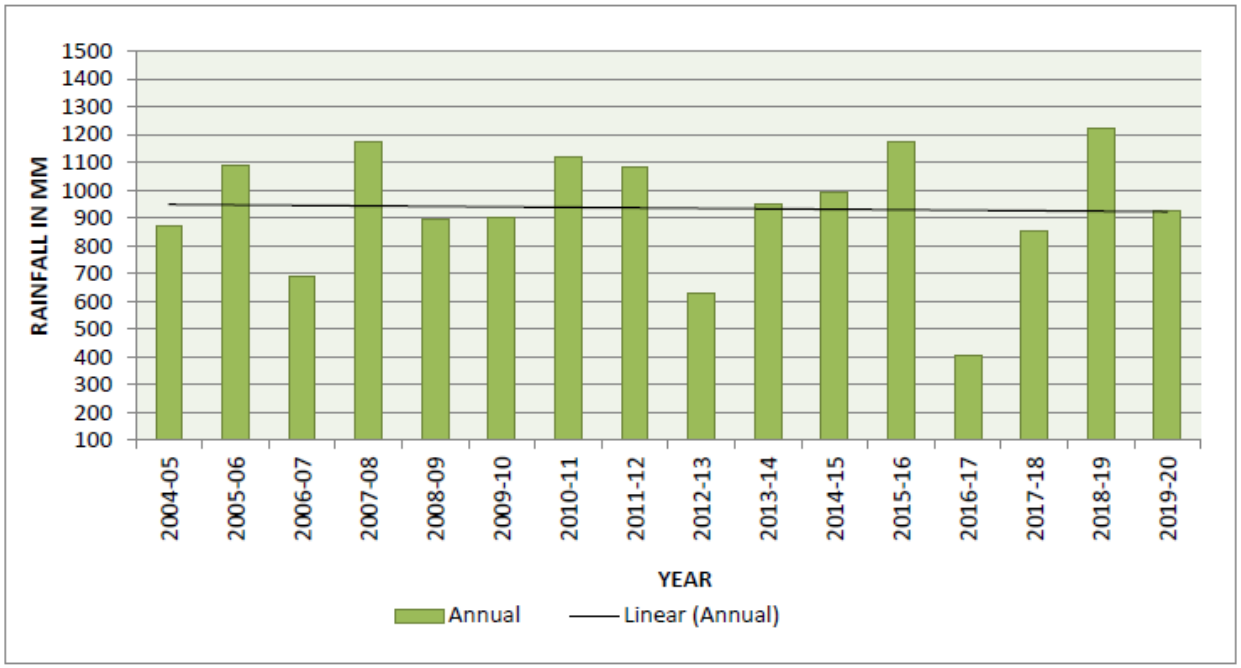
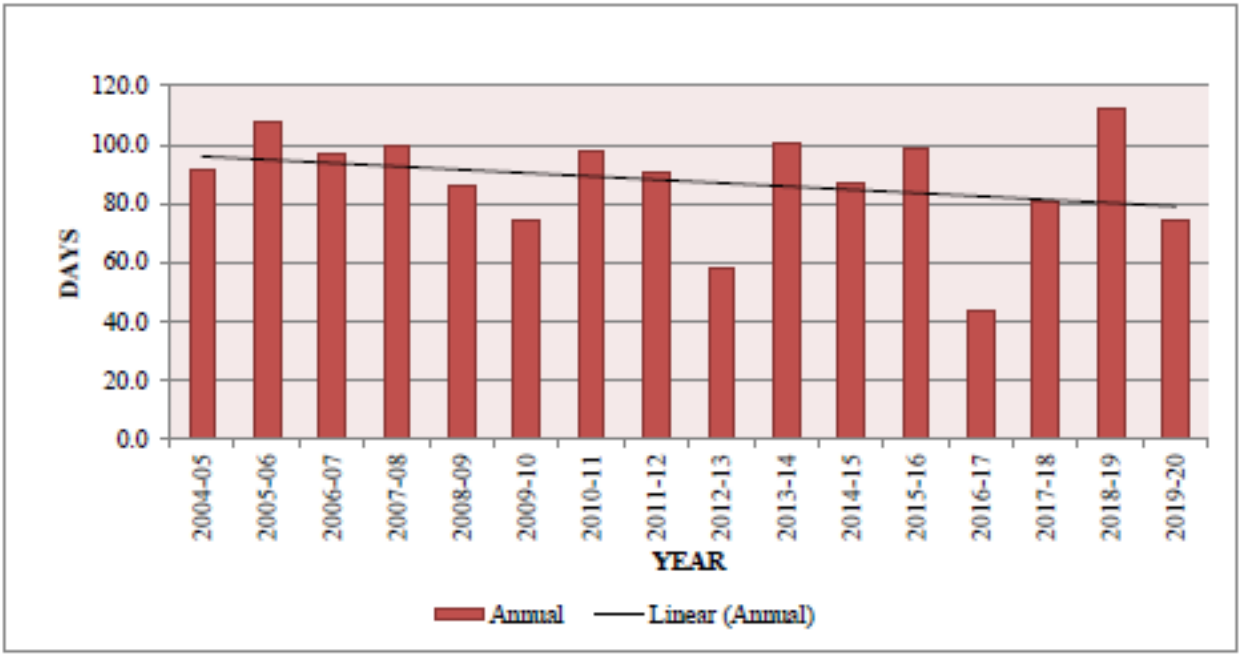


Figure 1.3. Administrative setup and connectivity of the Parambikulam – Aliyar Aquifer System

Rainfall

In general, Parambikulam Aliyar basin receives more rainfall in South West monsoon than North East monsoon. The highest rainfall of 2860.8 mm was recorded in Sholaiyar sub basin. Similarly lowest rainfall of 586.55 mm was recorded in Aliyar sub basin .The 33 years annual average rainfall of the basin is 1351.88 mm. On viewing the climatic pattern, it is observed that there is decrease in number of rainy days, further, trend line of annual rainfall shows marginal decline, a slight decrease in summer and winter maximum temperature trend, a marginal increase in summer and reasonable increase in winter minimum temperature trend.





1.6. Physiography and Drainage

Physiographic features are derived for Parambikulam Aliyar basin with the aid of Survey of India Toposheets, Digital Elevation Model (Shuttle Radar Topography Mission – SRTM 30 meter resolution) and satellite imageries etc. The salient physiographic features are described below. The elevation ranges between +2504 m AMSL and +155 m AMSL and the mean elevation is +1600 m AMSL. The highest elevation (+2504 m AMSL) is observed at Tanaka Malai in Anaimalai reserve forest. The lowest elevation (155 m AMSL) is observed at west of Ganapathypaalayam village (Marichinayakanpalayam Firka – Coimbatore District).

The basin area is covered by hills with reserve forests at the northwest and whole of southern portion. The reserve forests at the northwest are Boluvampatti and Shulakkarai where the elevation ranges from 200 m AMSL to 1308 m AMSL. The major portion of the area is covered by Anaimalai and Thunakadavu reserve forests at south and the elevation ranges between 300 m AMSL and 2504 m AMSL. Apart from this, the area has no significant hillocks. All the rivers in this basin are seasonal. Major rivers such as Nirar, also called as Kallar River, Sholaiyar, Tunakadavu are draining in hilly regions, where as Aliyar and Palar rivers are draining in the plain areas **(Figure 1.3)**. The surplus from Parambikulam reservoir flows into Parambikulam River, which is in Kerala. Similarly, the surplus of Peruvaripallam reservoir flows into Pervaripallam River in Kerala. Nearly 35 tributaries to the main rivers are draining in the basin. Eight reservoirs located in Tamil Nadu and three located in Kerala, along with various canal systems for catering the need of Coimbatore and Tiruppur districts of Tamil Nadu.

Walayar Sub Basin

Walayar River originates at an elevation of 1687 m MSL in Bolampatti Block II reserved forest in Kerala State and flows towards south east from the western boundary of the sub basin. The river feeds water into Walayar reservoir**,** after that the river continued in the name of Walayar along the State boundary and turns towards west near Kumandanparai and runs in to Kerala State. The total length of the Walayar River is 17.7 km. Kummattipatti Nadhi originates at an elevation of 631 m in Dharmalingammalai and runs through Madukkarai in the direction of south and afterward it turns to south west and finally it joins with Walayar River near Kummandanpatti. The total length of the river is 23.61 km.

The river Varattar having a length of 7.83 km originates at Palanikavundampudur at an elevation of 260 m MSL, runs towards south western direction and enters into Kerala near Anapur. Kodavadi River originates from Mandekavundanpudur tank at an elevation of 300 m MSL, runs towards south west direction and gain a name of Koraiyar River after the village Vadakkipalayam. After running 52.32 km, the river enters into Kerala State near Thavalam. unnamed river running parallel to Koraiyar river joins as left arm near Pattikavundanur. Five main canals distribute waters from Parambikulam Main Canal, among them Kovilpalayam lower canal (12.17 km) is the longest canal in this sub basin. There are 47 small to large sizes of water bodies such as tanks and ponds exist. The Walayar is the only reservoir in this sub basin.

Palar Sub Basin

There are fifteen rivers namely Palar, Devara Pallam, Kilavipatti Pallam, KottaiAr, Kottamadi Pallam, Kurumalai Ar, Mangalamalai Pallam, Mattala Pallam, Murigud Ar, Nallar, Pakka Pambar, Panchalingam Ar, Verapattimalai, Tattan Kanurai Ar, Vandi Ar and Vellaru Pallam drained in Palar sub basin**.**

Palar Sub Basin

Palar river, a tributary of Aliyar river originates from the Tirumurti reservoir at an elevation of 400 m MSL and running towards north west direction in about 37.22 km and finally empties into Aliyar river near west of Agilandapuram. The Nallar river, a tributary of Palar river originates at an elevation of 1260 m MSL at Verapattimalai having a right arm called as Pakka Pambar originates at Mangamalai (8.71 km) and a left arm called as Kottamadipallam (3.31 km) 34 originates at an elevation of 1020 m in Lallikattumalai joins with

Palar river after travelling 11.43 km near south of Anthiyur village. Murigud Ar originates at an elevation of 1580 m MSL in Arasiammalmalai and drains into Tirumurti reservoir after travelling a distance of 7.1 km. Vallaru Pallam a tributary of Murigud Ar originates at Kadamurutti Medu at an elevation of 1220 m MSL and joins with Murigud Ar. Tattankarunai Ar having a length of 9.92 km originates in Pambumalai at an elevation of 1680 m and empties into Tirumurti reservoir. At Pichchamalai, in the height of 2820 m, Vandiyar a tributary of Tattankarunai Ar originates and joins with the river after travelling a distance of 3.93 km. Panchalingam Ar originates Bhahiravamalai at the height of 1860 m MSL carrying waters of Mangamalai Pallam originates in the Tenmalai at an elevation of 1280 m MSL, Kottai Ar, Karumalai Ar, Devarapallam and Kilavipettaipallam into Titumurti reservoir. The river Mattanapallam originates in the Idi malai at an elevation of 1220 m MSL and empties water into Tirumurti reservoir after traveling a distance of 4.82 m. Avaraikodi Pallam originates at an elevation of 1040 m MSL at Sindatumadumalai and joins with Palar river after running a distance of 4.06 km. There are 9 small to large sizes of water bodies such as tanks and ponds available in this sub basin.

Aliyar Sub Basin

There are 16 rivers flowing in this sub basin namely, Chinnar, Devi Ar,Kadambarai Ar, Kadukannai Pallam, Konalar Nadi, Kottai Ar, Kurumalai Ar, Pambai Ar, Pana Pallam, Periyakulam Ar, Punganodai Pallam, Tonakadavu, Ummattipatti Nadi, Uppar Pallam, Vagarai Ar and Vellunipatti Pallam.

Sholaiyar Sub Basin

There are 18 rivers draining in this sub basin namely, Anali Ar, Andimedu Ar, Chinna Kallar Nadi, Karakundru Ar, Karinandu Todu, Ken Todu, Kolikamatti Pallam, Kurumpalli Pallam, Manampalli Ar, Minmettu Pallam, Nadu Ar, Naikunnu Ar, Panati Ar, Poyar Nadhi, Sholai Ar, Sirukundru Ar, Talappaniyan Ar and Urulikal Ar.

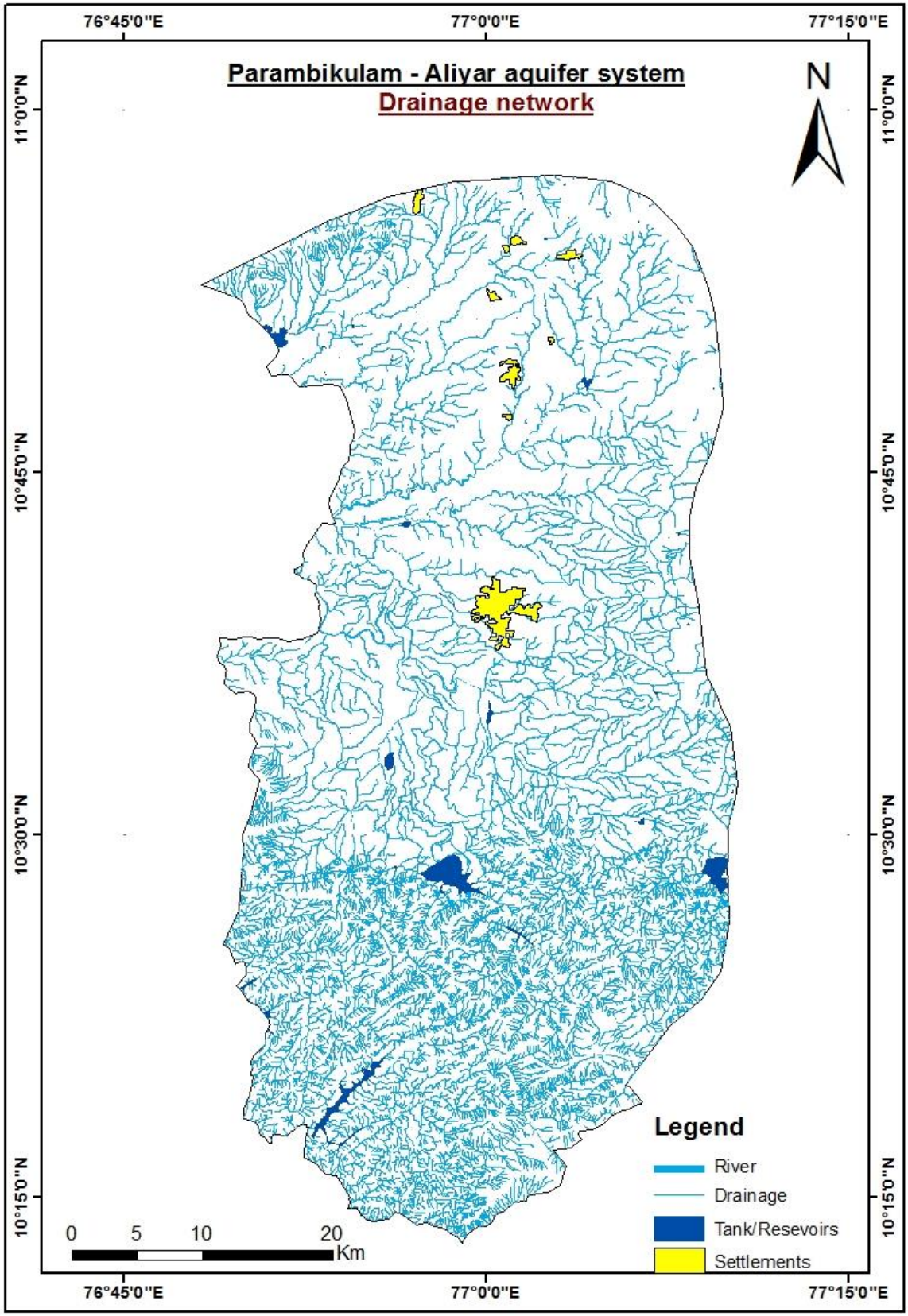


Figure 1.3. Drainage of the Parambikulam – Aliyar aquifer system

1.7. Geomorphology

The geomorphological study was carried out in the Parambikulam Aliyar basin by interpreting satellite data by its characteristics such as tone, texture, shape, pattern and associated features etc. Geomorphologically, being a stable land mass, Tamil Nadu is characterized by the Western Ghats made up of Archaean Complex, comprising different types of metamorphosed gneisses and Charnockites in the west, with a central plain, Eastern Ghats and Coastal plain. The following three major landforms were identified in the Parambikulam Aliyar Basin, based on its genesis **(Figure 1.4).**

Landforms of Structural origin

The structural hills are hills / mountain which exhibit geological structures such as folding, faulting, foliations trends etc. It is comprised of composite ridges and valleys traversed by above said structural features. Hydro geologically these are runoff zones with low infiltration rate. The relevance to groundwater prospects is moderate along its valleys, subject to weathering. Structural hills are found in the southern part around Anaimalai Reserve forest hill range and in north western region of the basin near Boluvampatti. Maximum area of Sholaiyar sub basin is formed by Structural hill comprising of foliated ridges and valleys. In between the ridges steep valleys are developed to drain the numerous streams, which is covered by thick forests. Ground water potential of this landform is poor.

Landforms of Denudation origin

The various geomorphic units in denudational landforms are pediment deep, pediment moderate, pediment shallow, inselberg and deflection slope. The denudation process is active in these landforms which lead to a reduction in elevation and in relief of landforms. Inselbergs are isolated steep conical hills that are surrounded by vast plain land. Inselbergs is located in isolated area in the north of Vettaikaranpudur, Odayakulam and Arivozhi Nagar and west of Dharamaraja colony. Generally these are landforms with varying hard rock lithology. Hydro geologically these are runoff zones with no infiltration chances .The groundwater prospects in inselberg is poor. Pediment is gently sloping, smooth surface of erosional bed rock between hill and plain with thin layer of rock debris. The lithology is various in hardrock formations. It forms around outcrops with or without soil cover. It occurs at the base of hill or as a plain having no associated hills. Shallow Pediment is an intermediate zone between pediments and deep pediments. It is a flat and smooth surface, with shallow overburden. Weathered thickness of this landform is comparatively less. Moderate infiltration and moderate recharge rate are hydrogeological characteristics which is influenced by run off and rainfall. Ground water potential of this landform is moderate to poor. Shallow pediment covers most of the central part of the basin.

Moderate Pediment is shallow than deep pediment area and have high relief than shallow pediment with moderately thick over burden. Weathered thickness of this landform is appreciable. It will have good drainage network. Among denudational landforms in the basin, moderate pediment occupies major area. Likewise shallow pediment zone moderate infiltration

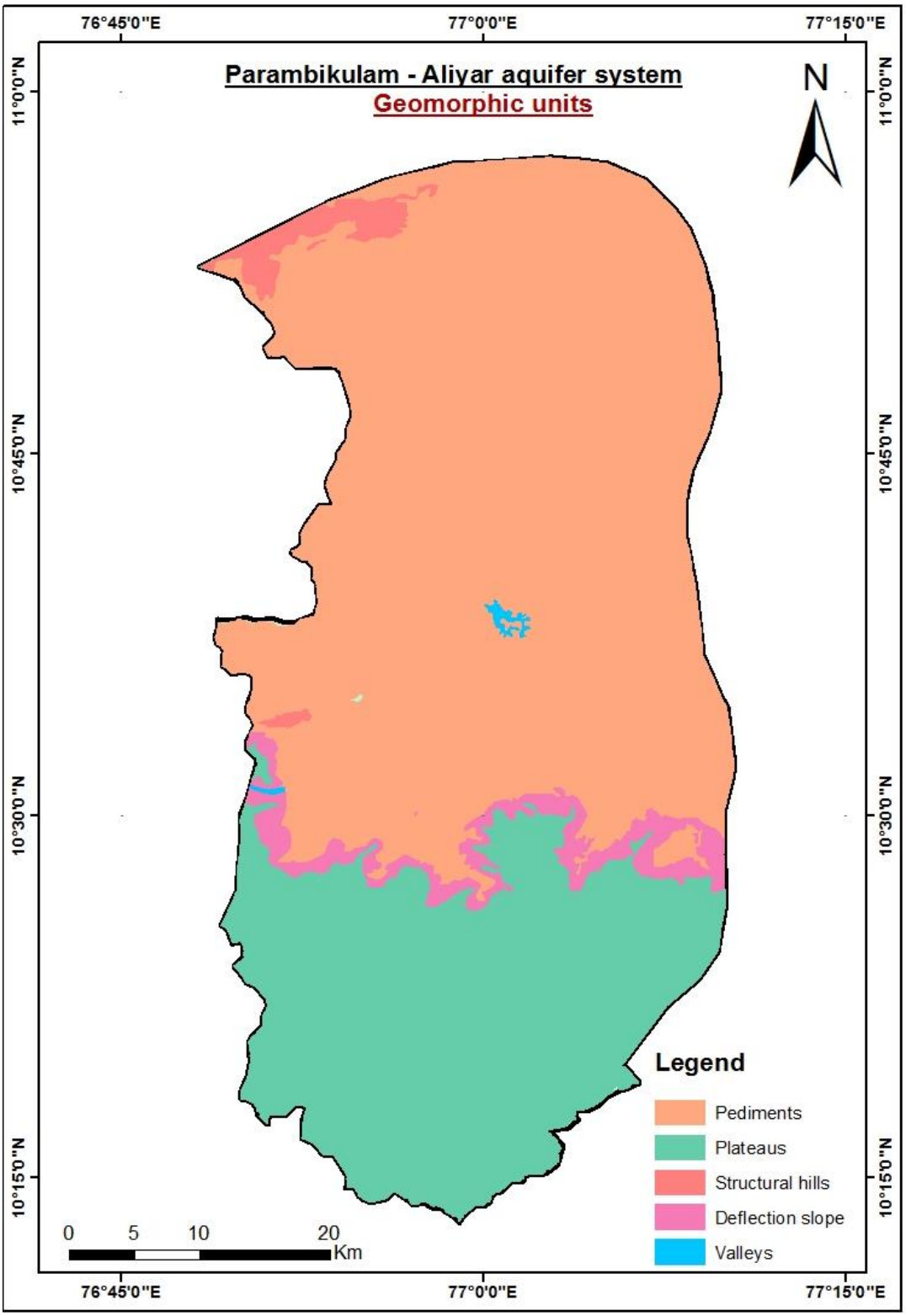


Figure 1.4. Geomorphology of the Parambikulam – Aliyar aquifer system

and moderate recharge rate are hydrogeological characteristics. Ground water potential of this landform is moderate. Deep Pediment have high relief than moderate pediment zone. It will have deep weathering with thick over burden and shallow soil cover and fracturing. Infiltration and recharge is moderate to good. Storage is complemented by secondary fractures. Groundwater potential of this landform is good. Shallow pediment and Moderate pediment landforms covers majority of the basin area in the central and northern parts of the basin except the southern part which is occupied by structural hills. These are found in and around Pollachi, Makkinampatti, Kodingiyam and Thalakkarai in the central part of the basin and Mettupalyam, Malumichampatty, Kinathukadavu and Panappatti etc in the northern part of the basin etc. Deep pediment is found near the western boundary of the basin in and around Aliyar and Meenakshipuram. Deflection slope is found as a linear belt at the foot hills of the vast structural hills in the southern part of the basin. Steep escarpments are found along these foot hills. Deflection slope is found in the Palar and Aliyar sub basin.

1.8. Land use and Land cover

In the Parambikulam Aliyar basin, the settlement area covers 0.95 %. Apart from dwelling area which is 19.92 sq. km, the factories and quarry land covers 3.05 sq. km of the Parambikulam Aliyar basin. Important urban settlements in this area are part of Coimbatore, Pollachi, Kinathukadavu and Metupalayam. Quarry land occupies 2.39 sq.km, which is 0.1 % of the total area. Most of the quarrying activities are witnessed in the northern portion of the study area where the Gneissic rocks are exploited for various purposes. Some of the locations are, east of Ramachandrapuram, east of Pudur and north of Poravipalayam and a quarry is located in the Boluvampatti Reserve forest. In 2018, majority of the area is covered by Grove. The total area of the agricultural land is 1496.55 sq.km, which is 62.2% of the total area**.** Groves and fallow land, covers much of the agricultural land, followed by Tea plantations, dry crops and wet crops. The settlement area has been spread for 62.95 sq. km (2.65%). Whereas the habitation is 51.9 sq. km and factory and Quarry are 1.5 sq. km and 9.5.5 sq. km respectively. The area covered by reserved forest is 707.7 sq. km and that of the barren land portion is 1.65 sq. km. The shrubs and scrubs cover 102 sq. km and the water bodies such as rivers, reservoirs and tanks is about 35.53 sq.km. Over the time, 13 number of Panchayat Union tanks covered an area of 0.14 Sq Km have been vanished and the area is occupied for grove and some are left fallow. **Table 1.3** shows the area occupied by the land use pattern. **Figure 1.5** shows the spatial spread of various land use patterns.

Table 1.3: Land use pattern of Parambikulam – Aliyar Aquifer system

Sl.No.	Landuse category	Area in sq.km	Percentage
1.	Built up land	62.95	2.56
2.	Agricultural land	1164.96	48.4
3.	Barren/Water land	82.65	3.44
4.	Reserve forest	707.70	29.41
5.	Fallow land	331.59	13.78
6.	Water bodies	35.53	1.47

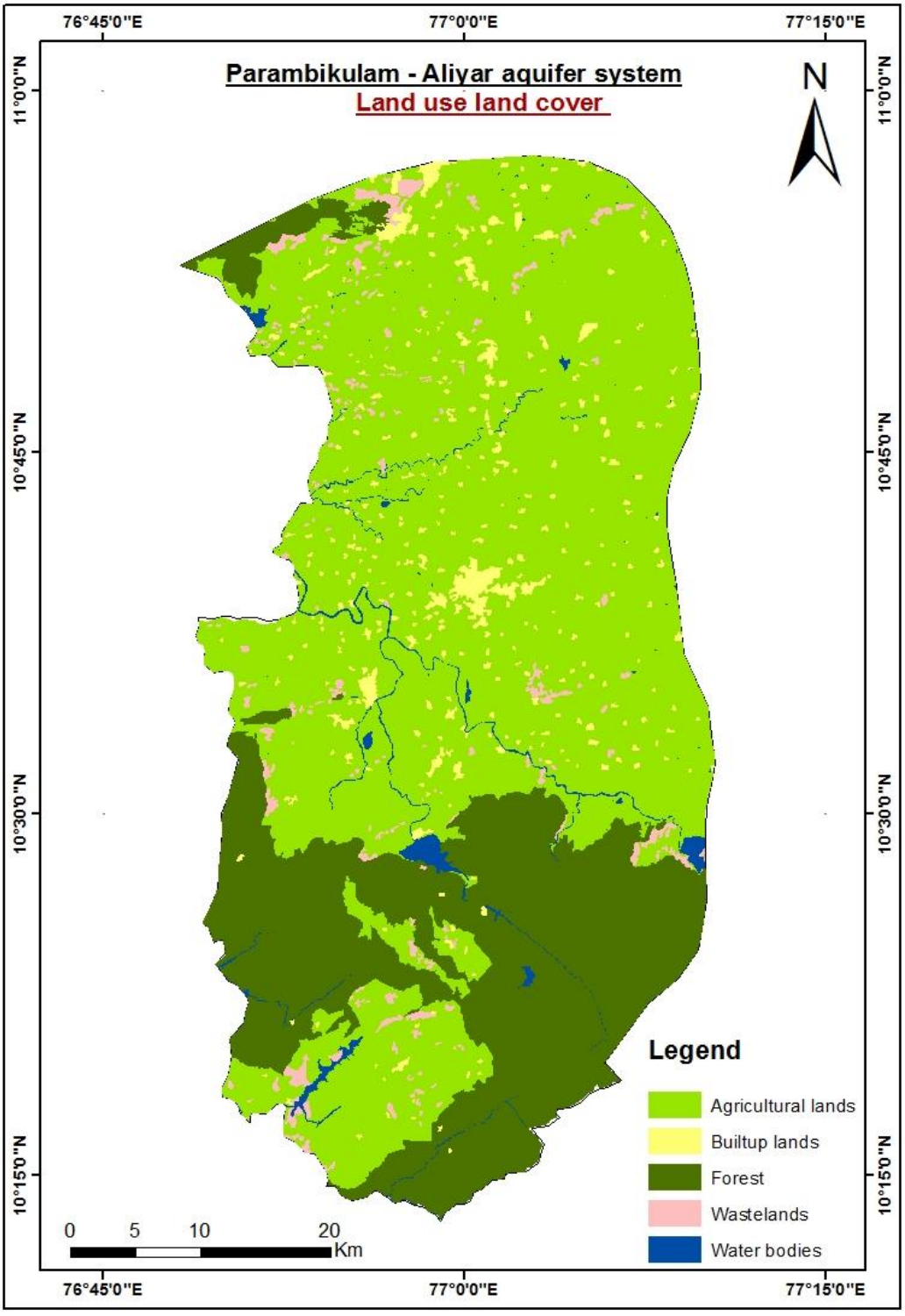


Figure 1.5. Land use/Land cover (level 3) of the Parambikulam – Aliyar aquifer system

1.9. Soils

The soil map of the Parambikulam Aliyar Basin has been shown in **Figure 1.6**. The predominant soil order types found in this river basin are Inceptisols, Alfisol, Entisol and Vertisols. Due to different stage of weathering of parent material, the above soil types are met with in combination. The predominant soil order of the basin is entisols. Major portion of the Aliyar sub basin and Palar sub basin belongs to this soil order and nearly one third of Walayar sub basin is composed of this soil order. Predominantly found in the Walayar sub basin and in minor patches in Palar and Aliyar sub basin. Alfisols is found mainly in Walayar sub basin and to some minor extent in Aliyar sub basin. This soil order is found meagre in Walayar sub basin and in traces in Palar sub basin.

Based on the soil properties and their classification the Basin soils were grouped for irrigation planning purposes, into 5 major groups denoted Type-I to Type-V. The intention is to determine uniform cropping patterns which would be associated to the soil types, mainly for the assessment of future scenarios. The soil types are described as follows:

Type-I soils. They are mostly with medium texture, well and moderately well drained, mostly moderately deep to deep, mostly with 1-3 % slope and with none to various degrees of erosion problems. The soils are irrigable and suitable for crops like groundnuts, cotton, pulses, millets, maize, sorghum, vegetables and tree crops.

Type-II soils. They are of fine texture, imperfectly drained, moderately deep to deep, with 1-3% slope, with none to moderate erosion problems. In spite of the above mentioned NR classification for sugarcane it can be concluded that in the future with improved irrigation methods and systems, Type-II soils with lower slopes, could also be cultivated by sugarcane.

Type-III soil. They are mostly of fine texture, mostly imperfectly drained, moderately deep to deep, mostly with 1-3 % slope, with none to moderate erosion problems. Type-III soils are irrigable and suitable to rice and sugarcane and also to relatively tolerant to imperfect drainage other crops such as cotton, sorghum and some fodder crops.

Type-IV soils. They are similar to Type-III soils, however due to salinity and sodic problems those soils could be sustainably irrigated if corrective measures to those problems would be taken.

Type-V soils. Those soils include non-irrigable soils, such as rock outcrops, dunes, flooded areas, steep slopes, etc.

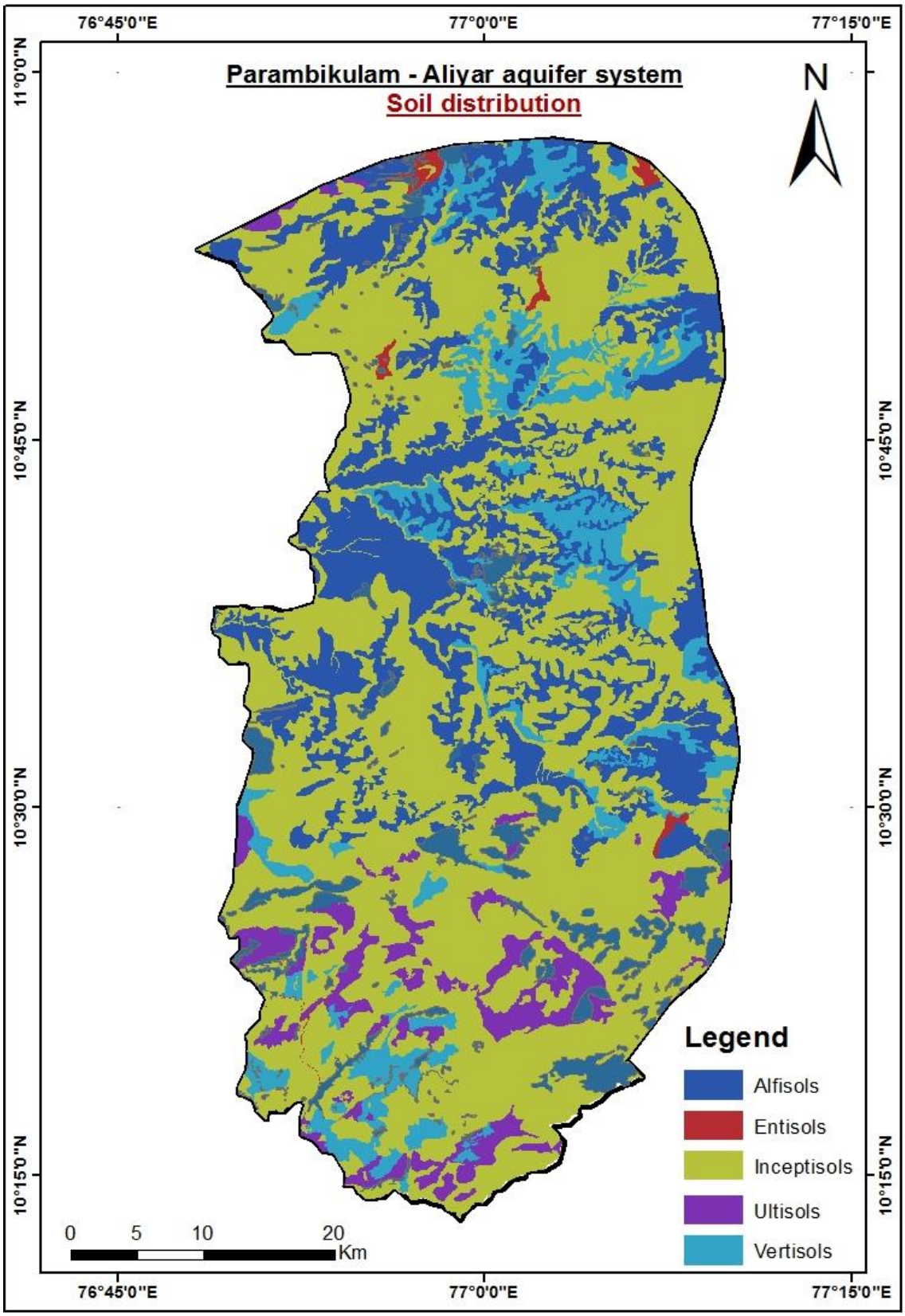


Figure 1.6. Soils of Parambikulam – Aliyar aquifer system

1.10. Slope

Gradients for Parambikulam Aliyar Basin were calculated using US Geological Survey's Digital Elevation Model "Shuttle Radar Topographic Mapping (SRTM)", which was used to generate the drainage network and analyzed in GIS software **(Figure 1.7)**. The Walayar sub basin has three major rivers viz., Kumattipatti Nadhi, Varattar and Koraiyar. The north most Kumattipatti Nadhi flows from the starting point to a distance of 2.22 Km in 1 to 1.62 m/km gradient and for the remaining distance the gradient is 1.62 – 2 m/Km. The Varattar river flows in a gradient of 1-1.39 m/Km for a distance of 5.32 Km and for a distance of 2.51 Km the gradient is 1.39 -2 m/Km. The southernmost river Koraiyar River flows in the gradient of 1-1.36, 1.36 – 1.84 and 1.84-3 m/Km before it runs into Kerala State.

The Palar sub basin is drained by Palar River and its tributary Nallar River. The gradient of Nallar River is 1-1.48 and 1.48 – 2 m/Km. the Palar River flows in the highest gradient of 2-2.55 m/Km to 2.55-3 m/Km. The Aliyar Sub Basin is drained by Aliyar River. The part of river before drains into the Aliyar Reservoir, flows in the gradient of 1- 2 m/Km. The Aliyar River flows in steepest gradient of 3-3.43 m/Km and at a gradient of 3.43-4 m/Km before flows out of the basin.

The north western part of the Walayar sub basin is covered by Bolampatti Reserve forest, Shulakkarai and small Shulakkarai Reserve forests. The Bolampatti RF comprises of hills namely Kuttadi Malai, Ayyaswami malai, Etti Malai and Dharmalingam Malai. In Palar sub basin, the dense forests are noticed in the southern portion of the sub basin and are spread over the hills viz. Thadaganachi Malai, Kolikuttu Malai, Idi Malai, Bhahiravamalai, Kadattimalai, Ten malai, Pichchamalai, ChikkaMalai, Kochchaimalai,Kombumalai and Konimalai. In Aliyar Sub basin, the Poonachi reserved forest and part of Anaimalai Reserved forest covers Tanaka Malai, Akka Malai, Tangachi malai, Kokkana malai, Pachchaipal Malai, Naivetti Malai and Munga Malai. The Sholaiyar sub basin has many hills viz., Peraiyar malai, Samba Malai, Usi malai, Podu malai, Karu Malai, Periya Anai Malai, kannisholai Malai, Periya Tanaka Malai, Murukalli Malia, Koipuli Malai, Perumkundru Malai, Helepaarai Malai, Tekkanaparai Malai, Kunjaliparai Malia, Sholaiyar Malai, Sittikkal malai, Karuvaru Malai, Tavittuoivu Malai, Olavara Malai, Nadu Malai, Korakkal Malia, Pamban Malai, Velli Malai and Umaya Malai and it contains a part of Anaimalai reserve forest.

Palakkad Gap, the most prominent discontinuity in the Western Ghats, is a low mountain pass in the Western Ghats between Coimbatore in Tamil Nadu and Palakkad in Kerala. It has an average elevation of 140 meters (460 ft) with a width of 24 –30 kilometres. The pass is located between the Nilgiri Hills to the north and Anaimalai Hills to the south.

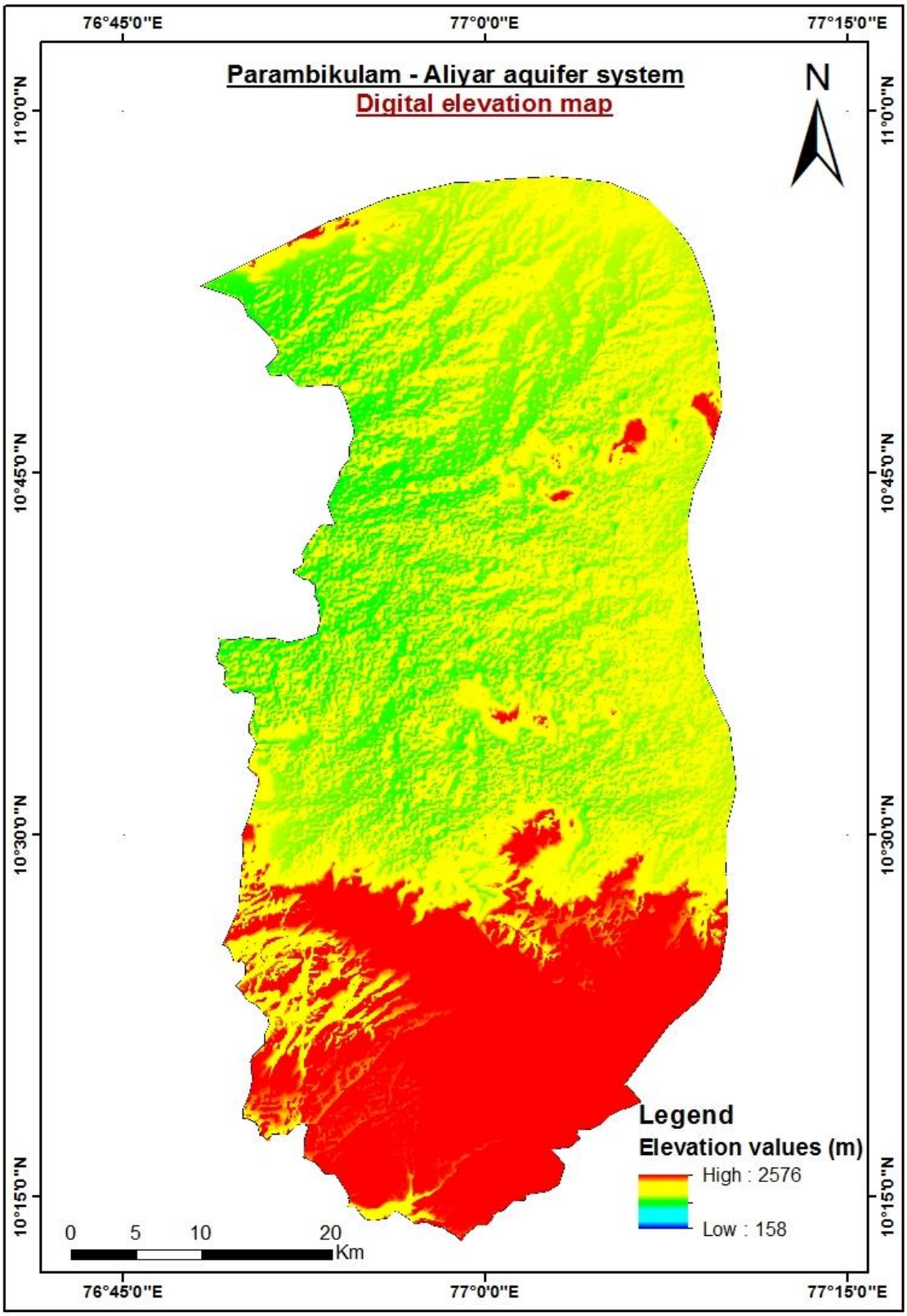


Figure 1.7. DEM of the Parambikulam – Aliyar aquifer system

1.11.Irrigation

The major crops cultivated in Parambikulam Aliyar Basin are Coconut, Paddy, Cholam, and Sugarcane. The irrigated area for the year 2019-20 in Parambikulam Aliyar basin under different crops is 71,735 Ha. Coconut is cultivated in 68,620 Ha, in the balance area, other crops are cultivated. For the year 2019-20, gross irrigated area in the basin under different crop is 71,735 Ha. Under irrigated conditions, Coconut (68,620 Ha) is the main crop in this basin, followed by Paddy (1,579 Ha), Cholam (549 Ha) and Sugarcane (493 Ha). The total irrigated area in Walaiyar Sub Basin is 10,950 Ha which accounts for 15% of basin area, Palar Sub Basin is 14,211 Ha which occupies 20%, Aliyar Sub Basin is 22,372 Ha which occupies 31% and Sholaiyar Sub Basin is 24,201Ha which occupies 34% of the total Basin area. **(Figure 1.8)**

The Gross irrigated area of crops in Parambikulam Aliyar Basin is reported to be 71,735 Ha. Irrigated area in Walaiyar sub basin is 10,950 Ha, Palar sub basin is 14,211 Ha, Aliyar sub basin is 22,372 Ha and Sholaiyar sub basin is 24,201 Ha. Out of the total area irrigated, about 96% is under Coconut cultivation and the remaining in Paddy, Cholam, Sugarcane, Groundnut, Pulses and millets cultivation. Net Irrigation demand of this basin at 75% dependable rainfall is 379.40 MCM. Net Irrigation demand of this basin at 50% dependable rainfall is 293.74 MCM. Sholaiyar sub basin has the maximum irrigated area of 24,201 Ha which accounts for about 34% of the total irrigated area. Walaiyar sub basin has the minimum irrigated area of 10,950 Ha which accounts for about 15% of the total irrigated area. Sholaiyar sub basin has the maximum irrigation demand of about 126.96 MCM (about 33%) and Walaiyar sub basin has the minimum irrigation demand of about 71.81MCM (about 19%). Organic farming practice is to be extended in greater manner in this Basin. Presently irrigated area is adopted as 71,735 Ha based on good rainfall year 2019-20. On comparing the cultivated area of the present study, it is found that the total irrigated area has decreased from 84,784 Ha to 71,735 Ha. Irrigated area of Coconut is increased from 45350 Ha to 68,620 Ha and Paddy is decreased from 21,310 Ha to 1,579 Ha.

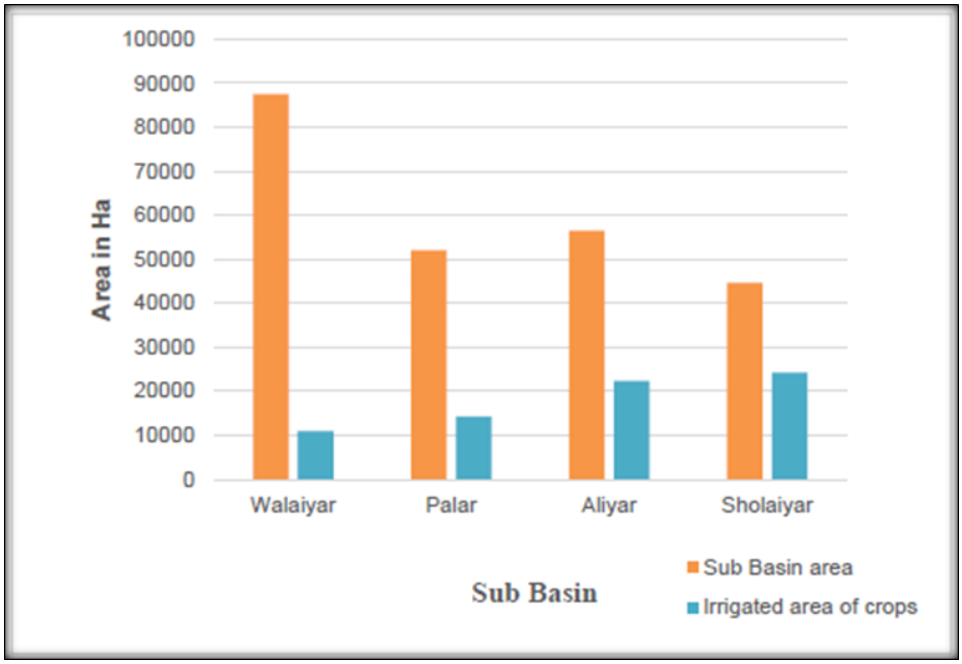


Figure 1.8. Basin-wise irrigated area of Parambikulam - Aliyar aquifer system

2.0. GEOLOGY

The study of Geology of the Parambikulam-Aliyar Basin is based on the District Resource maps published by the Geological Survey of India and the inferences derived from the lithology obtained through investigation borehole and water level observation well of SG&SWRDC. A Geological map (**Figure 2.1)** was prepared, showing the surface geology of the basin. And also vertical cross section of selected borehole lithology is prepared for better understanding of various litho units of the basin. An attempt has been made to understand the hydro Geology of the basin.

Parambikulam-Aliyar Basin is predominantly composed of weathered and fractured hard crystalline rock formations of Archean age and sparsely by soft rock and unconsolidated sediment. Geologically, Charnockite group of rocks and Khondalite group of rocks makes the prominent lithology. The Khondalite group consists of migmatitic gneiss such as, garnetiferous sillimanite gneiss, calc granulite, crystalline limestone etc. Charnockite group of rocks comprises of charnockite, pyroxene granulite, granite etc. Hornblende gneiss and pink migmatite represents migmatite complex in the study area. Major rock units are metamorphic in nature.

Gneiss is the most common rock type in the basin in which hornblende biotite gneiss is the predominant rock type which covers most of the basin area. Garnetiferous sillimanite gneiss is occupied in north northwest part of basin near to calc-granulite limestone area. Granites intruded into the older gneisses and charnockites, and have undergone metamorphism. They occupy mostly as small mounds in the southern reaches of the basin near Anamalai reserve forest area and linear domes in the eastern and western parts of the basin. Pink migmatite with granitic intrusion is found in north central area of the basin mainly in and around Kinathukadavu village. Charnockite is observed all over the study area, as linear stretches traversing the country rock in all directions.

Pyroxene granulite is found as few linear intrusions in the eastern part of basin mainly in Kakkadavu village and Vaguthampalayam village. Notable deposits of calc-granulite crystalline limestone are found in Madukkarai village. Black cotton soil with gypsum is found in small patches along the eastern side boundary of the basin which is fluvial in origin. Laterite occupy in very small areal extend towards south of the basin near granitic mounds in Anamalai reserve forest.

Out of the total area of basin, hard rock type occupies 2383.67 sq.km and soft rock/unconsolidated sediments occupies minor area of 22.71 sq.km **(Figure. 2.1).** The minimum area of one particular litho unit is occupied by Pyroxene granulite with an area of 2.98 sq.km and maximum area of 2113.04 sq.km by Gneiss**.** The percentage area in the basin comprised by hard rock is 99.06% and sedimentary formation is 0.94% **(Figure 2.2).**

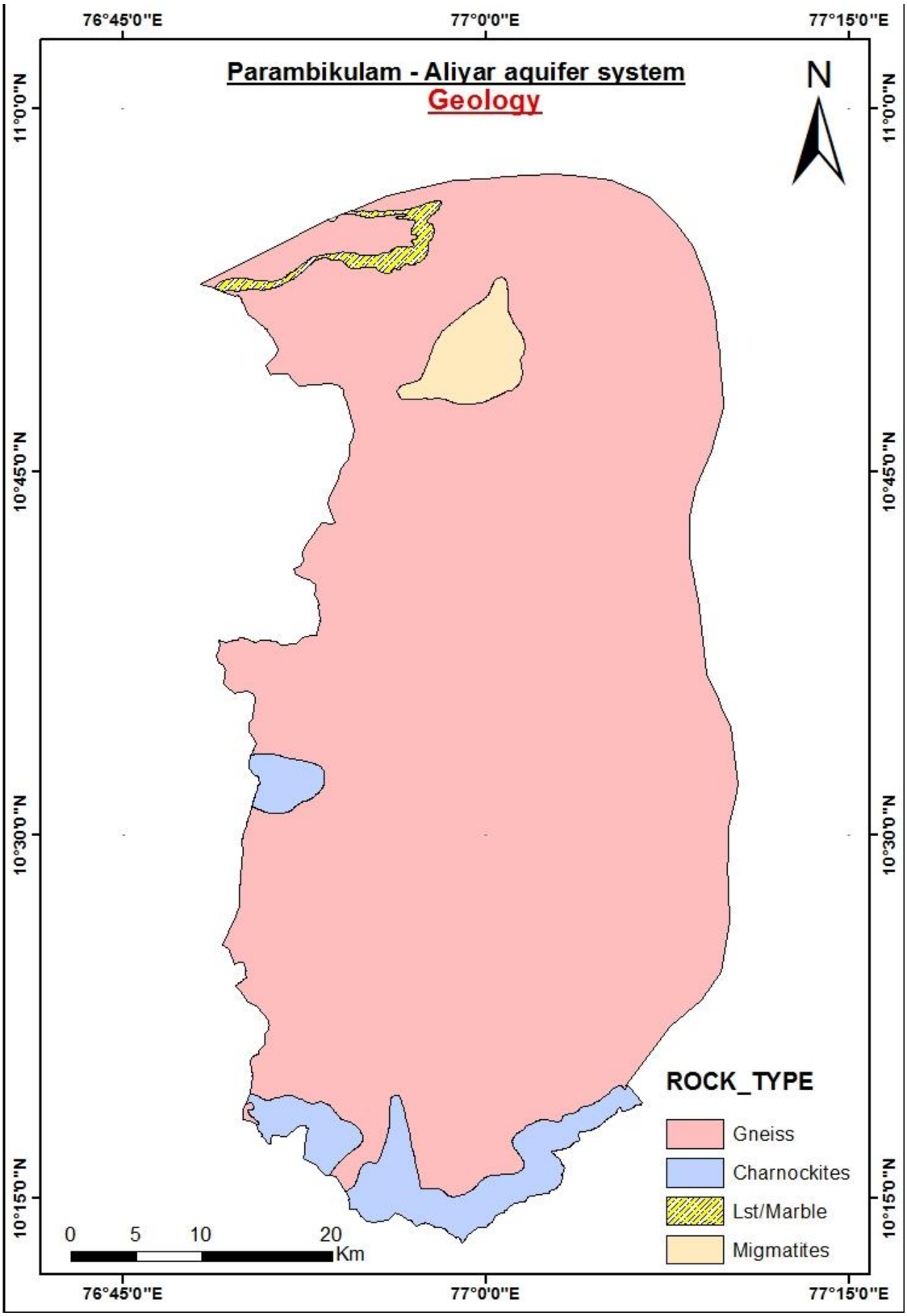


Figure 2.1. Geological map of Parambikulam – Aliyar aquifer system

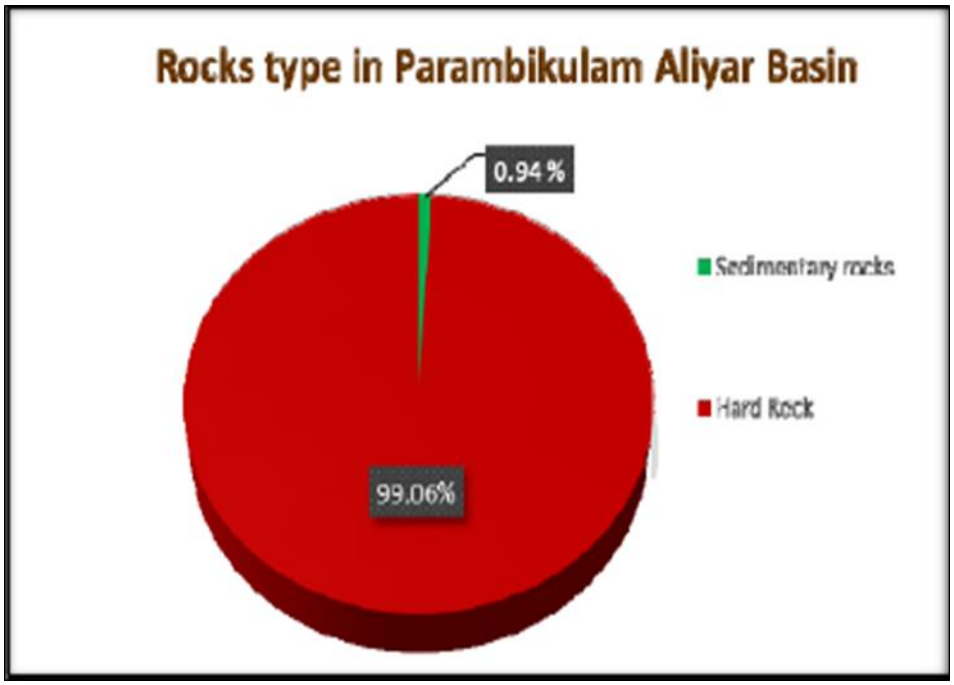


Figure 2.2: Percentage of area occupied by rocks in Parambikulam – Aliyar aquifer system.

The general geological sequence of the study area is given in **Table 2.1**:

Table 2.1: Geological succession of the Parambikulam - Aliyar Aquifer System

Era	Group	Age	Lithology
Cenozoic	-	Pleistocene - Recent	Fluvial Sediments
			Laterite
Late Archaean - Proterozoic	Migmatite complex	2200-2550 Ma	Granite
			Pink migmatite
			Hornblende gneiss
Archaean	Charnockite Group	2600 Ma	Pyroxene granulite
			Charnockite
	Khondalite Group	2700 Ma	Calc granulite
			Crystalline Limestone
			Garnet sillimanite graphite

3.0. DATA COLLECTION AND GENERATION

After the data gap analysis, additional key wells establishment, water sample collections and other hydrogeological data were the major field activities associated with the NAQUIM studies. During aquifer mapping studies, periodical data pertaining to groundwater levels, quality, pumping tests and slug tests were collected. In addition, geophysical data has been generated through conducting geo-electrical soundings after evaluation of data gap analysis. The data collected are synthesised and analysed for aquifer mapping studies.

3.1. Groundwater Exploration data

Data of 54 exploratory wells drilled in the Parambikulam – Aliyar aquifer system (23 Nos. CGWB and 31 Nos. State department wells) prior to National Aquifer Mapping project were compiled and analysed **(Figure 3.1).** Based on the data requirements, 23 Nos. of exploratory wells includes 6 observation wells in hard rock drilled through outsourcing activity as part of the data generation. 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. Similarly wells drilled by state department, 31 Nos. of wells drilled upto to the depth of 60 to 100 m bgl were used for deciphering the first aquifer.

3.2. 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 300 m. The objective of the study 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 36 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 **Figure 3.2.** The interpreted VES data are used in preparing aquifer disposition and other hydrogeological interpretation during the study.

3.3. Water level data

The periodical monitoring of groundwater levels reflects the groundwater recharge and discharge (natural and manmade) occurring in the aquifer systems. It also reveals the interaction between surface and sub-surface water systems. In the Parambikulam – Aliyar Aquifer system area, 16 groundwater monitoring wells of CGWB and State department wells 56 were monitored periodically. To fill data gap in the basin, 50 additional wells were established and monitored periodically during the pre and post monsoon period during the aquifer mapping study. This was useful to record the temporal and spatial changes in the aquifer system. The locations of monitoring wells are given in **Figure 3.3.**

3.4. Water Quality data

The groundwater quality of the Parambikulam – Aliyar aquifer system was studied by collecting water samples from dug wells and bore wells. Groundwater samples were collected from 64 locations, the sample locations in the Parambikulam – Aliyar aquifer system is presented in **Figure 3.4.** In addition to existing water quality details with CGWB, groundwater quality data has been collected from TWAD Board and State Ground and Surface Water Resources Data Centre (SG&SWRDC), Government of Tamil Nadu.

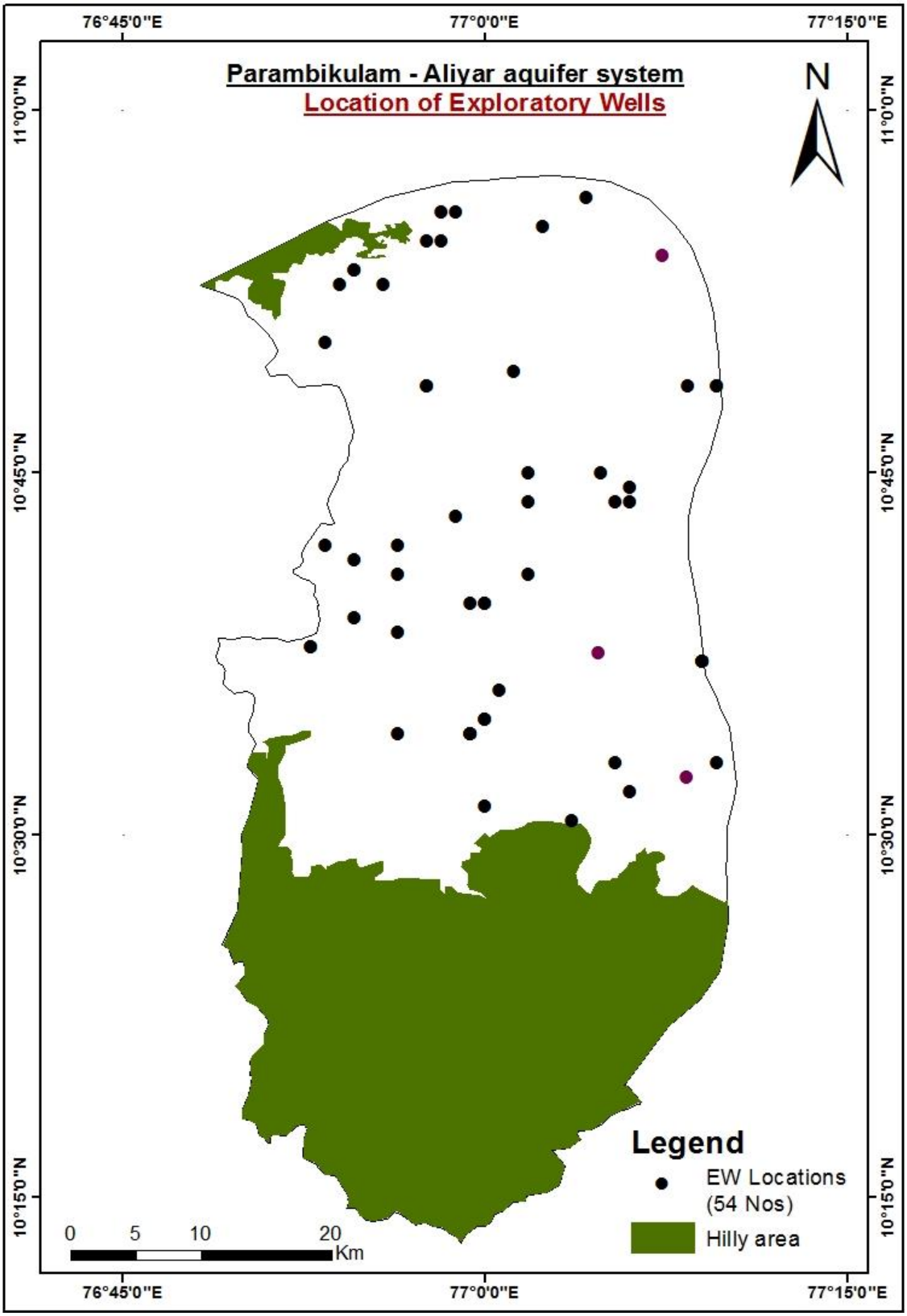


Figure 3.1. Locations of Vertical Electrical Sounding sites

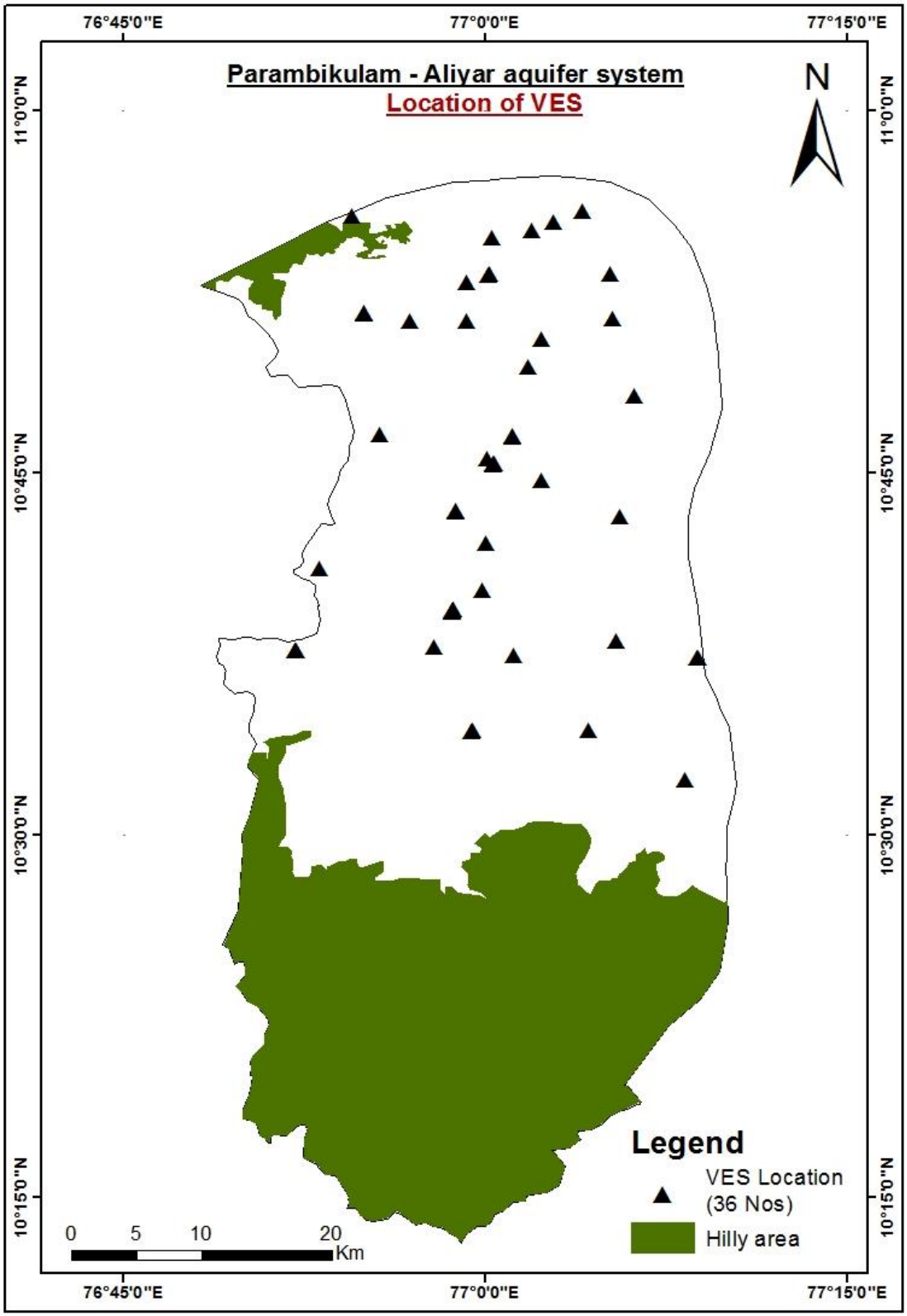


Figure 3.2. Locations of Vertical Electrical Sounding sites

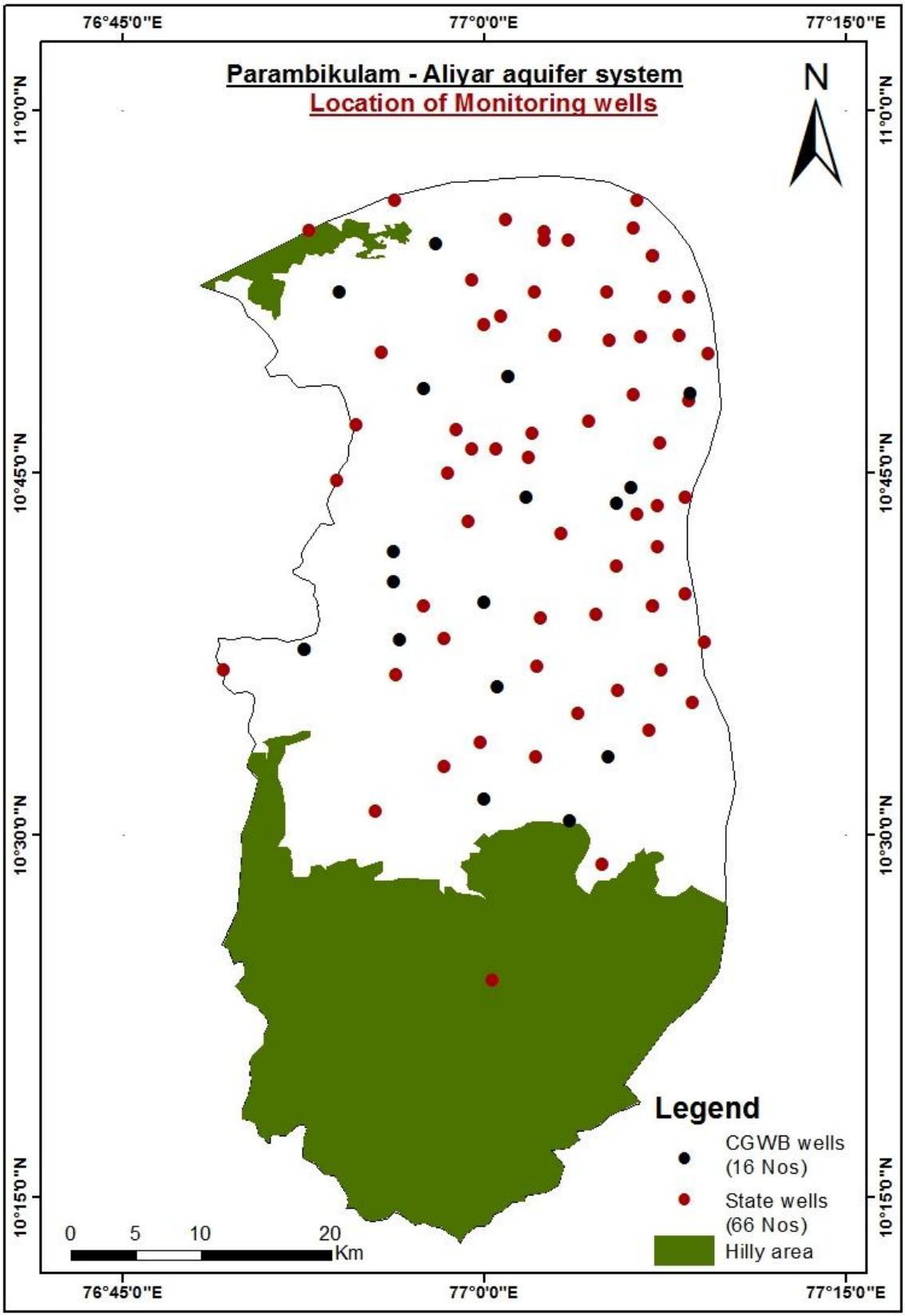


Figure 3.3. Locations of Groundwater Monitoring Wells

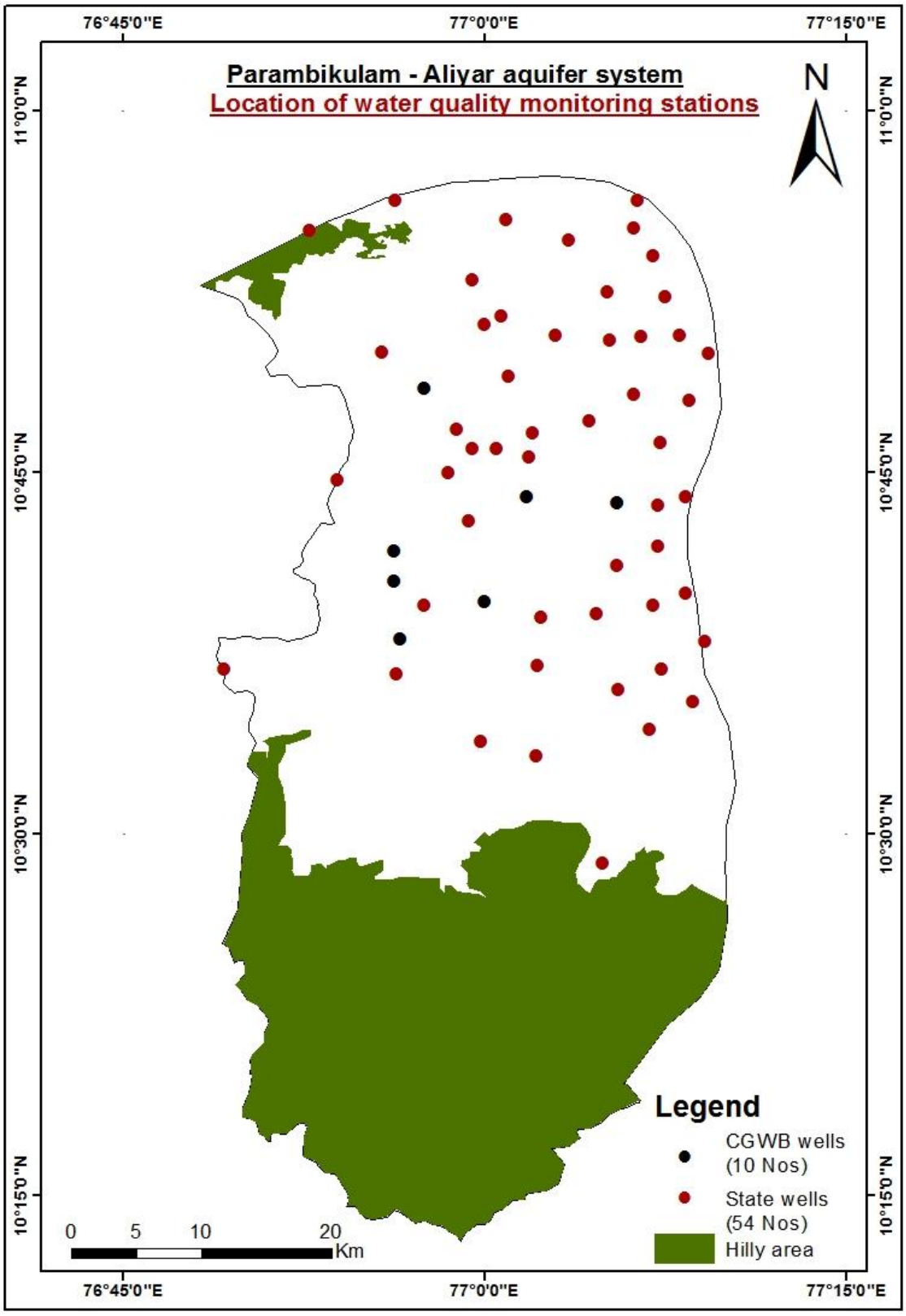


Figure 3.4. Locations of Groundwater quality Monitoring Wells

4. 0 DATA INTERPRETATION, INTEGRATION AND AQUIFER MAPPING

4.1. Hydrogeological Data Interpretation

Hard Rock Region

Hard rock region comprising of gneissic, charnockite, quartzite and other intrusive rocks is found in the Parambikulam – Aliyar aquifer system. The Gniessic formation and Charnockites formation (hard rocks) form two aquifer units namely the weathered and fracture/jointed aquifer unit. The details hard rock aquifers (Aquifer unit I - Weathered and Aquifer unit II – Fractured) are described below.

Lineaments

Rose diagram has been prepared with the lineament data to understand the orientation of the linear features in the basin area **(Figure 4.1).** It is a circular histogram plot which displays directional data and the frequency of each class. The rose diagram of the basin indicates that high frequency of lineaments is trending from NNE –SSW and NNW – SSE. This represents that most of the lineaments are vertical (perpendicular to the flow direction). The trend of the lineaments is in all directions. The lineaments are rarely in E-W direction.

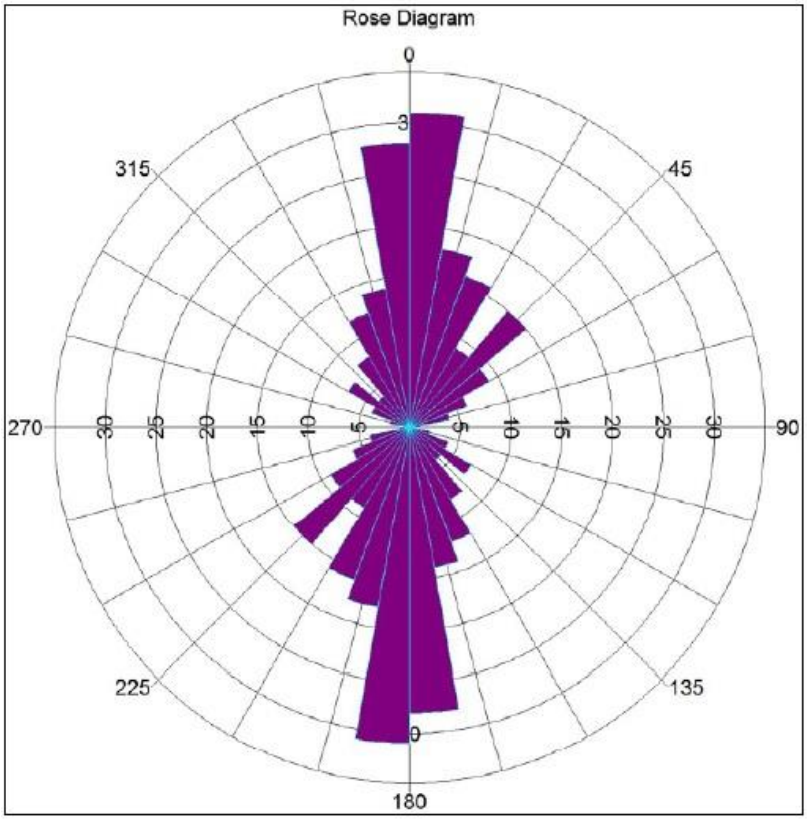


Figure 4.1: Rose Diagram showing orientation of lineaments

4.2 Aquifer Unit I – Weathered

The weathered aquifer unit occurs from the groundwater level and has a minimum thickness of 5 m and maximum thickness of 20 m with average thickness of 12 m. 2D disposition along west to south east clearly shows the vertical and lateral distribution of the gneissic and charnockitic formations. Yield of this weathered aquifer unit ranges from 1.5 to 20 m^3/hr. During monsoon period the wells tapping this aquifer unit sustain pumping for 2 to 4 hrs/day while during non-monsoon period (April to June) sustains for less than 1 hour/day. Groundwater occurs in unconfined condition. The aquifer parameter such as transmissivity in this aquifer unit ranges from 1.0 to 22.4 m^2/day. The Specific yield of this aquifer unit ranges from 1 to 1.5% with highly potable groundwater quality. The general EC of this aquifer unit ranges from 640 to 4380 µS/cm and is suitable for domestic uses.

4.3 Aquifer Unit II (Fractured/Jointed)

This aquifer unit comprises of fractured and jointed gneissic, charnockites other intrusives formed due to tectonic activity. Top of this aquifer unit occurs from 12 to 30 m bgl. Based on the analysis of the 120 wells it is observed that there is a possibility of occurrence of 3 to 4 fractures/joints exists upto 180 m bgl in the gneissic region. In Charnockite regions 3 to 4 fractures are likely to be encountered and they exist only upto 120 m bgl. The yield of this aquifer unit II ranges from 1 to 51 m^3/hr. During monsoon period the wells tapping this aquifer unit sustains pumping for 3 to 5 hrs /day while during non-monsoon period (April to June) sustains for 1 to 3 hour/day. Transmissivity of this aquifer unit ranges from 1.2 to 140 m^2/day.

The important aquifer systems in the basin are constituted by weathered and fractured crystalline rocks. The hard crystalline rocks are comprised of weathered and fractured Gneisses, Granites, Charnockites and other associated rocks. The major geological formation which is forming an aquifer in Parambikulam-Aliyar Basin is metamorphic rocks, namely Gneiss, Calc granulite limestone, Pink migmatite and Pyroxene granulite, next come the igneous rocks like Charnockite and Granite. Generally, the aquifer is heterogeneous in nature. The lithology of geological formations generally varies significantly in both horizontal and vertical planes. Such a formation is called heterogeneous. In these hard rock formations, occurrence of ground water depends upon zone of weathering, fractures, joints etc. Due to heterogeneity nature, these fractures generally do not occur uniformly in depth. Ground water occurs under phreatic conditions in the weathered mantle of gneissic rocks and under semi-confined conditions in the fractured zones. The shallow weathered and fractured zone makes the potential aquifers that are better developed in hornblende biotite gneisses than in Charnockites and granites. Charnockite is massive rock and development of fractures is less in it compared to other rock types. In the study area, the yield of wells tapping in the gneissic areas is comparatively higher than in other rock type area. Boreholes drilled in the basin were considered for hydro geological studies. In hard crystalline formation of the study area, the depths of boreholes ranging from 25 m to 140 m below ground level (m bgl).

4.4 Aquifer Disposition

Based on the lithologs of the exploratory wells, VES data and the well inventory details collected during field studies as part of Aquifer Mapping studies, 3D **(Figure 4.2)** and 2D models **(Figures 4.3 to 4.6)** of the aquifer system of the basin has been deciphered by using Rockworks

software. The data input for Rockworks is prepared in rockworks table format to generate 2D models of the basin along different selected sections.

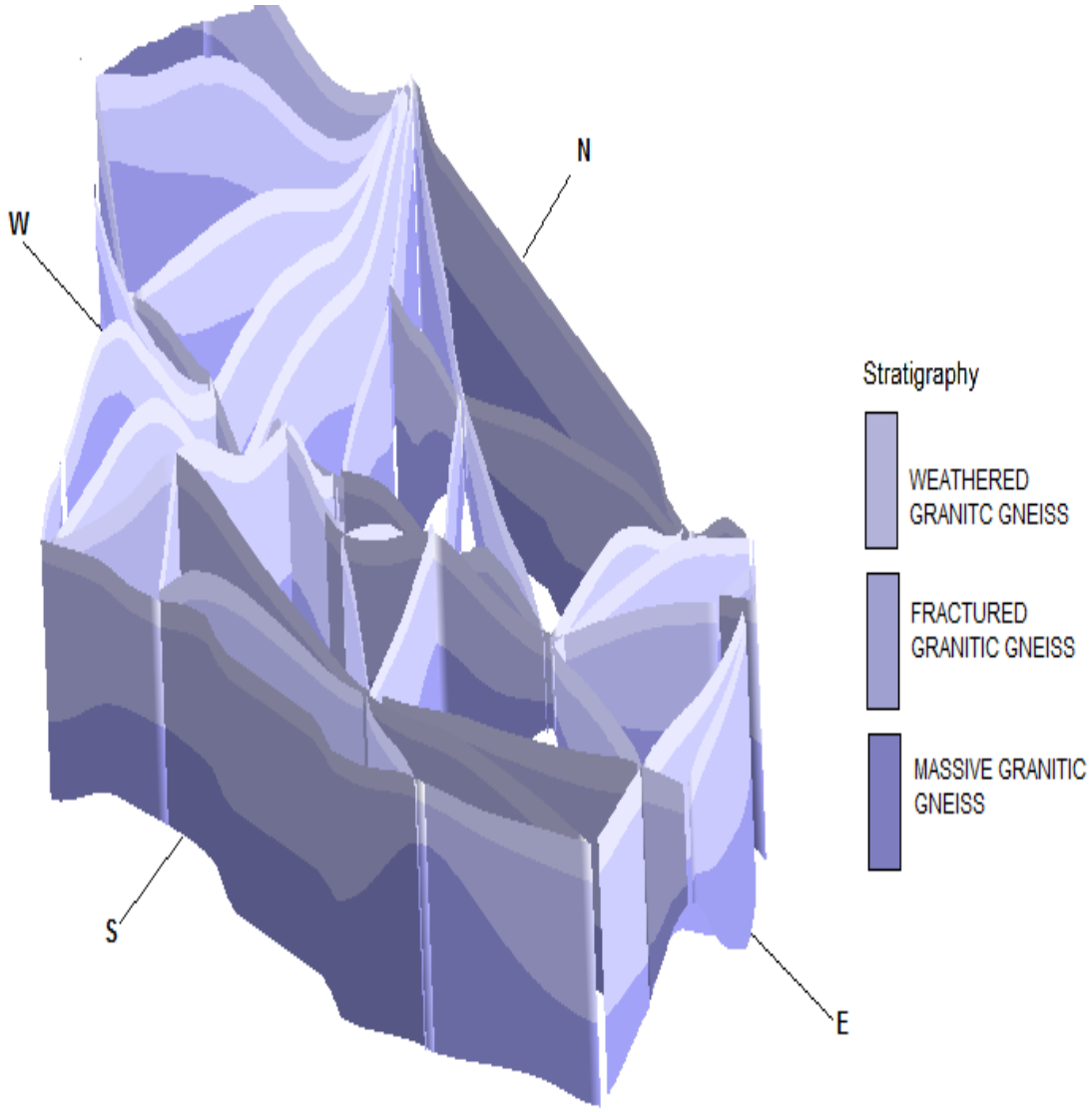


Figure 4.2. 3 Dimensional spatial distribution of the Parambikulam – Aliyar aquifer system.

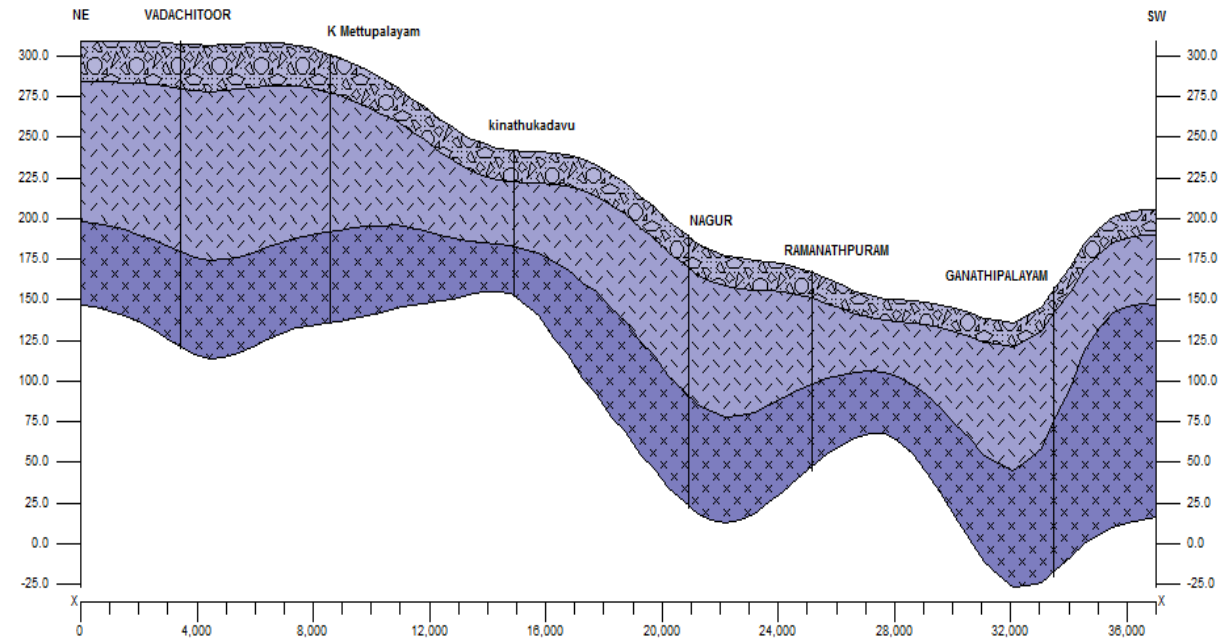


Figure 4.3 2D aquifer disposition of Parambikulam – Aliyar aquifer system along west – east

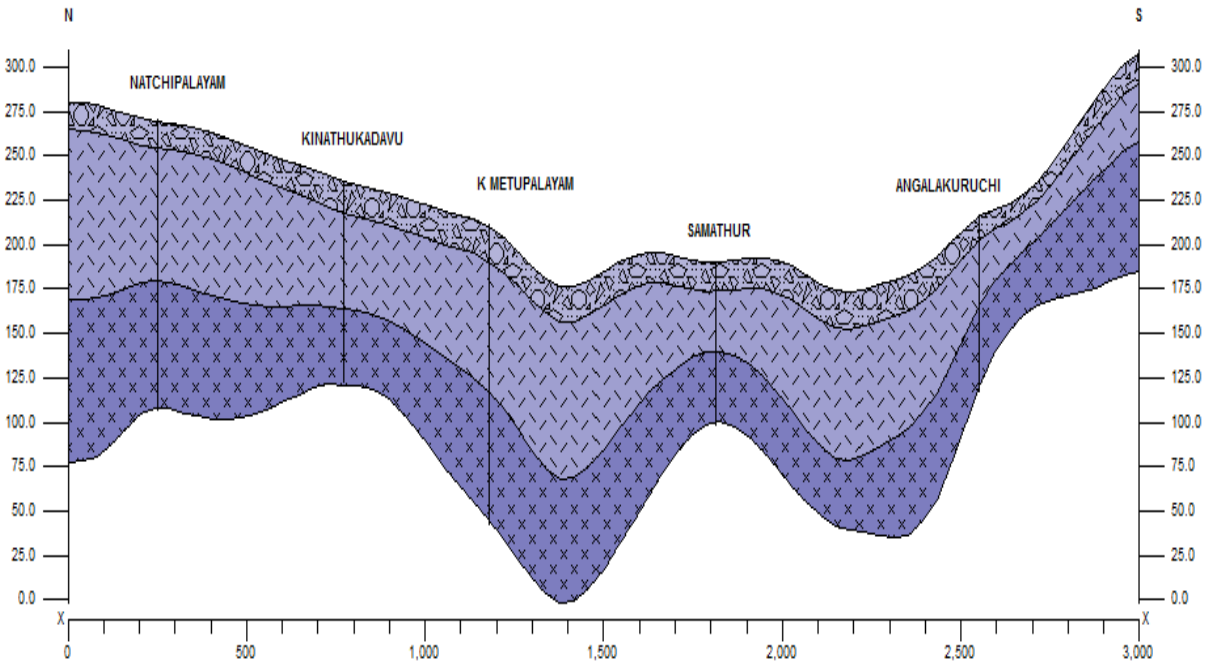


Figure 4.4. 2D aquifer disposition along northeast –west direction.

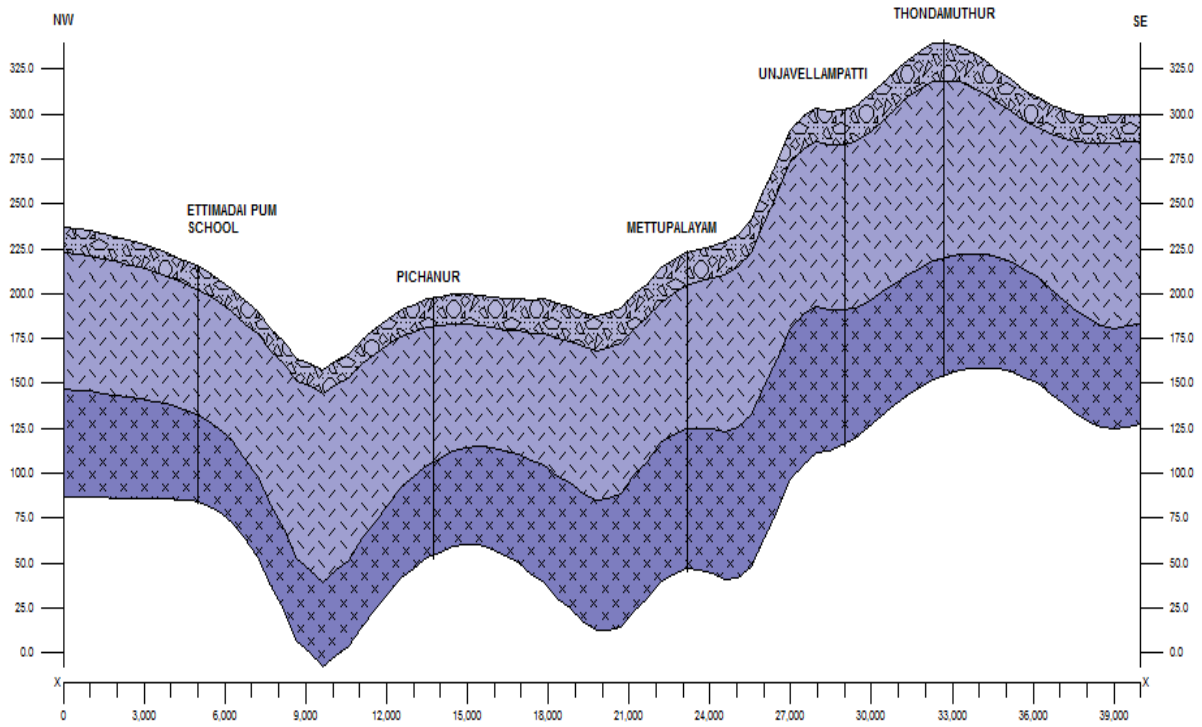


Figure 4.5. 2D aquifer disposition along North –South direction.

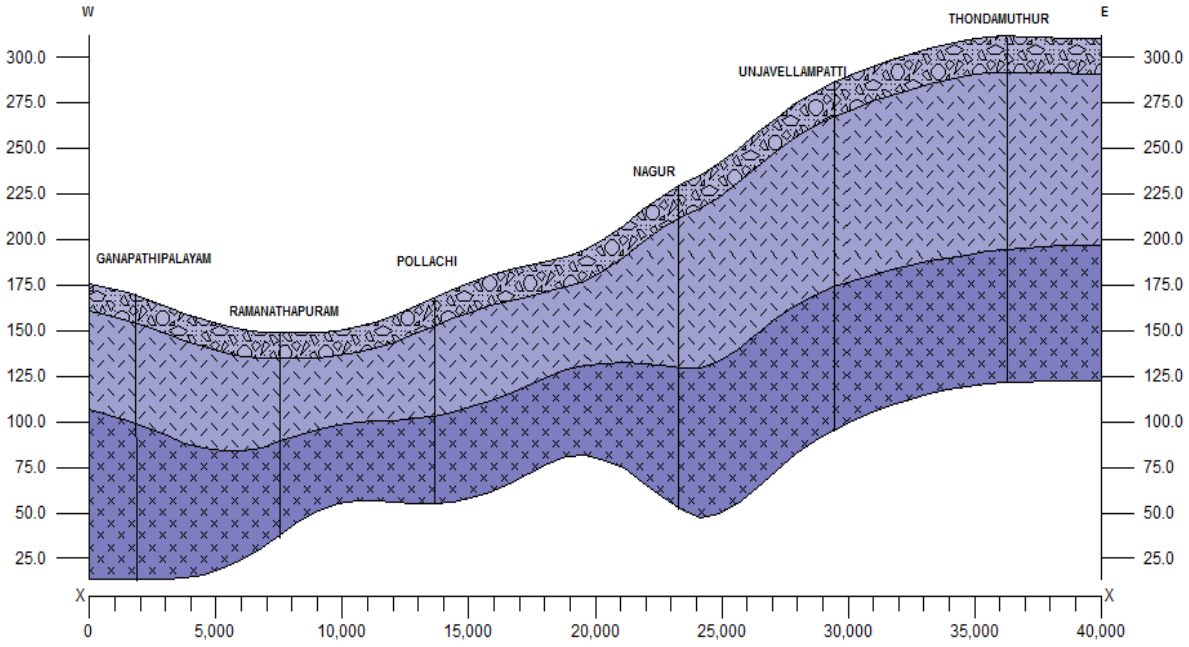


Figure 4.6. 2D disposition along north-north east-South-South west direction.

4.5 Hydrogeology of Parambikulam – Aliyar aquifer system

The principal aquifers in the Parambikulam – Aliyar aquifer system are weathered, fractured and alluvial aquifers. Primary porosity in the aquifers are negligible and secondary porosity developed due to tectonic disturbances leads to form good aquifers. Gondwana rocks behave as poor yielding aquifers and crystalline and alluvial formations forms good and productive aquifers. The range of aquifer parameters in hard crystalline rock region of the study area is as follows. The general well yield in crystalline formation is 9 to 135 litre/minute (lpm). and can sustain pumping for 2 to 4 hours per day in summer and 4 to 6 hours in winter. The general specific yield is 0.015%.The permeability is 0.25-26.75 m/day.

The Transmissivity value in the region is 1.49 – 164.18 m2/day (CGWB, Technical report-2008). The highly weathered (30-40 m) and highly fractured (70-140 m) zones are located in and around Vadachitoor, Periyakuyilai and Bogampatti in the north western part of Walayar Sub basin**.** Yield of the aquifer is 85 lpm. Medium weathered (20-30 m) and highly fractured depths (70-140 m) are located around Ganeshapuram, Sundarapuram, Malumichampatti, Teganiand Thottipalayam. Yield of the aquifer is 50-85 lpm. Highly weathered (30-40 m) and medium fractured (40-70 m) depths are located in Mamballi and Meenakshipuram. Yield of the aquifer is 85-130 lpm.

Medium weathered (20-30 m) and medium fractured (40-70 m) depths covers majority of the basin area in locations like Sethumadai, Samathur, Ganapathipalayam, Angalakurichi and Valparai. Yield of the aquifer is 9-135 lpm. Medium weathered (20-30 m) and low fractured (30-40 m) depths are located in Upper Aliyar, Vellimudipatti, Thanakalpatti, Uramakundru, Kadambarai. Yield of the aquifer is 9-50 lpm. Low weathered (10-20 m) and medium fractured (40-70 m) depths are located around Nallampalli, Alagapuri, Andiyur, Poosaripatti and Vanjipalayam. Yield of the aquifer is 50-135 lpm. Low weathered (10-20 m) and low fractured (30-40 m) depths are located in Unjapalayam, Dhalavaipalayam, Kolarpatti, Chandrapuram, and Vellakavundanpudur.

Yield of the aquifer is 50-100 litre/minute (lpm). The general water level fluctuation is studied for a period of 9 years. In the gneissic terrain, water level fluctuation is high. This is attributed to the high grade of weathering, good percolation, porosity and occurrence of fractures in the formation. On the other hand, the bore well representing Charnockite shows less variation in water level fluctuation due to the low weathering thickness and less fractured and jointed zones.

4.5.1. Groundwater Level

During Aquifer Mapping studies in Parambikulam – Aliyar aquifer system 116 Groundwater monitoring wells which are monitored regularly are used along with 50 key wells established (**Figure -3.3**) in different formations in order to know the behaviour of the groundwater regime. The water levels were monitored from May 2014 to Feb 2016 (four times in a year). Based on the data of key wells inventoried and National Groundwater monitoring wells, the decadal average water level maps of pre-monsoon and post-monsoon were prepared for the area. The decadal water level average in the aquifer system has been analysed using the water level data of May 2008 to May 2017. and for post-monsoon decadal average water level January 2009 to January 2018 period was analysed. Depth to water level maps for phreatic aquifer for pre and post is shown in **Figure 4.7** and **Figure 4.8** respectively. Water level fluctuation map is shown

in **Figure 4.9**. Depth to water level map for confined aquifer for pre and post is shown in **Figure 4.10** and **Figure 4.11** respectively.

The depth to water levels during pre-monsoon in the entire aquifer system remains in the range of less than 5 to 10 m bgl and 10 to 20 m bgl, whereas during post-monsoon the water level ranges become shallower compared to pre-monsoon, corresponding to rainfall recharge in the entire aquifer system.

Groundwater Level trends

Hydrographs of groundwater level for the 69 wells have been prepared. The linear trend lines drawn in the Hydrograph of wells were used to interpret the long-term trend in water level fluctuation. Rise or fall in water level in the range of 0-2 metre may not be significant due to dynamic nature of groundwater (CGWB 2010). From the trend line, if there is a long term water level depletion or rise, in the range of 2-3 metre, it is classified as moderate depletion or rise. If the depletion or rise is greater than 3 metre, it is classified as high depletion or rise. In this basin, moderate rise is found in 6 wells and high rise in water level is found in 9 wells. Moderate depletion is found in 7 wells and high depletion in water level is found in 29 wells.

Annual Groundwater Level Fluctuations

Annual groundwater level fluctuation is significant in the context that it indicates the level/degree of groundwater recharge. Annual water level fluctuation in observation wells varies from 0.00m to 18.21m in Walaiyar sub-basin, 0.60m to 16.34m in Palar sub-basin, 0.00m to 18.25m in Aliyar sub-basin and Annual water level fluctuation in piezometric wells varies from 0.00m to 63.28m in Walaiyar sub-basin, 0.17m to 44.65m in Palar sub-basin, 1.40m to 49.65m in Aliyar sub-basin and 3.90m to 20.60m in Sholaiyar sub-basin

ii) Monsoon Groundwater Level Variation

a) In observation wells:

In Walaiyar sub-basin, pre-monsoon groundwater level varies from 0.76m to 31.61m and post monsoon groundwater level varies from 0.55m to 30.05m

In Palar sub-basin, pre-monsoon groundwater level varies from 1.80m to 18.20m and post monsoon groundwater level varies from 1.26m to 18.20m

In Aliyar sub-basin, pre-monsoon groundwater level varies from 2.65m to 21.72m and post monsoon groundwater level varies from 2.30m to 20.50m.

b) In piezometric wells

In Walaiyar sub-basin, pre-monsoon groundwater level varies from 2.35m to 86.84m and post monsoon groundwater level varies from 2.00m to 75.00m

In Palar sub-basin, pre-monsoon groundwater level varies from 3.90m to 58.00m and post monsoon groundwater level varies from 3.70m to 59.00m

In Aliyar sub-basin, pre-monsoon groundwater level varies from 4.10m to 78.60m and post monsoon groundwater level varies from 3.00m to 64.00m.

In Sholaiyar sub-basin, pre-monsoon groundwater level varies from 15.20m to 33.05m and post monsoon groundwater level varies from 16.10m to 30.70m.

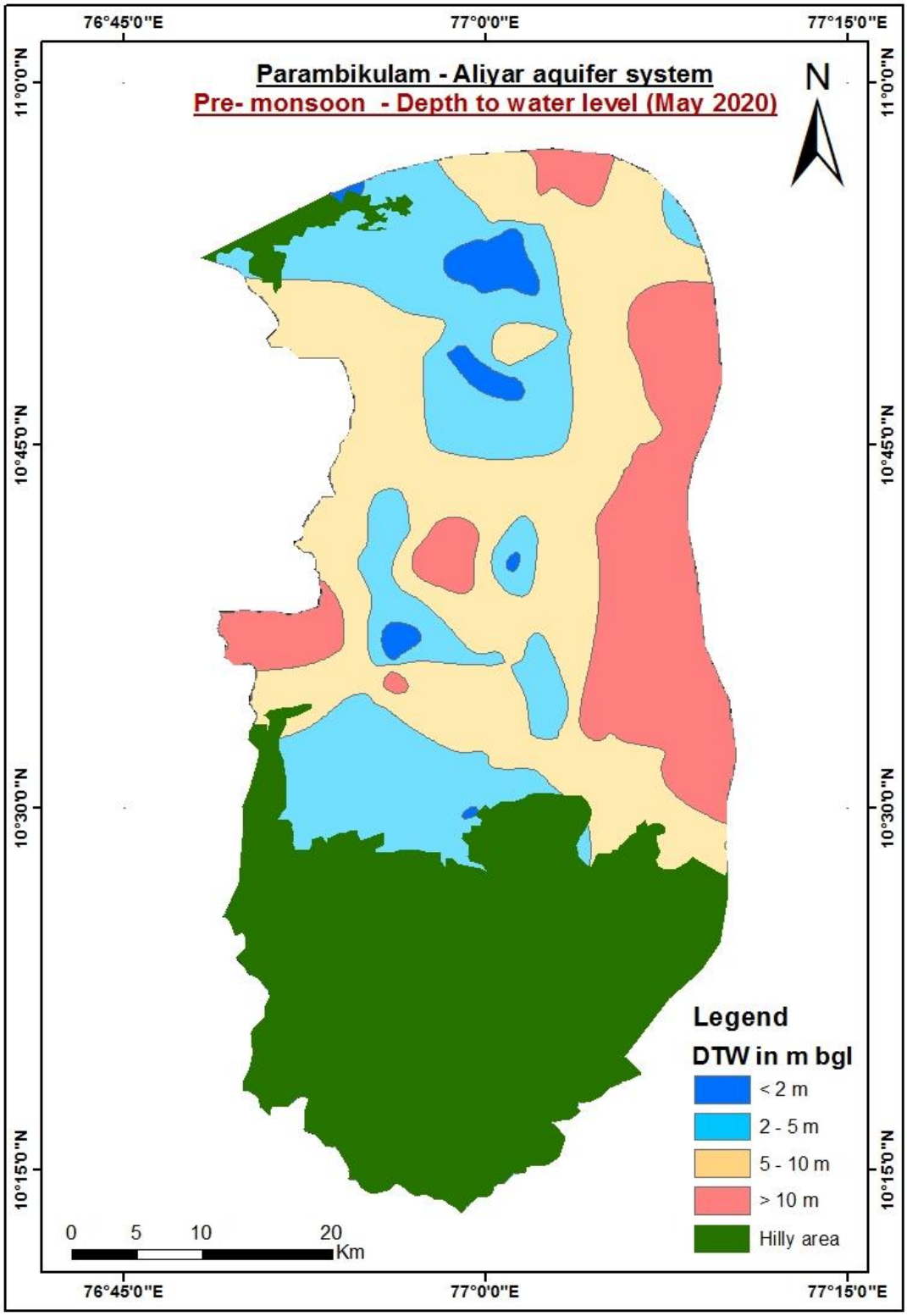


Figure 4.7. Depth to water levels of unconfined aquifer during pre-monsoon period.

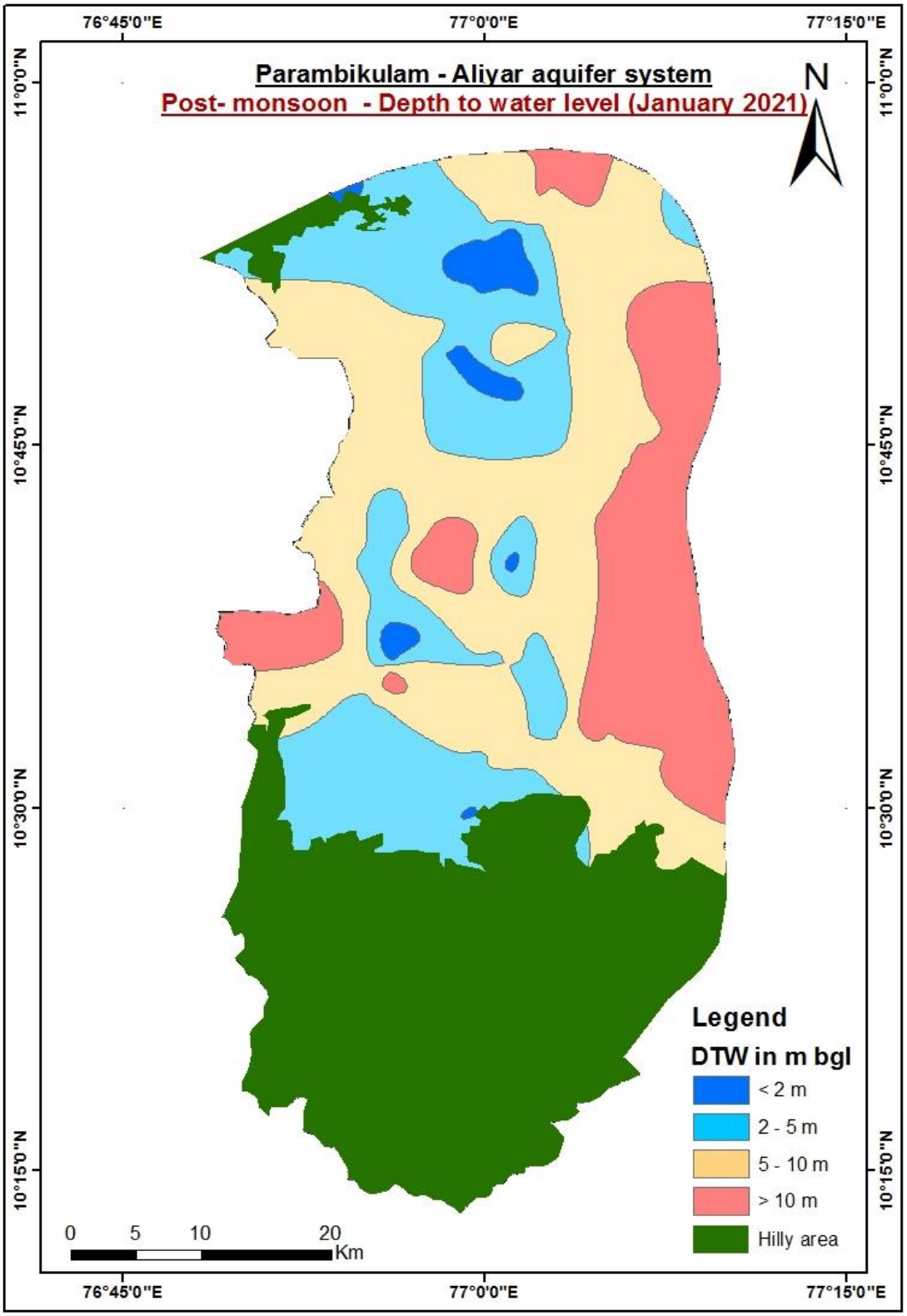


Figure 4.8. Depth to water levels of unconfined aquifer during post monsoon period.

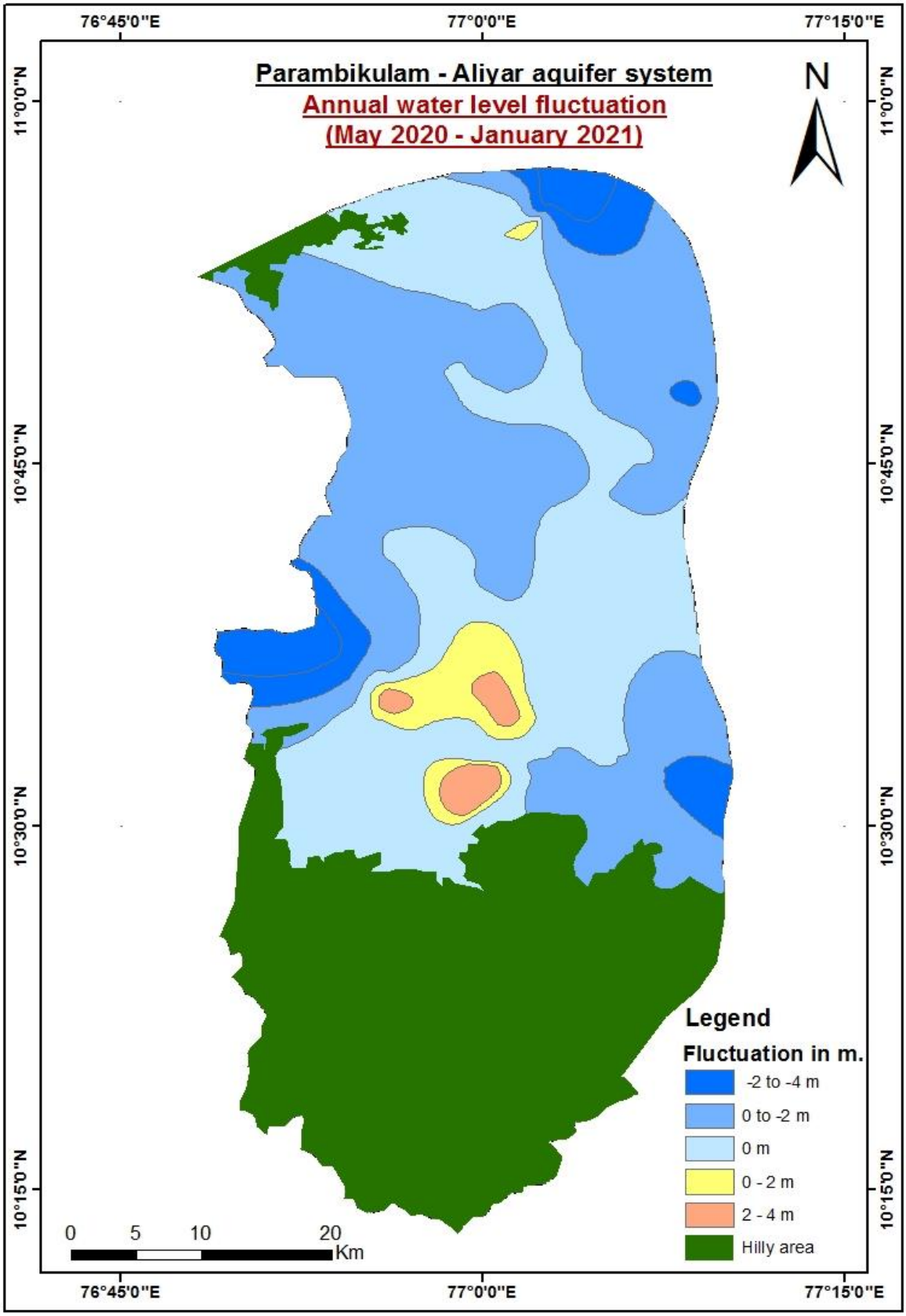


Figure 4.9. Annual water level fluctuation in unconfined aquifer

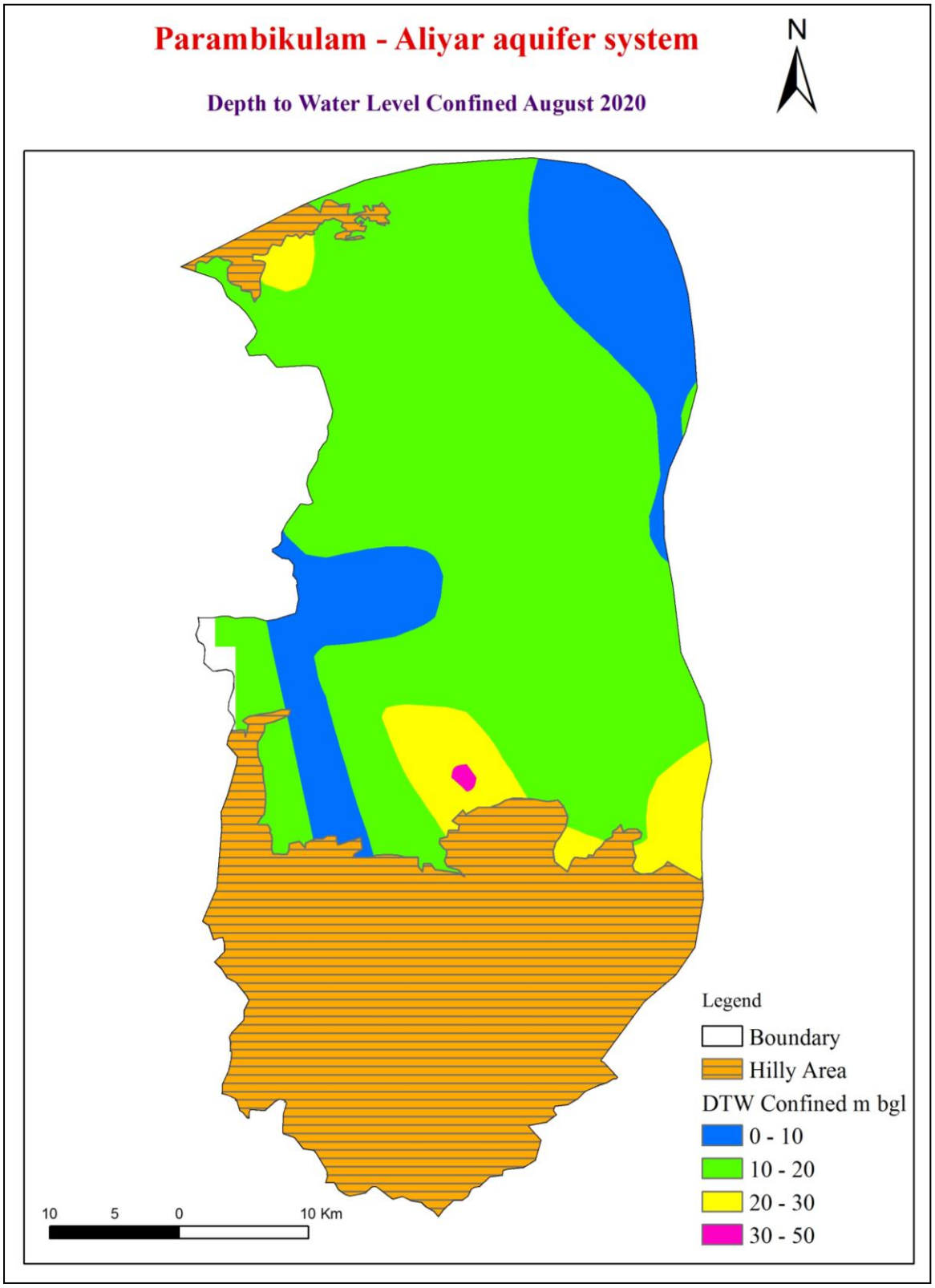


Figure 4.10. Depth to water levels of confined aquifer during pre-monsoon

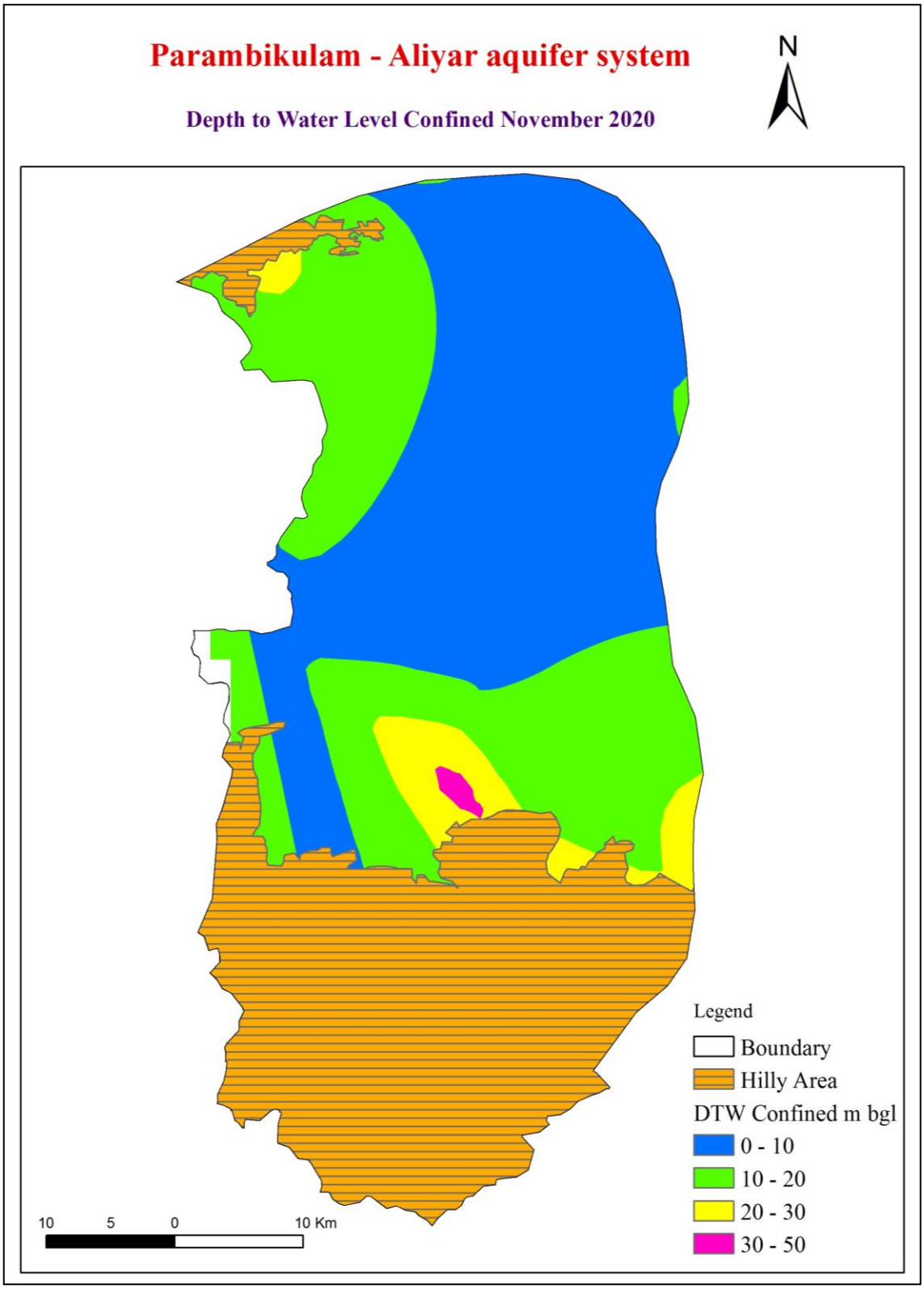


Figure 4.11. Depth to water levels of confined aquifer during post monsoon period.

5.0 GROUNDWATER QUALITY STUDIES

A total of 64 observation wells and bore wells were taken for the study, for the pre monsoon period of the year 2020. Major cations and anions were analysed for the study. The physio – chemical analysis was performed following the standard methods.

The waters are generally alkaline with pH ranging from 7.0 – 8.15. The chemical quality of ground water in general is good and potable except in the coastal part of the aquifer system. A perusal of the iso-conductivity map reveals that good quality groundwater with EC less than 750 micro siemens/cm at 25°C occur in the south part of basin. High EC values of more than 2250 micro siemens/cm at 25°C were observed in firkas of Kinathukadavu, Varapatti, Madukkarai, Othakalmandapam,, Selaikaraichal and Pollachi Firka. The high values EC in groundwater observed high intensive agricultural area with coconut cultivation. Return flow from irrigation attributed to the high EC values in the aquifer system. **(Figure 5.1)**

The chloride in water is also having essentially the same distribution as that of Electrical Conductance in the area. Chloride concentration are with permissible limit of 1000 mg/l. **(Figure 5.2)**

The TDS value in the basin ranges from 45 mg/l (Valparai village) to 907 mg/l (Kurichy village). Generally the TDS value ranges from good to moderate in this basin. The TDS value in the basin ranges from 45 mg/l (Valparai village) to 907 mg/l (Kurichy village). Generally the TDS value ranges from good to moderate in this basin.

The Nitrate values in the basin ranges from 1.5 mg/l (Valparai village) to 244 mg/l (Pollachi North). 72 percent wells tapping phreatic aquifers contains nitrate concentration more than 45 mg/l. observed in micro siemens/cm at 25°C firkas of Kinathukadavu,, Kinathukadavu, Varapatti, Madukkarai, othakalmandapam, and Selaikaraichal Firka. The high values Nitrate in groundwater observed high intensive agricultural area with coconut cultivation. Leaching nitrate fertilisers contributes high Nitrate values in groundwater in the aquifer system. **(Figure 5.3)**

High values of Fluoride concentration observed in wells tapping phreatic aquifers. The permissible limit for Fluoride in groundwater is 1.5 mg/l. In places, at Anamalai 4 mg/l, Madukkarai 3 mg/l, Kinathukadavu 3 mg/l, Pollachi 2.0 mg/l and Samathur 1.8 mg/l observed in groundwater. Fluoride concentration more than permissible limit observed in aquifers tapping gneissic rocks, and are geogenic origin. **(Figure 5.4)**

Generally the water quality is good in most of the wells in the basin while a few wells have moderate quality of groundwater in the aquifer system. In general, the groundwater quality is good, suitable for domestic, agricultural and other industrial uses.

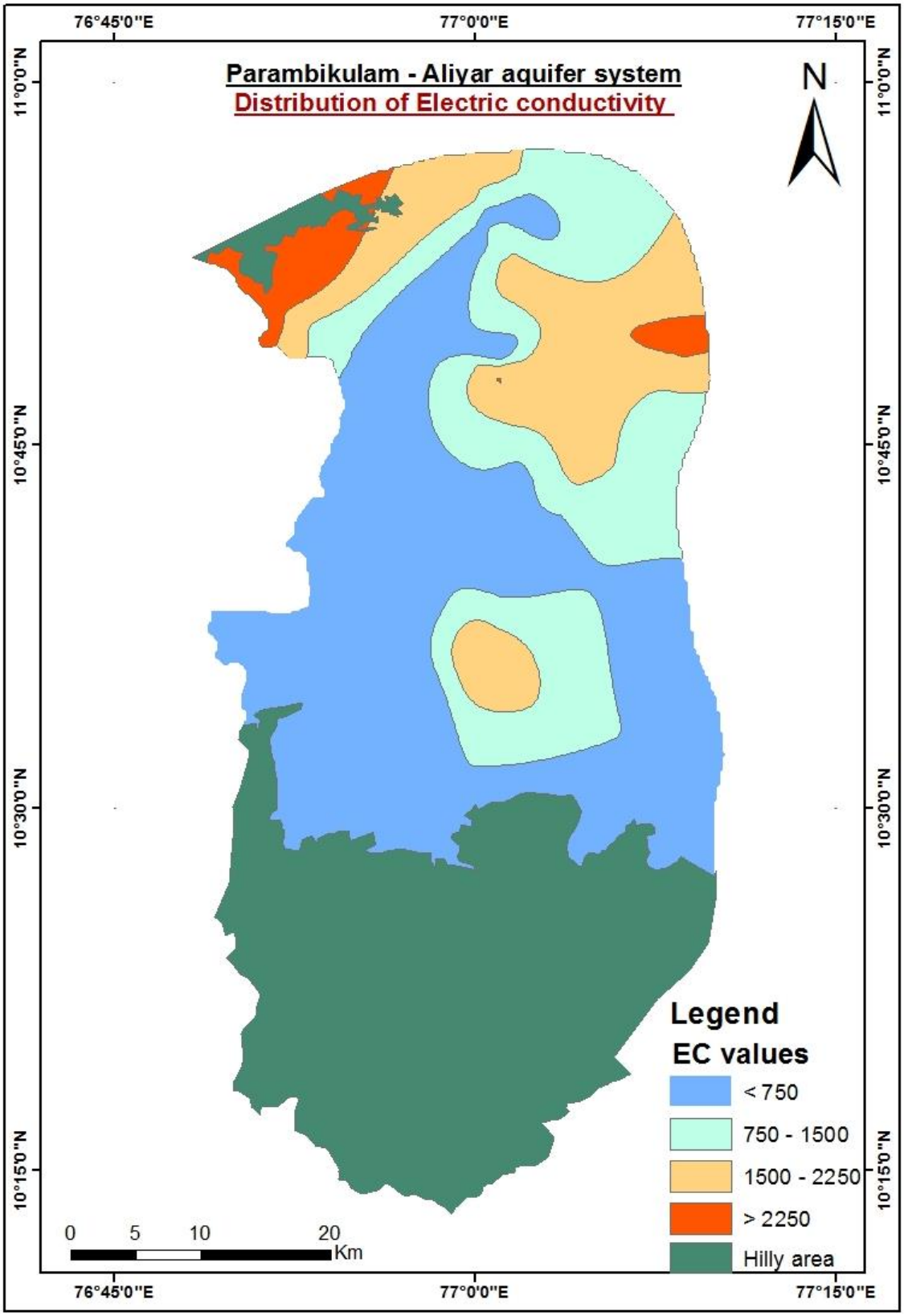


Figure 5.1: Distribution of Electrical conductivity in phreatic aquifers

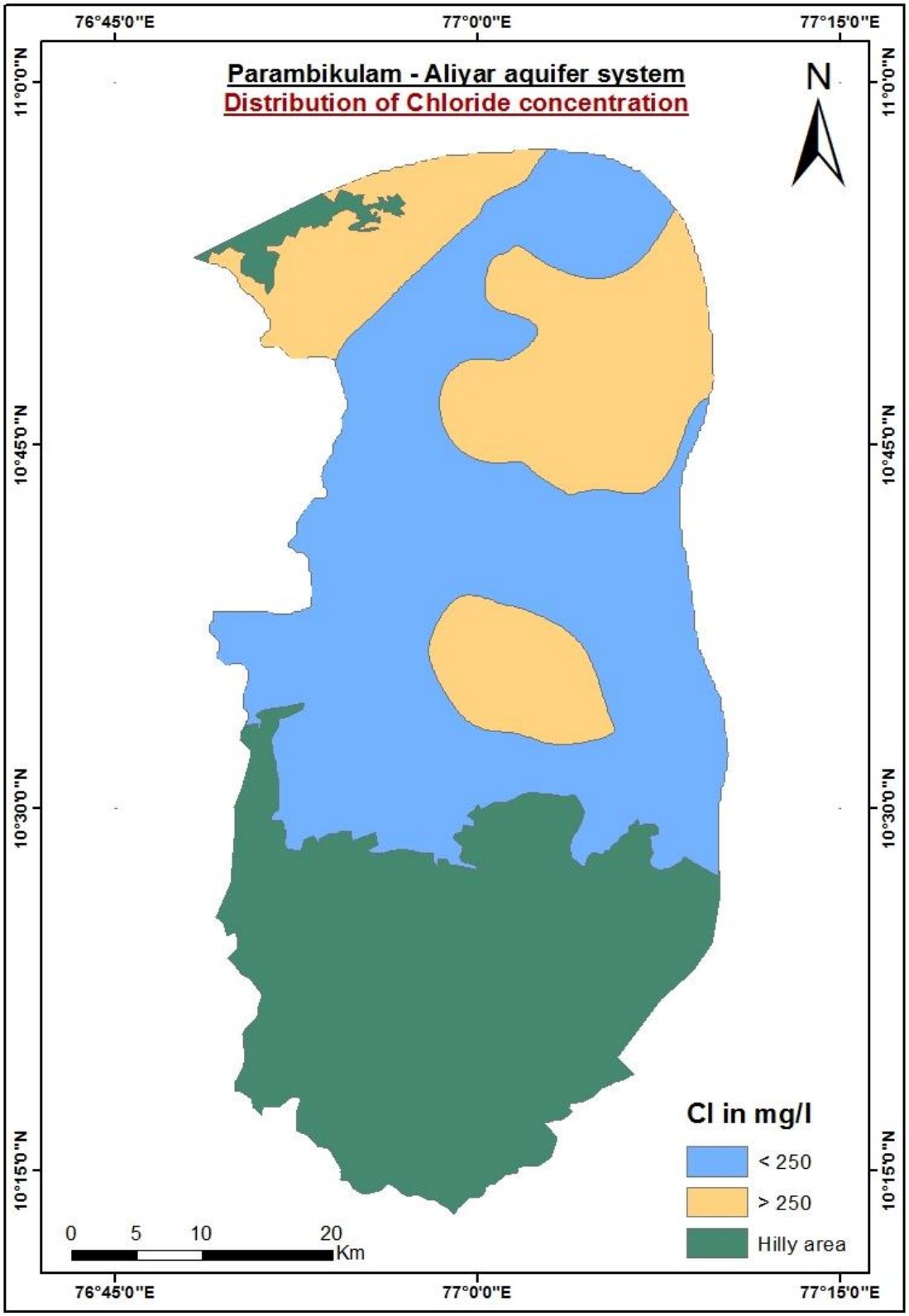


Figure 5.2: Distribution of Chloride concentration in phreatic aquifers

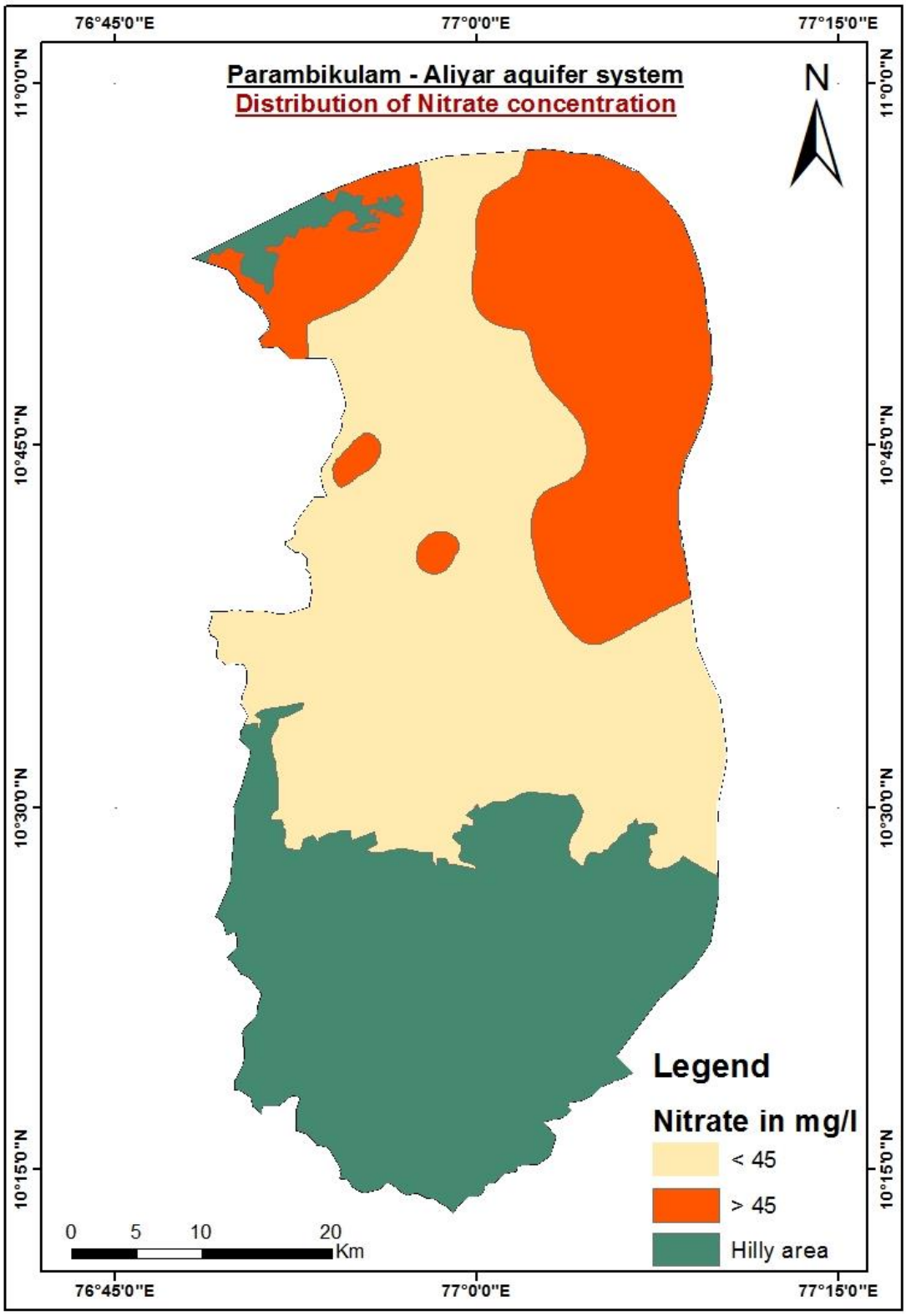


Figure 5.3: Distribution of Nitrate concentration in phreatic aquifers

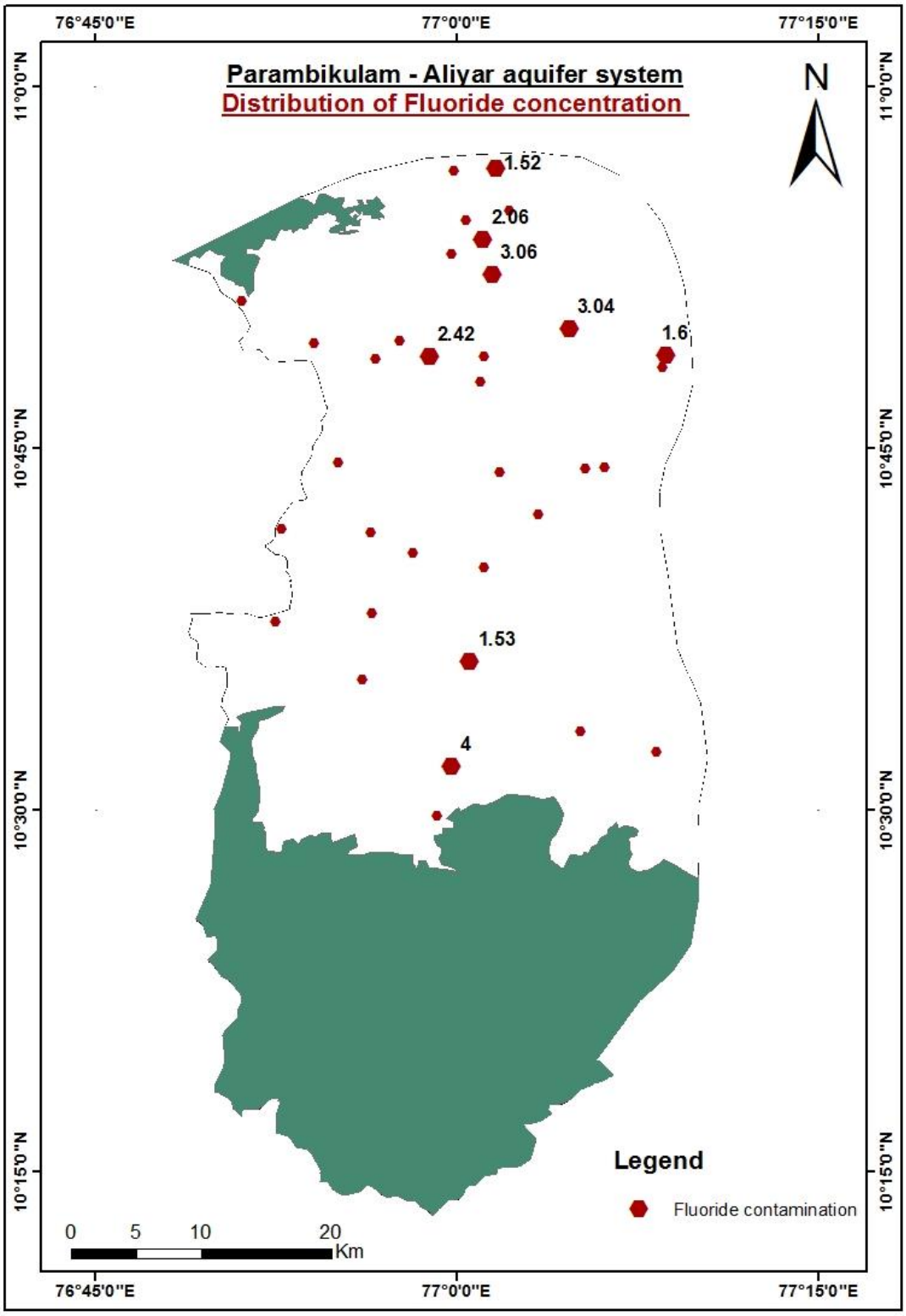


Figure 5.4: Distribution of Fluoride concentration in phreatic aquifers

6.0 GROUNDWATER RESOURCES

For long term planning, development and management, a systematic and scientific assessment of groundwater resources is quite essential. Groundwater is a more reliable, easily available natural resource, serves as a dependable water resource during drought and in achieving food security.

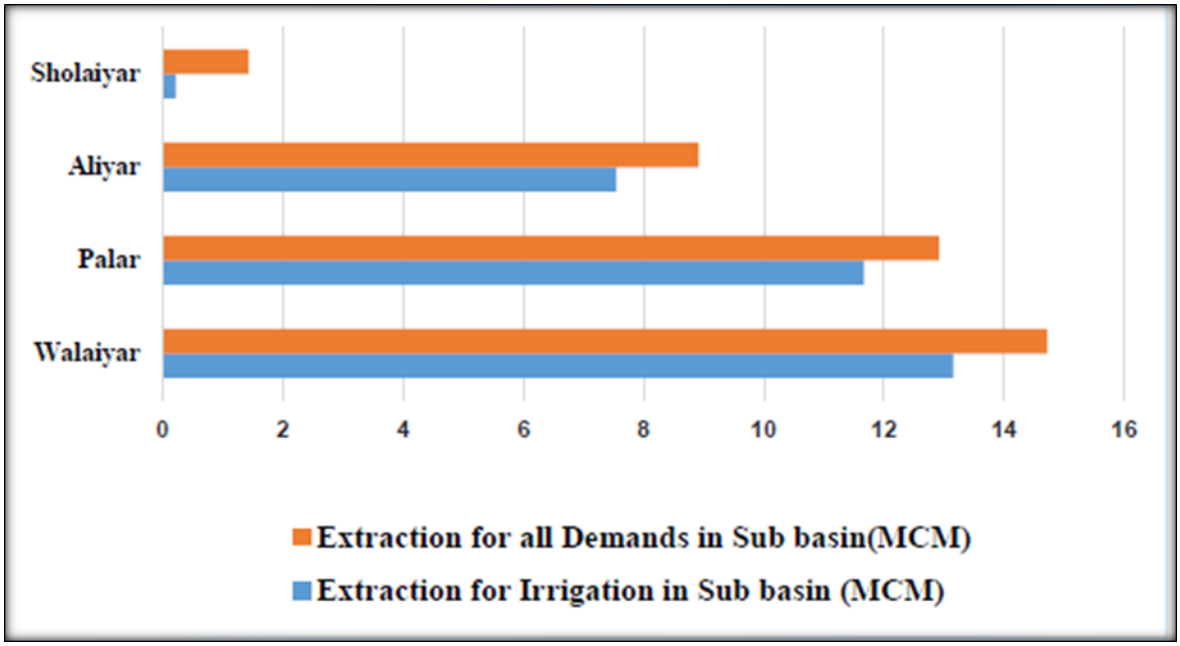
The sub-basin wise groundwater availability and extraction (draft) are calculated from the Firka's availability and extraction on proportionate basis i.e based on the percentage of firka area falling in the sub-basin. The balance of groundwater availability in each firka for further development is arrived by deducting the gross groundwater extraction from the net groundwater availability. If the balance groundwater availability is found to be negative, that negative value is ignored and the balance is taken as zero for that sub-basin. The Firka-wise groundwater resources of the aquifer system presented in the below table.

Table 6.1: Groundwater resources of Parambikulam – Aliyar aquifer system.

District Name	Firka Name	Net GW	Irrigation Draft	Domestic draft	Total Draft	Stage of GW Extraction	Category
Coimbatore	Valparai	4042	0	121	121	3	Safe
Coimbatore	Anamalai	4228	1870	73	1943	46	Safe
Coimbatore	Kottur	2314	1551	101	1652	71	Semi-critical
Coimbatore	Alandurai	1696	1247	102	1350	80	Semi-critical
Coimbatore	Marchinaickenpalayam	1401	1100	59	1159	83	Semi-critical
Coimbatore	Madukkarai	1569	1246	97	1343	86	Semi-critical
Coimbatore	Vadachittur	1438	1475	44	1519	106	Over-exploited
Coimbatore	Ottakkal Mandabam	971	953	87	1040	107	Over-exploited
Coimbatore	Selakkarichal	942	1108	43	1151	122	Over-exploited
Coimbatore	Pollachi(S)	1518	1701	256	1957	129	Over-exploited
Coimbatore	Pollachi(N)	888	1034	190	1224	138	Over-exploited
Coimbatore	Kinathukatavu	1164	1574	69	1643	141	Over-exploited
Coimbatore	Ramapattinam	1774	1956	656	2612	147	Over-exploited
Coimbatore	Perianegamam	1075	1685	43	1729	161	Over-exploited
Coimbatore	Kolarpatti	915	1500	37	1537	168	Over-exploited
Coimbatore	Kovilpalayam	1016	1721	236	1957	193	Over-exploited
Tiruppur	Udumalpet	1983	1324	198	1521	77	Semi-critical
Tiruppur	Thungavi	2285	1868	65	1933	85	Semi-critical
Tiruppur	Periavalavadi	1485	1962	62	2023	136	Over-exploited
		41009	**34456**	**3210**	**37666**		

6.1 Groundwater Draft

The gross groundwater 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 total net groundwater availability in aquifer system is 41009 ham whereas the net groundwater draft is 37666 ham.



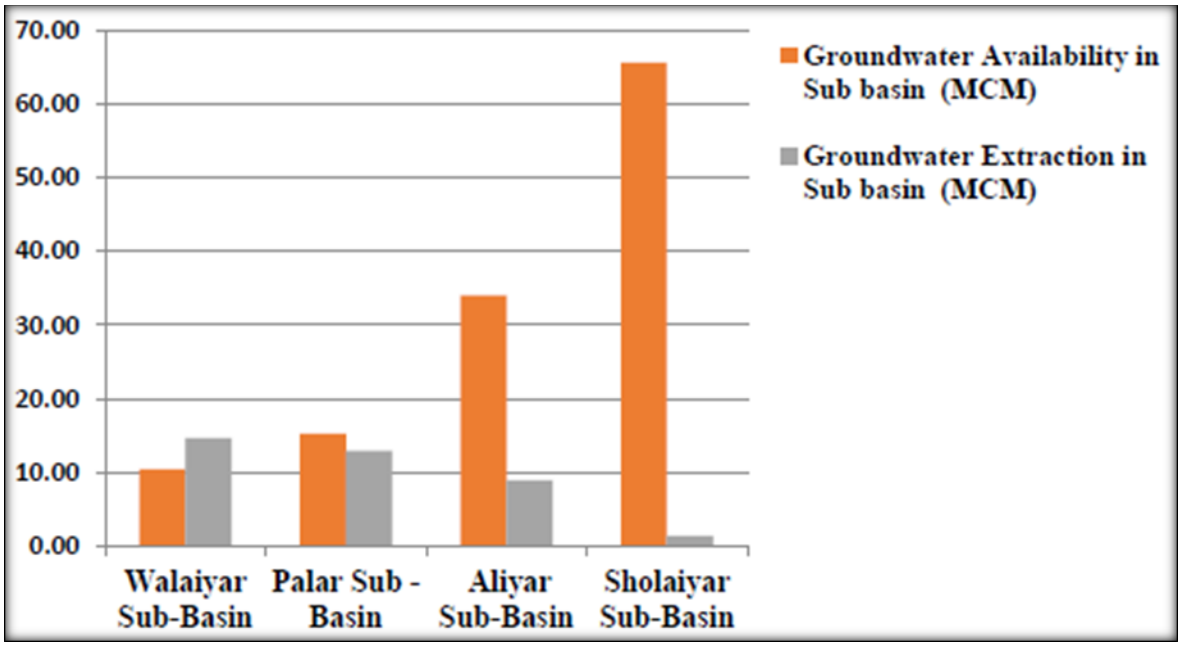


Figure 6.1. Groundwater resources and demand of Parambikulam – Aliyar aquifer system

6.2. Stage of Development and Categorization

The stage of development is defined by stage of groundwater development (%) = (Existing groundwater draft/ Net Groundwater availability) x 100

The stage of groundwater development is calculated for all the 19 firkas of the basin The Categorization has been done by considering the two factors as suggested by GEC 97, viz.,

Stage of Development and 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 and d) Over-exploited

The categorization was done on a fine scale based on firkas as per latest Groundwater assessment done during 2017.The 1,166 revenue Firkas in Tamil Nadu were categorized as Safe, Semi Critical, Critical and Over-Exploited depending upon the stage of groundwater development. The criteria for categorization of Firkas are tabulated as follows

Out of 19 firkas in the basin, 11 firkas of the Parambikulam – Aliyar aquifer system fall under over exploited category, of which 10 Firkas lie in Coimbatore and 1 Firka in Tiruppur Districts. There are 2 safe firkas, falling in Coimbatote district. There are 6 Semi-Critical firkas 4 Firkas in Coimbatore and 2 Firkas in Tiruppur Districts of the aquifer system. The total stage of development of Parambikulam - Aliyaraquifer system is 109%. The District wise categorisation firkas are tabulated below. **(Figure 6.2)**

Sl. No	District	Safe	Semi Critical	Saline	OE
1	**Coimbatore**	**2**	**4**	**-**	**10**
2	**Tiruppur**	0	**2**	**-**	**1**
	Total	**2**	**6**	-	11

The groundwater management plan for OE firkas falling in the aquifer system described in the subsequent chapter. Studies show that groundwater recharge and discharge conditions are reflection of the precipitation regime, climatic variables, landscape characteristics and human impacts. Hence, management of groundwater is an essential requirement and it requires an understanding of balancing the management on supply side and demand side.

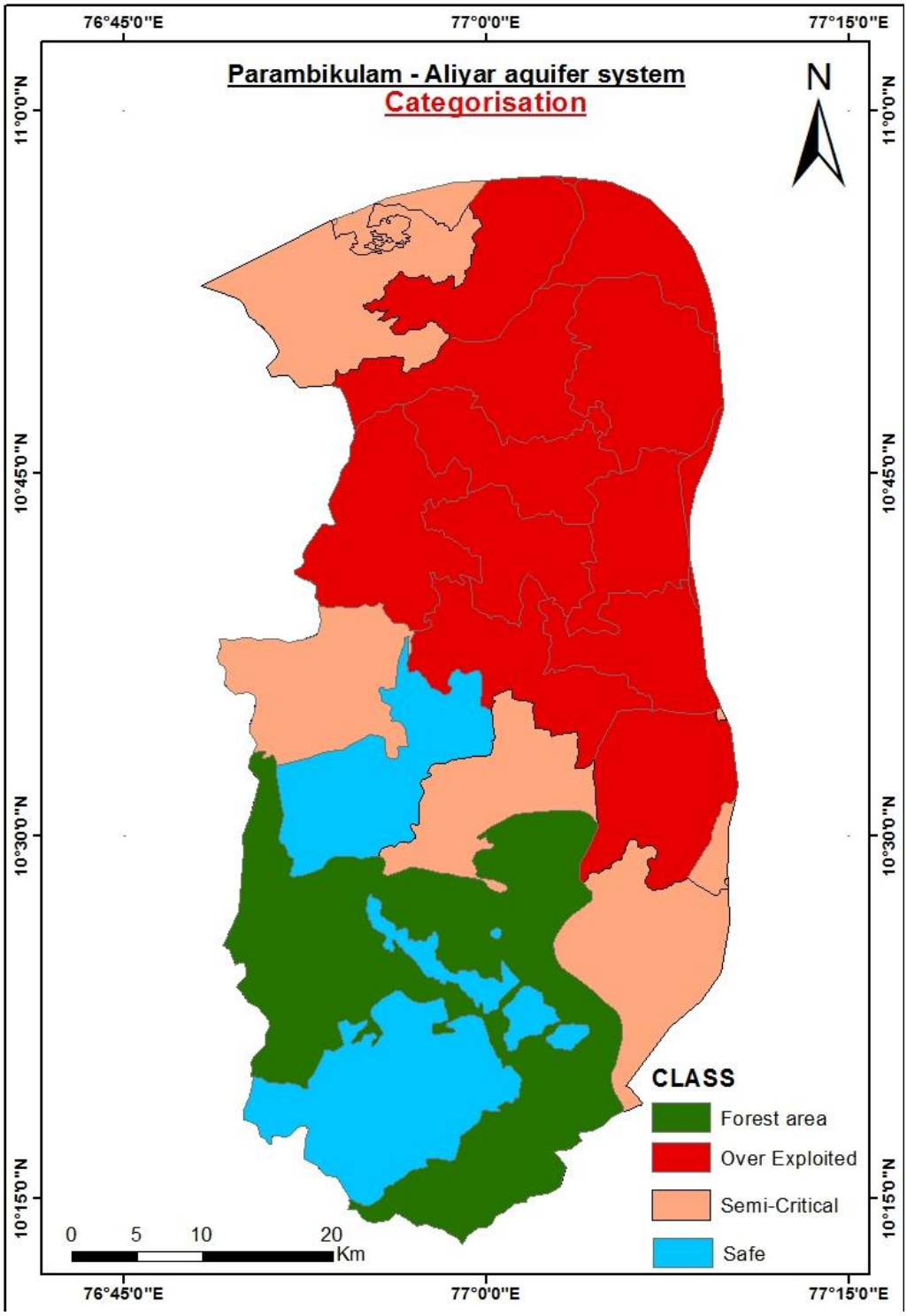


Figure 6.2: Categorisation of Firka in Parambikulam – Aliyar aquifer system

7.0 GROUND WATER MANAGEMENT STRATIGIES:

The groundwater 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 groundwater resource in a more rational and scientific way.

In the present study area of Parambikulam – Aliyar aquifer system, the sustainable management plan for groundwater is being proposed after a thorough understanding of the aquifer disposition down to a depth of 200m bgl. The study area is characterized by weathered and fractured system with very heavy abstraction of groundwater for irrigation practices.

7.1. Surface water potentials:

Parambikulam Aliyar Project successfully accomplishes the diversion and integration of 8 West flowing rivers; 6 in the Anamalai Hills and 2 in the plains- for the benefit of the drought prone areas in the Coimbatore and Erode Districts of Tamilnadu State and stabilizing the existing irrigation system in Chittoorpuzha of Kerala State. Dams on the 8 rivers with inter connecting tunnels have been constructed. The tunnels divert the waters impounded in the rivers to the plains of the Coimbatore District and Erode District of Tamil Nadu State and Chittur area of the Kerala State.

The reservoirs lies at various elevations ranging between elevation of + 3780 feet and + 1050 ft. and this difference of elevations has made it possible to utilize the drop between them for the development of hydroelectric power.This project is situated in Anamalais range amongst its flora and Fauna and on the arid and semi arid plains of the Southern Taluks of Coimbatore District. All the rivers which has its sources in the Anamalai Range are served by the South-West Monsoon. The Major portion of the Dams and Tunnels are located in the Scenic and scene surroundings of the Anamalai Range and the reservoirs are located amongst picturesque and natural surroundings in the reserved forest areas and Tea Estates. This project takes its name after the two important rivers (1) Parambikulam representing the series of rivers on the west (2) Aliyar representing the east of Western Ghats. In a sense this project is a symbol of Inter-State Co-operation of the two neighbourly States of Kerala and Tamil Nadu. The main components of this project comprises of 10 Dams, 4 Power Houses, 6 Main Tunnels and 7 Irrigation canals.

The availability of surface water in this basin are mainly from the diversion of the West flowing rivers of Anamalai hills to east to irrigate dry areas of Coimbatore and Tiruppur Districts. This involves the sharing of water between Kerala and Tamil Nadu State. This includes the inter State Periyar, Chalakudi and Bharathapuzha basins. The fact is that, storage structures have been constructed and located in Kerala, whereas the catchment area contributing to the flow into those storage structures is mainly from Tamil Nadu. Therefore, only the diversion / storage structures are located in Kerala and the waters generated in the catchment are being shared as per the agreement. As per agreement, the entitled quantity of water for Tamil Nadu from the diverted

water is 30.5 TMC (at present is 28 TMC) and for Kerala it is 19.55 TMC in an average year. To know whether the required quantities are met out in each year as per agreement, the flows are being measured at each diversion structure. "Joint Water Regulation Board" comprising the Chief Engineers, Water resources & Chief Engineers of both the States has been constituted to monitor the availability of water to both states and is functioning. As per PAP agreement, the water entitled to Kerala is 19.55 TMC and the quantity of water entitled for diversion to Tamil Nadu is 30.5 TMC (at present is 28 TMC), Vide the salient features of agreement. But after meeting out the required share to Kerala State, the quantity of diverted water available to Tamil Nadu is not always 28 TMC.

Surface Water Resources and Irrigation System

Surface runoff is the response of a catchment to precipitation reflecting the integrated effects of a wide range of parameters like orientation and shape of the catchment, climate and intensity of precipitation, duration, the direction of storm, slope, soil, land use, etc. Parambikulam Aliyar system comprises of 10 reservoirs in which the Upper Nirar Weir, Lower Nirar Dam, Sholayar Dam, Parambikulam Dam, Thunacadavu and Peruvaripallam Dams are located in the Anamalai Hills of the Western Ghats, whereas the Aliyar Dam and the Thirumurthy Dam are located in the plains along with that 4 Power Houses, 6 Main Tunnels, the unique Contour Canal, Leading Channels and a network of 7 Irrigation Canals, Branch Canals and Distributaries.

There are 35 interstates gauging points in this basin where, the flow is being measured and recorded. The flow records are maintained by P.W.D. This also includes the flow measurements that are taken in reservoirs and weirs. "Joint Water Regulation Board" comprising the Chief Engineers, Water resources & Chief Engineers of both the States has been constituted to monitor the availability of water to both states and is functioning.

The annual Surface Water Potential of Parambikulam and Aliyar river basin is calculated for average annual flow is 769 Mcum. Irrigation is the artificial application of water to the land in order to fulfill the water requirements of the crops throughout the crop period for the full nourishment of crops. The State has a net irrigated area of 26.27 lakh hectares as per the season and crop report 2017-18. About 56.62% of the net area sown is benefitted by irrigation. The total Gross Irrigated area of Parambikulam Aliyar Basin is 98,048 Ha as per the season and crop report 2017-18 year crop area. The main crops cultivated in Parambikulam Aliyar Basin are Coconut, Paddy, Sugarcane, Cholam, Maize and Pulses in addition to Fruits and Vegetables.

PAP – A Unique Project - The flows in the rivers of the PAP system are regulated and diverted by the storage / diversion structures which have been constructed with the intention to serve the drought prone areas in the Cauvery basin also. Part of the area irrigated by the PAP system fed by the canals taking off from the Thirumurthy Reservoir viz., Parambikulam Main Canal, Udumalpet Canal and the High level Canal falls in the Cauvery basin. The total command area spread over in Coimbatore, Erode and Tiruppur districts of Tamil Nadu lies both in "Parambikulam Aliyar basin" and Cauvery basin. The command area of the Parambikulam Main Canal system has been grouped into four near equal zones in a manner convenient for facilitating the supply by rotation. The extent of command area, under PMC fed by Thirumurthy reservoir, under the four zones are 98,558 acres, 98,418 acres, 94,024 acres, 86,152 acres respectively, totalling to 3,77,152 acres.

This is a unique project in the sense that farmers get water once in two years for their ayacut for 41/2 months. The Palar sub basin irrigated area is fed by Thirumurthy Reservoir. The command area of 44378 acres in Aliyar sub basin has been divided into two near equal zones. In a normal year about 2.35 Lakh acres are expected to be irrigated by the PAP system.

A combination of factors such as increasing industrialization, urbanization, housing activities and infrastructure development triggered the conversion of agricultural land into non-agricultural uses. This has resulted in a declination of area under cultivation. The scope for the expansion of area available for cultivation is also very limited.As per the latest Agricultural Census 2017-18, the State had 79.38 lakh holdings with an operating area of 59.70 lakh Ha. The land holding details of this basin are as detailed below.

- Marginal farmers (area less than 1 Ha) : 30492 (43.14%)
- Small farmers (1 to 1.99 Ha) : 19721 (27.90%)
- Semi-medium farmers (2 to 3.99 Ha) : 13208 (18.69%)
- Medium farmers (4 to 9.99 Ha) : 6294 (8.91%)
- Large farmers (more than 10 Ha) : 959 (1.36%)

The Gross irrigated area of crops in Parambikulam Aliyar Basin is reported to be 71,735 Ha. Out of the total area irrigated, about 96% is under Coconut cultivation and the remaining in Paddy, Cholam, Sugarcane, Groundnut, Pulses and millets cultivation. Presently irrigated area is adopted as 71,735 Ha based on good rainfall year 2019- 20. On comparing the cultivated area of the present study, it is found that the total irrigated area has decreased from 84,784 Ha to 71,735 Ha. Irrigated area of Coconut is increased from 45350 Ha to 68,620 Ha and Paddy is decreased from 21,310 Ha to 1,579 Ha7.2. Augmentation Plan

Augmentation of groundwater can be achieved through construction of percolation ponds with 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 & Critical firkas of the basin through utilizing the uncommitted surface runoff of 10.9 MCM.

7.2 Ground water potential

The total net groundwater availability in aquifer system is 41009 ham whereas the net groundwater draft is 37666 ham. About 76% of groundwater draft attributed to irrigation. The supply and demand side intervention can yield good understanding groundwater management in the aquifer system.

Supply-side Management of Groundwater

Constructing Artificial Recharge Structures like check dams, percolation ponds, recharge pits, shafts or wells are considered to be the best option in rural areas for recharging groundwater

where soil condition is favourable. Accordingly favourable groundwater recharge sites are identified with the application of GIS after focusing appropriate weight-age for spatial and nonspatial parameters like geo-morphology, geology, lineament, depth to bed rock, soil, aquifer and rainfall level. .On the other hand, roof-top rainwater harvesting, either as direct use or recharge into the aquifers is suited for urban habitations with its characteristic space constraints.

Many structural measures have been taken by the Government to increase the groundwater availability. Various State Government agencies namely, Water Resources Department, Agricultural Department, Agricultural Engineering Department, TWAD Board and Forest Department with and without Central Government assistance have taken up augmentation of ground water resources through artificial recharge structures. Success of Artificial Recharge Structures (ARS) depends largely on geological and hydrological features of an area and design of ARS. Percolation ponds, check dams, recharge shafts and sub-surface barriers are effective structures in hard rock areas, recharge trench and recharge tube wells are more suitable in alluvial areas. In the coastal zone, tidal regulators which impound the fresh water upstream and enhance the natural recharge, help control salinity ingress effectively. In case of urban areas and hilly terrains with high rainfall, roof top rain water structures are most useful.

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 36 check dams, 62 nala bunds and 83 recharge shafts are proposed in the OE firka of the basin. A total number of 83 recharge rejuvenation ponds are selected for desilting followed by construction of recharge shafts within the tanks. 306 Farm ponds were suggested in the aquifer system. The expected recharge through these artificial recharge structures is in the order of 10.9 MCM.. The expected benefit by the recharge structures in the 11 OE firka area will be creation of additional crop area. Firka wise and structure wise supply side interventions are annexed separately.

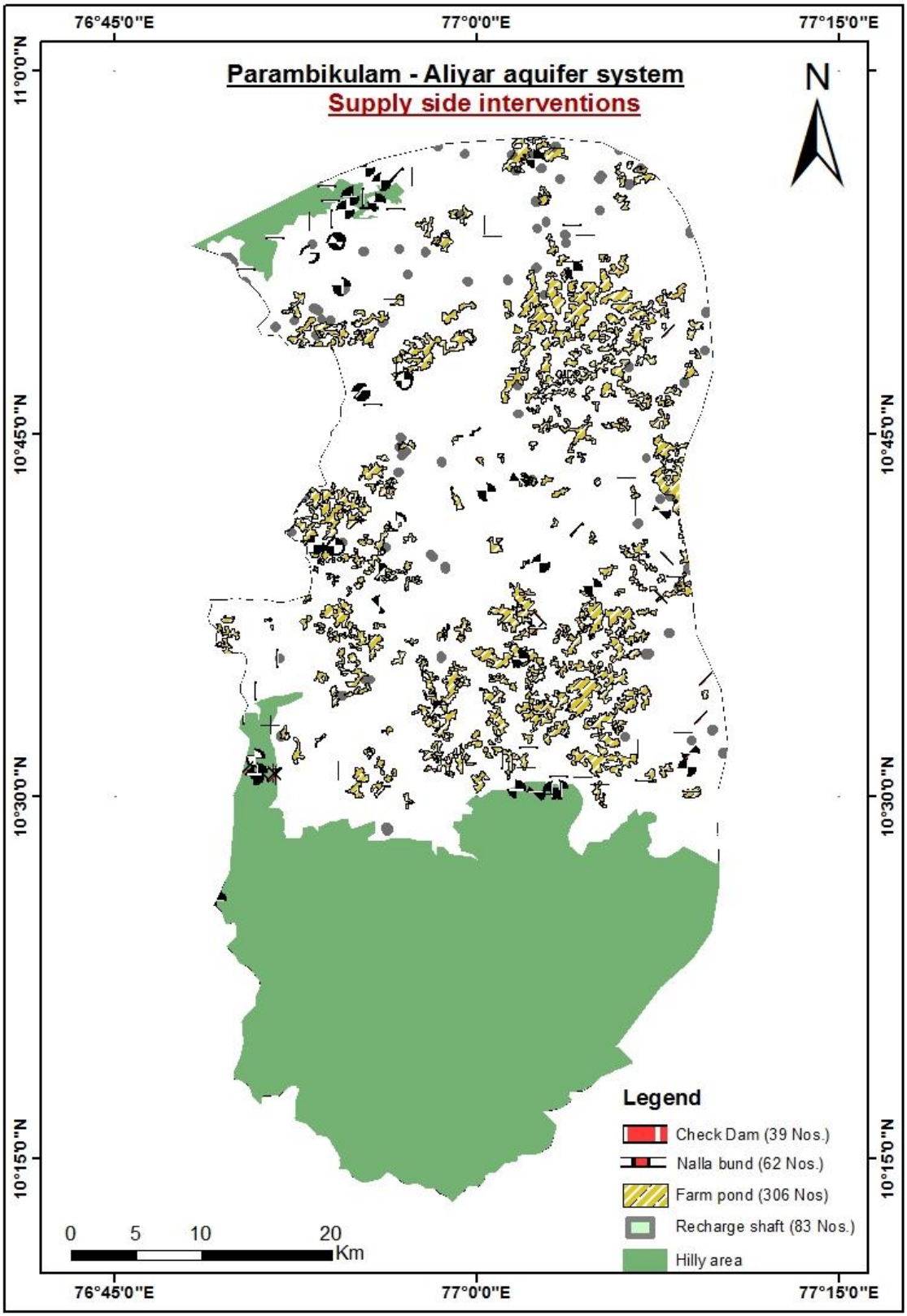


Figure 7.1: Supply side interventions – Groundwater recharge structures

Demand-side Management of Groundwater

The total water demand of four sectors, i.e., Domestic, Irrigation, Livestock and Industries of Parambikulam & Aliyar River Basin for the present year 2020 and the projected target years 2020, 2030, 2040 & 2050 are worked out respectively and are given in **Table 7.1**

Table 7.1: Comparison between the reappraisal studies of Parambikulam & Aliyar River Basin

Sl. No.	Water Demand	Year				
		2006	2020	2030	2040	2050
	Domestic	28.077	53.210	58.78	64.93	71.73
	Irrigation	629.83	379.40	379.40	379.40	379.40
	Livestock	14.67	11.324	11.324	11.324	11.324
	Industrial	50.34	7.118	12.8	23.061	41.51
Total		**722.917**	**451.042**	**462.306**	**478.705**	**503.95**

The supply and demand side interventions for sustainable groundwater management worked out and presented in Figure 7.2

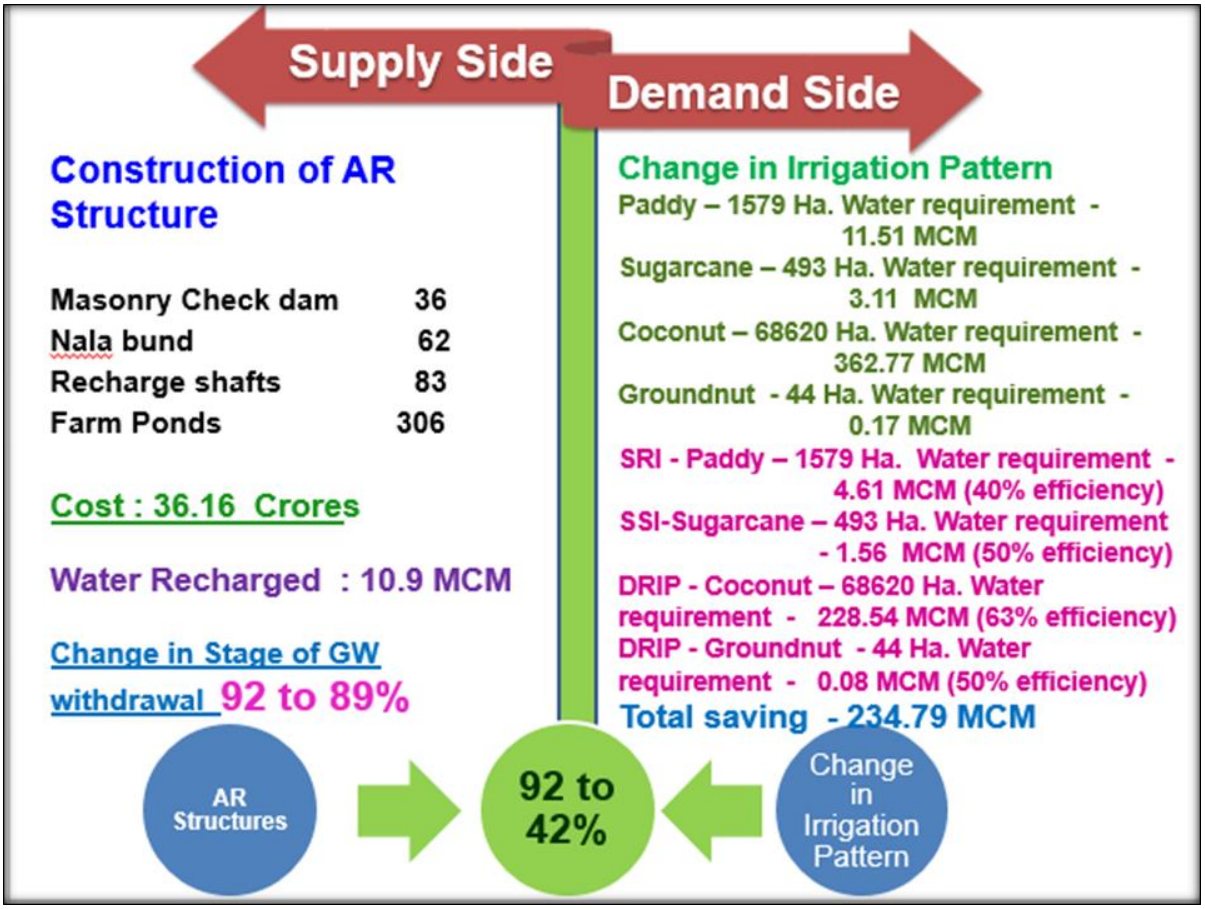


Figure 7.2. Supply and demand side interventions for Parambikulam – Aliyar aquifer system.

The total water demand of our sectors, i.e., Domestic, Irrigation, Livestock, and Industries of Parambikulam & Aliyar River Basin for the present year 2019 was worked out as **450.004** MCM. But the water demand in 2006 was 722.917MCM_This shows that there is 37.75 % decrease in water demand within 13 years for the present year, when compared to the water demand during 2006.

Percentage of saving in water when water saving techniques are adopted on cultivation for the present cultivable area of different crops in Parambikulam Aliyar River Basin is given below.

Sl.No.	Crop	Cultivated area in Ha	Water requirement-conventional method (MCM)	% of saving by adopting saving technique	Savings (MCM)
1	SRI-Paddy	1579	11.51	40	4.61
2	SSI-Sugarcane	493	3.11	50	1.56
3	Coconut - DRIP	68620	362.77	63	228.54
4	Groundnut-DRIP	44	0.17	50	0.08
				Total	**234.79**

7.3. Strategies to overcome the future stresses

Future stresses are only hypothetical. 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 irrigation pattern change

Agronomic Water Conservation

Reducing water use, reduction in urban areas

Annexure

Firka - wise supply side interventions, proposed locations of artificial recharge structures in Parambikulam - Aliyar aquifer system.

Sl. No.	District	Firka	Longitude	Lattitude	Structure
1	Coimbatore	Anamalai	76.859	10.519	Nalla Bund
2	Coimbatore	Anamalai	76.860	10.516	Nalla Bund
3	Coimbatore	Anamalai	76.860	10.515	Nalla Bund
4	Coimbatore	Anamalai	76.857	10.549	Nalla Bund
5	Coimbatore	Anamalai	76.860	10.515	Nalla Bund
6	Coimbatore	Anamalai	76.861	10.514	Nalla Bund
7	Coimbatore	Anamalai	76.905	10.517	Nalla Bund
8	Coimbatore	Anamalai	76.860	10.516	Nalla Bund
9	Coimbatore	Anamalai	76.970	10.560	Nalla Bund
10	Coimbatore	Anamalai	77.058	10.504	Nalla Bund
11	Coimbatore	Anamalai	76.846	10.528	Nalla Bund
12	Coimbatore	Anamalai	76.975	10.596	Desiltation with Recharge Shaft
13	Coimbatore	Anamalai	76.864	10.541	Desiltation with Recharge Shaft
14	Coimbatore	Anamalai	76.9137	10.6155	Farm Pond
15	Coimbatore	Anamalai	76.9900	10.6149	Farm Pond
16	Coimbatore	Anamalai	76.9762	10.6119	Farm Pond
17	Coimbatore	Anamalai	76.9551	10.6065	Farm Pond
18	Coimbatore	Anamalai	77.0257	10.5891	Farm Pond
19	Coimbatore	Anamalai	76.9460	10.5952	Farm Pond
20	Coimbatore	Anamalai	76.9617	10.5917	Farm Pond
21	Coimbatore	Anamalai	76.9771	10.5645	Farm Pond
22	Coimbatore	Anamalai	76.9674	10.5790	Farm Pond
23	Coimbatore	Anamalai	77.0105	10.5691	Farm Pond
24	Coimbatore	Anamalai	76.8669	10.5428	Farm Pond
25	Coimbatore	Anamalai	76.9384	10.5455	Farm Pond
26	Coimbatore	Anamalai	76.8909	10.5389	Farm Pond
27	Coimbatore	Anamalai	76.8756	10.5301	Farm Pond
28	Coimbatore	Anamalai	76.9252	10.5303	Farm Pond
29	Coimbatore	Anamalai	76.9329	10.5210	Farm Pond
30	Coimbatore	Anamalai	76.9180	10.5094	Farm Pond
31	Coimbatore	Anamalai	76.9425	10.5162	Farm Pond
32	Coimbatore	Anamalai	76.9383	10.5120	Farm Pond

33	Coimbatore	Anamalai	76.9319	10.5054	Farm Pond
34	Coimbatore	Anamalai	76.9518	10.4972	Farm Pond
35	Coimbatore	Kinathukatavu	77.041	10.865	Desiltation with Recharge Shaft
36	Coimbatore	Kinathukatavu	77.021	10.856	Desiltation with Recharge Shaft
37	Coimbatore	Kinathukatavu	77.046	10.846	Desiltation with Recharge Shaft
38	Coimbatore	Kinathukatavu	76.935	10.827	Desiltation with Recharge Shaft
39	Coimbatore	Kinathukatavu	77.028	10.784	Desiltation with Recharge Shaft
40	Coimbatore	Kinathukatavu	77.0515	10.8798	Farm Pond
41	Coimbatore	Kinathukatavu	77.0580	10.8702	Farm Pond
42	Coimbatore	Kinathukatavu	77.0603	10.8601	Farm Pond
43	Coimbatore	Kinathukatavu	77.0743	10.8433	Farm Pond
44	Coimbatore	Kinathukatavu	77.0443	10.8324	Farm Pond
45	Coimbatore	Kinathukatavu	77.0535	10.8477	Farm Pond
46	Coimbatore	Kinathukatavu	77.0210	10.8392	Farm Pond
47	Coimbatore	Kinathukatavu	76.9852	10.8336	Farm Pond
48	Coimbatore	Kinathukatavu	76.9269	10.8291	Farm Pond
49	Coimbatore	Kinathukatavu	77.0213	10.8321	Farm Pond
50	Coimbatore	Kinathukatavu	76.9019	10.8162	Farm Pond
51	Coimbatore	Kinathukatavu	76.8947	10.8221	Farm Pond
52	Coimbatore	Kinathukatavu	77.0276	10.8221	Farm Pond
53	Coimbatore	Kinathukatavu	76.9222	10.8169	Farm Pond
54	Coimbatore	Kinathukatavu	76.9668	10.8071	Farm Pond
55	Coimbatore	Kinathukatavu	77.0321	10.8091	Farm Pond
56	Coimbatore	Kinathukatavu	77.0473	10.8122	Farm Pond
57	Coimbatore	Kinathukatavu	77.0471	10.7977	Farm Pond
58	Coimbatore	Kinathukatavu	77.0868	10.7989	Farm Pond
59	Coimbatore	Kinathukatavu	77.0699	10.7902	Farm Pond
60	Coimbatore	Kinathukatavu	77.0246	10.7852	Farm Pond
61	Coimbatore	Kinathukatavu	77.0562	10.7913	Farm Pond
62	Coimbatore	Kinathukatavu	77.0491	10.7863	Farm Pond
63	Coimbatore	Kinathukatavu	77.0762	10.7788	Farm Pond
64	Coimbatore	Kinathukatavu	77.0379	10.7765	Farm Pond
65	Coimbatore	Kinathukatavu	77.0449	10.7797	Farm Pond
66	Coimbatore	Kinathukatavu	77.0572	10.7790	Farm Pond
67	Coimbatore	Kinathukatavu	77.0652	10.7782	Farm Pond
68	Coimbatore	Kinathukatavu	77.0476	10.7748	Farm Pond
69	Coimbatore	Kolarpatti	77.043	10.622	Nalla Bund
70	Coimbatore	Kolarpatti	77.127	10.638	Nalla Bund
71	Coimbatore	Kolarpatti	77.131	10.664	Nalla Bund

72	Coimbatore	Kolarpatti	77.044	10.661	Check Dam
73	Coimbatore	Kolarpatti	77.042	10.616	Check Dam
74	Coimbatore	Kolarpatti	77.138	10.651	Check Dam
75	Coimbatore	Kolarpatti	77.041	10.616	Check Dam
76	Coimbatore	Kolarpatti	77.146	10.657	Desiltation with Recharge Shaft
77	Coimbatore	Kolarpatti	77.140	10.645	Desiltation with Recharge Shaft
78	Coimbatore	Kolarpatti	77.132	10.613	Desiltation with Recharge Shaft
79	Coimbatore	Kolarpatti	77.117	10.598	Desiltation with Recharge Shaft
80	Coimbatore	Kolarpatti	77.1428	10.6662	Farm Pond
81	Coimbatore	Kolarpatti	77.1126	10.6710	Farm Pond
82	Coimbatore	Kolarpatti	77.1030	10.6683	Farm Pond
83	Coimbatore	Kolarpatti	77.1132	10.6615	Farm Pond
84	Coimbatore	Kolarpatti	77.0328	10.6604	Farm Pond
85	Coimbatore	Kolarpatti	77.1212	10.6573	Farm Pond
86	Coimbatore	Kolarpatti	77.1097	10.6499	Farm Pond
87	Coimbatore	Kolarpatti	77.0896	10.6553	Farm Pond
88	Coimbatore	Kolarpatti	77.1393	10.6430	Farm Pond
89	Coimbatore	Kolarpatti	77.1269	10.6501	Farm Pond
90	Coimbatore	Kolarpatti	77.0262	10.6286	Farm Pond
91	Coimbatore	Kolarpatti	77.1213	10.6433	Farm Pond
92	Coimbatore	Kolarpatti	77.0983	10.6412	Farm Pond
93	Coimbatore	Kolarpatti	77.0835	10.6210	Farm Pond
94	Coimbatore	Kolarpatti	77.1495	10.6282	Farm Pond
95	Coimbatore	Kolarpatti	77.1167	10.6270	Farm Pond
96	Coimbatore	Kolarpatti	77.0580	10.6127	Farm Pond
97	Coimbatore	Kolarpatti	77.0335	10.6125	Farm Pond
98	Coimbatore	Kolarpatti	77.0981	10.6126	Farm Pond
99	Coimbatore	Kolarpatti	77.0907	10.6134	Farm Pond
100	Coimbatore	Kolarpatti	77.1099	10.6094	Farm Pond
101	Coimbatore	Kolarpatti	77.0988	10.6006	Farm Pond
102	Coimbatore	Kottur	77.034	10.519	Nalla Bund
103	Coimbatore	Kottur	77.024	10.522	Nalla Bund
104	Coimbatore	Kottur	77.073	10.513	Nalla Bund
105	Coimbatore	Kottur	77.018	10.525	Check Dam
106	Coimbatore	Kottur	77.036	10.533	Check Dam
107	Coimbatore	Kottur	77.040	10.502	Check Dam
108	Coimbatore	Kottur	76.938	10.477	Desiltation with Recharge Shaft
109	Coimbatore	Kottur	77.0257	10.5891	Farm Pond
110	Coimbatore	Kottur	76.9771	10.5645	Farm Pond

111	Coimbatore	Kottur	77.0149	10.5807	Farm Pond
112	Coimbatore	Kottur	77.0723	10.5694	Farm Pond
113	Coimbatore	Kottur	77.0245	10.5755	Farm Pond
114	Coimbatore	Kottur	77.0105	10.5691	Farm Pond
115	Coimbatore	Kottur	77.0471	10.5595	Farm Pond
116	Coimbatore	Kottur	77.0874	10.5476	Farm Pond
117	Coimbatore	Kottur	77.0137	10.5518	Farm Pond
118	Coimbatore	Kottur	77.0544	10.5447	Farm Pond
119	Coimbatore	Kottur	76.9988	10.5425	Farm Pond
120	Coimbatore	Kottur	77.0349	10.5401	Farm Pond
121	Coimbatore	Kottur	77.0143	10.5396	Farm Pond
122	Coimbatore	Kottur	76.9982	10.5358	Farm Pond
123	Coimbatore	Kottur	77.0095	10.5367	Farm Pond
124	Coimbatore	Kottur	76.9768	10.5253	Farm Pond
125	Coimbatore	Kottur	77.0857	10.5246	Farm Pond
126	Coimbatore	Kottur	77.0235	10.5255	Farm Pond
127	Coimbatore	Kottur	77.0069	10.5297	Farm Pond
128	Coimbatore	Kottur	76.9936	10.5246	Farm Pond
129	Coimbatore	Kottur	77.0014	10.5103	Farm Pond
130	Coimbatore	Kottur	76.9518	10.4972	Farm Pond
131	Coimbatore	Kovilpalayam	76.944	10.795	Nalla Bund
132	Coimbatore	Kovilpalayam	76.949	10.787	Check Dam
133	Coimbatore	Kovilpalayam	77.028	10.764	Desiltation with Recharge Shaft
134	Coimbatore	Kovilpalayam	76.9668	10.8071	Farm Pond
135	Coimbatore	Kovilpalayam	77.0699	10.7902	Farm Pond
136	Coimbatore	Kovilpalayam	77.0246	10.7852	Farm Pond
137	Coimbatore	Kovilpalayam	77.0762	10.7788	Farm Pond
138	Coimbatore	Kovilpalayam	77.0379	10.7765	Farm Pond
139	Coimbatore	Kovilpalayam	77.0572	10.7790	Farm Pond
140	Coimbatore	Kovilpalayam	77.0652	10.7782	Farm Pond
141	Coimbatore	Kovilpalayam	77.0476	10.7748	Farm Pond
142	Coimbatore	Kovilpalayam	77.0822	10.7698	Farm Pond
143	Coimbatore	Kovilpalayam	77.0394	10.7667	Farm Pond
144	Coimbatore	Kovilpalayam	77.0553	10.7663	Farm Pond
145	Coimbatore	Kovilpalayam	77.0698	10.7508	Farm Pond
146	Coimbatore	Kovilpalayam	77.0472	10.7559	Farm Pond
147	Coimbatore	Kovilpalayam	77.0896	10.7556	Farm Pond
148	Coimbatore	Kovilpalayam	76.9979	10.7514	Farm Pond
149	Coimbatore	Kovilpalayam	76.9850	10.7466	Farm Pond

150	Coimbatore	Kovilpalayam	77.0382	10.7426	Farm Pond
151	Coimbatore	Kovilpalayam	77.0718	10.7343	Farm Pond
152	Coimbatore	Kovilpalayam	77.0163	10.7339	Farm Pond
153	Coimbatore	Kovilpalayam	77.0636	10.7324	Farm Pond
154	Coimbatore	Kovilpalayam	77.0327	10.7185	Farm Pond
155	Coimbatore	Kovilpalayam	77.0477	10.7181	Farm Pond
156	Coimbatore	Madukkarai	76.930	10.910	Nalla Bund
157	Coimbatore	Madukkarai	76.925	10.906	Nalla Bund
158	Coimbatore	Madukkarai	76.942	10.842	Nalla Bund
159	Coimbatore	Madukkarai	76.841	10.519	Nalla Bund
160	Coimbatore	Madukkarai	76.849	10.516	Nalla Bund
161	Coimbatore	Madukkarai	76.955	10.928	Nalla Bund
162	Coimbatore	Madukkarai	76.884	10.874	Nalla Bund
163	Coimbatore	Madukkarai	76.884	10.896	Nalla Bund
164	Coimbatore	Madukkarai	77.057	10.505	Nalla Bund
165	Coimbatore	Madukkarai	76.929	10.910	Nalla Bund
166	Coimbatore	Madukkarai	76.839	10.556	Nalla Bund
167	Coimbatore	Madukkarai	76.924	10.934	Nalla Bund
168	Coimbatore	Madukkarai	76.860	10.885	Check Dam
169	Coimbatore	Madukkarai	76.903	10.883	Check Dam
170	Coimbatore	Madukkarai	76.907	10.852	Check Dam
171	Coimbatore	Madukkarai	76.840	10.863	Check Dam
172	Coimbatore	Madukkarai	76.944	10.905	Check Dam
173	Coimbatore	Madukkarai	76.899	10.911	Check Dam
174	Coimbatore	Madukkarai	77.027	10.504	Check Dam
175	Coimbatore	Madukkarai	76.945	10.929	Check Dam
176	Coimbatore	Madukkarai	76.900	10.898	Check Dam
177	Coimbatore	Madukkarai	76.846	10.514	Check Dam
178	Coimbatore	Madukkarai	76.989	10.902	Desiltation with Recharge Shaft
179	Coimbatore	Madukkarai	76.886	10.881	Desiltation with Recharge Shaft
180	Coimbatore	Madukkarai	76.921	10.876	Desiltation with Recharge Shaft
181	Coimbatore	Madukkarai	76.830	10.870	Desiltation with Recharge Shaft
182	Coimbatore	Madukkarai	76.908	10.851	Desiltation with Recharge Shaft
183	Coimbatore	Madukkarai	76.889	10.836	Desiltation with Recharge Shaft
184	Coimbatore	Madukkarai	76.892	10.830	Desiltation with Recharge Shaft
185	Coimbatore	Madukkarai	76.898	10.829	Desiltation with Recharge Shaft
186	Coimbatore	Madukkarai	76.874	10.828	Desiltation with Recharge Shaft
187	Coimbatore	Madukkarai	76.861	10.824	Desiltation with Recharge Shaft
188	Coimbatore	Madukkarai	76.888	10.819	Desiltation with Recharge Shaft

189	Coimbatore	Madukkarai	76.889	10.817	Desiltation with Recharge Shaft
190	Coimbatore	Madukkarai	76.9884	10.9012	Farm Pond
191	Coimbatore	Madukkarai	76.9646	10.8932	Farm Pond
192	Coimbatore	Madukkarai	76.9766	10.8827	Farm Pond
193	Coimbatore	Madukkarai	76.8747	10.8387	Farm Pond
194	Coimbatore	Madukkarai	76.9459	10.8420	Farm Pond
195	Coimbatore	Madukkarai	76.9187	10.8339	Farm Pond
196	Coimbatore	Madukkarai	76.9269	10.8291	Farm Pond
197	Coimbatore	Madukkarai	76.8791	10.8197	Farm Pond
198	Coimbatore	Madukkarai	76.9019	10.8162	Farm Pond
199	Coimbatore	Madukkarai	76.8947	10.8221	Farm Pond
200	Coimbatore	Marchinaickenpalayam	76.857	10.549	Nalla Bund
201	Coimbatore	Marchinaickenpalayam	76.847	10.527	Nalla Bund
202	Coimbatore	Marchinaickenpalayam	76.859	10.519	Check Dam
203	Coimbatore	Marchinaickenpalayam	77.056	10.513	Check Dam
204	Coimbatore	Marchinaickenpalayam	76.847	10.572	Check Dam
205	Coimbatore	Marchinaickenpalayam	77.052	10.503	Check Dam
206	Coimbatore	Marchinaickenpalayam	76.862	10.595	Check Dam
207	Coimbatore	Marchinaickenpalayam	76.932	10.632	Check Dam
208	Coimbatore	Marchinaickenpalayam	76.863	10.595	Desiltation with Recharge Shaft
209	Coimbatore	Marchinaickenpalayam	76.924	10.581	Desiltation with Recharge Shaft
210	Coimbatore	Marchinaickenpalayam	76.907	10.569	Desiltation with Recharge Shaft
211	Coimbatore	Marchinaickenpalayam	76.9148	10.6636	Farm Pond
212	Coimbatore	Marchinaickenpalayam	76.9286	10.6630	Farm Pond
213	Coimbatore	Marchinaickenpalayam	76.8883	10.6567	Farm Pond
214	Coimbatore	Marchinaickenpalayam	76.9253	10.6556	Farm Pond
215	Coimbatore	Marchinaickenpalayam	76.9381	10.6505	Farm Pond
216	Coimbatore	Marchinaickenpalayam	76.9002	10.6504	Farm Pond
217	Coimbatore	Marchinaickenpalayam	76.9186	10.6470	Farm Pond
218	Coimbatore	Marchinaickenpalayam	76.9114	10.6417	Farm Pond
219	Coimbatore	Marchinaickenpalayam	76.8826	10.6360	Farm Pond
220	Coimbatore	Marchinaickenpalayam	76.9089	10.6314	Farm Pond
221	Coimbatore	Marchinaickenpalayam	76.9137	10.6155	Farm Pond
222	Coimbatore	Marchinaickenpalayam	76.8814	10.6204	Farm Pond
223	Coimbatore	Marchinaickenpalayam	76.8275	10.6216	Farm Pond
224	Coimbatore	Marchinaickenpalayam	76.8553	10.6216	Farm Pond
225	Coimbatore	Marchinaickenpalayam	76.8915	10.6162	Farm Pond
226	Coimbatore	Marchinaickenpalayam	76.9298	10.6173	Farm Pond
227	Coimbatore	Marchinaickenpalayam	76.8216	10.6160	Farm Pond

228	Coimbatore	Marchinaickenpalayam	76.9342	10.6177	Farm Pond
229	Coimbatore	Marchinaickenpalayam	76.8583	10.6165	Farm Pond
230	Coimbatore	Marchinaickenpalayam	76.8295	10.6126	Farm Pond
231	Coimbatore	Marchinaickenpalayam	76.8979	10.6134	Farm Pond
232	Coimbatore	Marchinaickenpalayam	76.9016	10.6098	Farm Pond
233	Coimbatore	Marchinaickenpalayam	76.9074	10.6112	Farm Pond
234	Coimbatore	Marchinaickenpalayam	76.8259	10.6033	Farm Pond
235	Coimbatore	Marchinaickenpalayam	76.9155	10.6027	Farm Pond
236	Coimbatore	Marchinaickenpalayam	76.9125	10.5888	Farm Pond
237	Coimbatore	Marchinaickenpalayam	76.8922	10.5821	Farm Pond
238	Coimbatore	Marchinaickenpalayam	76.9224	10.5738	Farm Pond
239	Coimbatore	Marchinaickenpalayam	76.9012	10.5690	Farm Pond
240	Coimbatore	Marchinaickenpalayam	76.9139	10.5715	Farm Pond
241	Coimbatore	Ottakkal Mandabam	77.005	10.894	Nalla Bund
242	Coimbatore	Ottakkal Mandabam	77.039	10.940	Nalla Bund
243	Coimbatore	Ottakkal Mandabam	77.011	10.886	Nalla Bund
244	Coimbatore	Ottakkal Mandabam	77.054	10.949	Desiltation with Recharge Shaft
245	Coimbatore	Ottakkal Mandabam	77.024	10.943	Desiltation with Recharge Shaft
246	Coimbatore	Ottakkal Mandabam	77.037	10.941	Desiltation with Recharge Shaft
247	Coimbatore	Ottakkal Mandabam	77.044	10.933	Desiltation with Recharge Shaft
248	Coimbatore	Ottakkal Mandabam	77.026	10.932	Desiltation with Recharge Shaft
249	Coimbatore	Ottakkal Mandabam	77.057	10.926	Desiltation with Recharge Shaft
250	Coimbatore	Ottakkal Mandabam	77.041	10.911	Desiltation with Recharge Shaft
251	Coimbatore	Ottakkal Mandabam	77.047	10.897	Desiltation with Recharge Shaft
252	Coimbatore	Ottakkal Mandabam	77.041	10.892	Desiltation with Recharge Shaft
253	Coimbatore	Ottakkal Mandabam	76.946	10.878	Desiltation with Recharge Shaft
254	Coimbatore	Ottakkal Mandabam	76.964	10.876	Desiltation with Recharge Shaft
255	Coimbatore	Ottakkal Mandabam	76.952	10.861	Desiltation with Recharge Shaft
256	Coimbatore	Ottakkal Mandabam	76.994	10.856	Desiltation with Recharge Shaft
257	Coimbatore	Ottakkal Mandabam	77.0375	10.9438	Farm Pond
258	Coimbatore	Ottakkal Mandabam	77.0458	10.9138	Farm Pond
259	Coimbatore	Ottakkal Mandabam	76.9884	10.9012	Farm Pond
260	Coimbatore	Ottakkal Mandabam	76.9766	10.8827	Farm Pond
261	Coimbatore	Ottakkal Mandabam	76.9852	10.8336	Farm Pond
262	Coimbatore	Perianegamam	77.103	10.719	Nalla Bund
263	Coimbatore	Perianegamam	77.110	10.700	Nalla Bund
264	Coimbatore	Perianegamam	77.127	10.696	Nalla Bund
265	Coimbatore	Perianegamam	77.080	10.644	Check Dam
266	Coimbatore	Perianegamam	77.117	10.733	Desiltation with Recharge Shaft

267	Coimbatore	Perianegamam	77.133	10.707	Desiltation with Recharge Shaft
268	Coimbatore	Perianegamam	77.126	10.705	Desiltation with Recharge Shaft
269	Coimbatore	Perianegamam	77.111	10.688	Desiltation with Recharge Shaft
270	Coimbatore	Perianegamam	77.1160	10.7738	Farm Pond
271	Coimbatore	Perianegamam	77.1262	10.7592	Farm Pond
272	Coimbatore	Perianegamam	77.0698	10.7508	Farm Pond
273	Coimbatore	Perianegamam	77.1025	10.7563	Farm Pond
274	Coimbatore	Perianegamam	77.0965	10.7551	Farm Pond
275	Coimbatore	Perianegamam	77.1301	10.7397	Farm Pond
276	Coimbatore	Perianegamam	77.0718	10.7343	Farm Pond
277	Coimbatore	Perianegamam	77.1327	10.7148	Farm Pond
278	Coimbatore	Perianegamam	77.0828	10.7170	Farm Pond
279	Coimbatore	Perianegamam	77.1084	10.7091	Farm Pond
280	Coimbatore	Perianegamam	77.1404	10.6836	Farm Pond
281	Coimbatore	Perianegamam	77.0793	10.6782	Farm Pond
282	Coimbatore	Perianegamam	77.1126	10.6710	Farm Pond
283	Coimbatore	Perianegamam	77.1030	10.6683	Farm Pond
284	Coimbatore	Perianegamam	77.1132	10.6615	Farm Pond
285	Coimbatore	Perianegamam	77.0835	10.6210	Farm Pond
286	Tiruppur	Periavalavadi	77.158	10.581	Nalla Bund
287	Tiruppur	Periavalavadi	77.111	10.532	Nalla Bund
288	Tiruppur	Periavalavadi	77.085	10.507	Nalla Bund
289	Tiruppur	Periavalavadi	77.154	10.554	Nalla Bund
290	Tiruppur	Periavalavadi	77.142	10.543	Nalla Bund
291	Tiruppur	Periavalavadi	77.145	10.519	Check Dam
292	Tiruppur	Periavalavadi	77.116	10.510	Check Dam
293	Tiruppur	Periavalavadi	77.147	10.530	Check Dam
294	Tiruppur	Periavalavadi	77.148	10.503	Check Dam
295	Tiruppur	Periavalavadi	77.162	10.546	Desiltation with Recharge Shaft
296	Tiruppur	Periavalavadi	77.102	10.541	Desiltation with Recharge Shaft
297	Tiruppur	Periavalavadi	77.148	10.538	Desiltation with Recharge Shaft
298	Tiruppur	Periavalavadi	77.170	10.530	Desiltation with Recharge Shaft
299	Tiruppur	Periavalavadi	77.0861	10.5820	Farm Pond
300	Tiruppur	Periavalavadi	77.0723	10.5694	Farm Pond
301	Tiruppur	Periavalavadi	77.1088	10.5672	Farm Pond
302	Tiruppur	Periavalavadi	77.1570	10.5703	Farm Pond
303	Tiruppur	Periavalavadi	77.0874	10.5476	Farm Pond
304	Tiruppur	Periavalavadi	77.0984	10.5480	Farm Pond
305	Tiruppur	Periavalavadi	77.0857	10.5246	Farm Pond

306	Tiruppur	Periavalavadi	77.1299	10.5181	Farm Pond
307	Tiruppur	Periavalavadi	77.1200	10.5141	Farm Pond
308	Tiruppur	Periavalavadi	77.0839	10.5013	Farm Pond
309	Tiruppur	Periavalavadi	77.1488	10.5020	Farm Pond
310	Coimbatore	Perur	76.897	10.921	Nalla Bund
311	Coimbatore	Perur	76.820	10.428	Nalla Bund
312	Coimbatore	Perur	76.909	10.905	Nalla Bund
313	Coimbatore	Perur	76.913	10.914	Nalla Bund
314	Coimbatore	Perur	76.851	10.517	Nalla Bund
315	Coimbatore	Perur	76.925	10.906	Nalla Bund
316	Coimbatore	Perur	76.930	10.910	Nalla Bund
317	Coimbatore	Perur	77.050	10.501	Nalla Bund
318	Coimbatore	Perur	76.922	10.913	Nalla Bund
319	Coimbatore	Perur	76.914	10.915	Check Dam
320	Coimbatore	Perur	76.934	10.925	Check Dam
321	Coimbatore	Perur	76.973	10.949	Desiltation with Recharge Shaft
322	Coimbatore	Perur	76.991	10.943	Desiltation with Recharge Shaft
323	Tiruppur	Pethappampatti	77.146	10.657	Desiltation with Recharge Shaft
324	Tiruppur	Pethappampatti	77.1301	10.7397	Farm Pond
325	Tiruppur	Pethappampatti	77.1395	10.7317	Farm Pond
326	Tiruppur	Pethappampatti	77.1327	10.7148	Farm Pond
327	Tiruppur	Pethappampatti	77.1404	10.6836	Farm Pond
328	Tiruppur	Pethappampatti	77.1428	10.6662	Farm Pond
329	Coimbatore	Pollachi(N)	77.029	10.718	Nalla Bund
330	Coimbatore	Pollachi(N)	77.007	10.710	Nalla Bund
331	Coimbatore	Pollachi(N)	77.069	10.684	Check Dam
332	Coimbatore	Pollachi(N)	76.975	10.731	Desiltation with Recharge Shaft
333	Coimbatore	Pollachi(N)	77.038	10.718	Desiltation with Recharge Shaft
334	Coimbatore	Pollachi(N)	77.0163	10.7339	Farm Pond
335	Coimbatore	Pollachi(N)	77.0019	10.7318	Farm Pond
336	Coimbatore	Pollachi(N)	77.0327	10.7185	Farm Pond
337	Coimbatore	Pollachi(N)	77.0477	10.7181	Farm Pond
338	Coimbatore	Pollachi(N)	77.0390	10.7167	Farm Pond
339	Coimbatore	Pollachi(N)	76.9858	10.7037	Farm Pond
340	Coimbatore	Pollachi(N)	77.0569	10.7096	Farm Pond
341	Coimbatore	Pollachi(N)	77.0533	10.6885	Farm Pond
342	Coimbatore	Pollachi(N)	77.0122	10.6727	Farm Pond
343	Coimbatore	Pollachi(N)	77.0262	10.6286	Farm Pond
344	Coimbatore	Pollachi(S)	77.028	10.628	Nalla Bund

345	Coimbatore	Pollachi(S)	77.030	10.594	Nalla Bund
346	Coimbatore	Pollachi(S)	77.030	10.594	Check Dam
347	Coimbatore	Pollachi(S)	76.969	10.666	Desiltation with Recharge Shaft
348	Coimbatore	Pollachi(S)	76.978	10.658	Desiltation with Recharge Shaft
349	Coimbatore	Pollachi(S)	77.0328	10.6604	Farm Pond
350	Coimbatore	Pollachi(S)	76.9545	10.6480	Farm Pond
351	Coimbatore	Pollachi(S)	77.0262	10.6286	Farm Pond
352	Coimbatore	Pollachi(S)	77.0835	10.6210	Farm Pond
353	Coimbatore	Pollachi(S)	76.9900	10.6149	Farm Pond
354	Coimbatore	Pollachi(S)	77.0580	10.6127	Farm Pond
355	Coimbatore	Pollachi(S)	76.9762	10.6119	Farm Pond
356	Coimbatore	Pollachi(S)	77.0335	10.6125	Farm Pond
357	Coimbatore	Pollachi(S)	77.0907	10.6134	Farm Pond
358	Coimbatore	Pollachi(S)	77.0988	10.6006	Farm Pond
359	Coimbatore	Pollachi(S)	76.9551	10.6065	Farm Pond
360	Coimbatore	Pollachi(S)	77.0257	10.5891	Farm Pond
361	Coimbatore	Pollachi(S)	77.0822	10.5984	Farm Pond
362	Coimbatore	Pollachi(S)	77.0534	10.5922	Farm Pond
363	Coimbatore	Pollachi(S)	77.0861	10.5820	Farm Pond
364	Coimbatore	Pollachi(S)	77.0848	10.5908	Farm Pond
365	Coimbatore	Pollachi(S)	77.0587	10.5867	Farm Pond
366	Coimbatore	Pollachi(S)	77.0723	10.5694	Farm Pond
367	Coimbatore	Pollachi(S)	77.0471	10.5595	Farm Pond
368	Coimbatore	Pollachi(S)	77.0874	10.5476	Farm Pond
369	Coimbatore	Pollachi(S)	77.0544	10.5447	Farm Pond
370	Coimbatore	Ramapattinam	76.928	10.770	Nalla Bund
371	Coimbatore	Ramapattinam	76.919	10.779	Nalla Bund
372	Coimbatore	Ramapattinam	76.902	10.673	Check Dam
373	Coimbatore	Ramapattinam	76.917	10.690	Check Dam
374	Coimbatore	Ramapattinam	76.933	10.655	Check Dam
375	Coimbatore	Ramapattinam	76.945	10.689	Check Dam
376	Coimbatore	Ramapattinam	76.888	10.674	Check Dam
377	Coimbatore	Ramapattinam	76.947	10.748	Desiltation with Recharge Shaft
378	Coimbatore	Ramapattinam	76.946	10.741	Desiltation with Recharge Shaft
379	Coimbatore	Ramapattinam	76.949	10.737	Desiltation with Recharge Shaft
380	Coimbatore	Ramapattinam	76.975	10.731	Desiltation with Recharge Shaft
381	Coimbatore	Ramapattinam	76.945	10.724	Desiltation with Recharge Shaft
382	Coimbatore	Ramapattinam	76.881	10.707	Desiltation with Recharge Shaft
383	Coimbatore	Ramapattinam	76.872	10.682	Desiltation with Recharge Shaft

384	Coimbatore	Ramapattinam	76.907	10.675	Desiltation with Recharge Shaft
385	Coimbatore	Ramapattinam	76.937	10.672	Desiltation with Recharge Shaft
386	Coimbatore	Ramapattinam	76.9668	10.8071	Farm Pond
387	Coimbatore	Ramapattinam	76.9850	10.7466	Farm Pond
388	Coimbatore	Ramapattinam	76.9513	10.7422	Farm Pond
389	Coimbatore	Ramapattinam	76.9349	10.7336	Farm Pond
390	Coimbatore	Ramapattinam	76.9276	10.7241	Farm Pond
391	Coimbatore	Ramapattinam	76.9383	10.7119	Farm Pond
392	Coimbatore	Ramapattinam	76.9288	10.7143	Farm Pond
393	Coimbatore	Ramapattinam	76.8960	10.6982	Farm Pond
394	Coimbatore	Ramapattinam	76.9858	10.7037	Farm Pond
395	Coimbatore	Ramapattinam	76.9139	10.7001	Farm Pond
396	Coimbatore	Ramapattinam	76.8824	10.6869	Farm Pond
397	Coimbatore	Ramapattinam	76.9416	10.6858	Farm Pond
398	Coimbatore	Ramapattinam	76.9334	10.6745	Farm Pond
399	Coimbatore	Ramapattinam	76.9551	10.6785	Farm Pond
400	Coimbatore	Ramapattinam	76.9226	10.6761	Farm Pond
401	Coimbatore	Ramapattinam	76.9505	10.6772	Farm Pond
402	Coimbatore	Ramapattinam	76.8968	10.6667	Farm Pond
403	Coimbatore	Ramapattinam	76.9148	10.6636	Farm Pond
404	Coimbatore	Ramapattinam	76.8880	10.6672	Farm Pond
405	Coimbatore	Ramapattinam	76.9286	10.6630	Farm Pond
406	Coimbatore	Ramapattinam	76.9047	10.6635	Farm Pond
407	Coimbatore	Ramapattinam	76.8920	10.6616	Farm Pond
408	Coimbatore	Ramapattinam	76.9513	10.6580	Farm Pond
409	Coimbatore	Ramapattinam	76.8883	10.6567	Farm Pond
410	Coimbatore	Ramapattinam	76.9253	10.6556	Farm Pond
411	Coimbatore	Ramapattinam	76.9410	10.6553	Farm Pond
412	Coimbatore	Ramapattinam	76.9381	10.6505	Farm Pond
413	Coimbatore	Ramapattinam	76.9545	10.6480	Farm Pond
414	Coimbatore	Selakkarichal	77.075	10.887	Nalla Bund
415	Coimbatore	Selakkarichal	77.066	10.894	Nalla Bund
416	Coimbatore	Selakkarichal	77.097	10.946	Desiltation with Recharge Shaft
417	Coimbatore	Selakkarichal	77.113	10.934	Desiltation with Recharge Shaft
418	Coimbatore	Selakkarichal	77.086	10.928	Desiltation with Recharge Shaft
419	Coimbatore	Selakkarichal	77.084	10.926	Desiltation with Recharge Shaft
420	Coimbatore	Selakkarichal	77.105	10.923	Desiltation with Recharge Shaft
421	Coimbatore	Selakkarichal	77.105	10.922	Desiltation with Recharge Shaft
422	Coimbatore	Selakkarichal	77.085	10.904	Desiltation with Recharge Shaft

423	Coimbatore	Selakkarichal	77.147	10.889	Desiltation with Recharge Shaft
424	Coimbatore	Selakkarichal	77.061	10.888	Desiltation with Recharge Shaft
425	Coimbatore	Selakkarichal	77.061	10.882	Desiltation with Recharge Shaft
426	Coimbatore	Selakkarichal	77.1051	10.9360	Farm Pond
427	Coimbatore	Selakkarichal	77.0989	10.9283	Farm Pond
428	Coimbatore	Selakkarichal	77.1124	10.9323	Farm Pond
429	Coimbatore	Selakkarichal	77.1147	10.9265	Farm Pond
430	Coimbatore	Selakkarichal	77.0986	10.9128	Farm Pond
431	Coimbatore	Selakkarichal	77.1021	10.9074	Farm Pond
432	Coimbatore	Selakkarichal	77.0515	10.8798	Farm Pond
433	Coimbatore	Vadachittur	77.066	10.863	Nalla Bund
434	Coimbatore	Vadachittur	77.132	10.821	Nalla Bund
435	Coimbatore	Vadachittur	77.067	10.869	Check Dam
436	Coimbatore	Vadachittur	77.158	10.834	Desiltation with Recharge Shaft
437	Coimbatore	Vadachittur	77.157	10.808	Desiltation with Recharge Shaft
438	Coimbatore	Vadachittur	77.105	10.796	Desiltation with Recharge Shaft
439	Coimbatore	Vadachittur	77.143	10.786	Desiltation with Recharge Shaft
440	Coimbatore	Vadachittur	77.0875	10.8714	Farm Pond
441	Coimbatore	Vadachittur	77.0580	10.8702	Farm Pond
442	Coimbatore	Vadachittur	77.0983	10.8653	Farm Pond
443	Coimbatore	Vadachittur	77.0603	10.8601	Farm Pond
444	Coimbatore	Vadachittur	77.0743	10.8433	Farm Pond
445	Coimbatore	Vadachittur	77.0443	10.8324	Farm Pond
446	Coimbatore	Vadachittur	77.0535	10.8477	Farm Pond
447	Coimbatore	Vadachittur	77.1376	10.8474	Farm Pond
448	Coimbatore	Vadachittur	77.0967	10.8451	Farm Pond
449	Coimbatore	Vadachittur	77.1267	10.8421	Farm Pond
450	Coimbatore	Vadachittur	77.1058	10.8379	Farm Pond
451	Coimbatore	Vadachittur	77.1275	10.8339	Farm Pond
452	Coimbatore	Vadachittur	77.1150	10.8302	Farm Pond
453	Coimbatore	Vadachittur	77.0951	10.8289	Farm Pond
454	Coimbatore	Vadachittur	77.1492	10.8226	Farm Pond
455	Coimbatore	Vadachittur	77.0880	10.8231	Farm Pond
456	Coimbatore	Vadachittur	77.1288	10.8244	Farm Pond
457	Coimbatore	Vadachittur	77.1115	10.8111	Farm Pond
458	Coimbatore	Vadachittur	77.0929	10.8126	Farm Pond
459	Coimbatore	Vadachittur	77.0807	10.8181	Farm Pond
460	Coimbatore	Vadachittur	77.0705	10.8180	Farm Pond
461	Coimbatore	Vadachittur	77.0874	10.8160	Farm Pond

462	Coimbatore	Vadachittur	77.0751	10.8090	Farm Pond
463	Coimbatore	Vadachittur	77.0678	10.8054	Farm Pond
464	Coimbatore	Vadachittur	77.1509	10.8054	Farm Pond
465	Coimbatore	Vadachittur	77.0868	10.7989	Farm Pond
466	Coimbatore	Vadachittur	77.0646	10.7993	Farm Pond
467	Coimbatore	Vadachittur	77.0991	10.7920	Farm Pond
468	Coimbatore	Vadachittur	77.1470	10.7936	Farm Pond
469	Coimbatore	Vadachittur	77.0699	10.7902	Farm Pond
470	Coimbatore	Vadachittur	77.0898	10.7801	Farm Pond
471	Coimbatore	Vadachittur	77.0762	10.7788	Farm Pond
472	Coimbatore	Vadachittur	77.1351	10.7798	Farm Pond
473	Coimbatore	Vadachittur	77.1060	10.7786	Farm Pond
474	Coimbatore	Vadachittur	77.1160	10.7738	Farm Pond
475	Coimbatore	Vadachittur	77.1263	10.7727	Farm Pond
476	Coimbatore	Vadachittur	77.1315	10.7751	Farm Pond
477	Coimbatore	Vadachittur	77.1103	10.7708	Farm Pond
478	Coimbatore	Vadachittur	77.1324	10.7710	Farm Pond
479	Coimbatore	Vadachittur	77.0822	10.7698	Farm Pond
480	Coimbatore	Vadachittur	77.1262	10.7592	Farm Pond
481	Coimbatore	Vadachittur	77.0990	10.7594	Farm Pond
482	Coimbatore	Vadachittur	77.1025	10.7563	Farm Pond
483	Coimbatore	Vadachittur	77.0896	10.7556	Farm Pond
484	Coimbatore	Vadachittur	77.0965	10.7551	Farm Pond
485	Coimbatore	Valparai	76.949	10.338	Desiltation with Recharge Shaft
486	Coimbatore	Valparai	76.851	10.364	Desiltation with Recharge Shaft
487	Coimbatore	Valparai	77.0235	10.5255	Farm Pond
488	Coimbatore	Valparai	77.0014	10.5103	Farm Pond