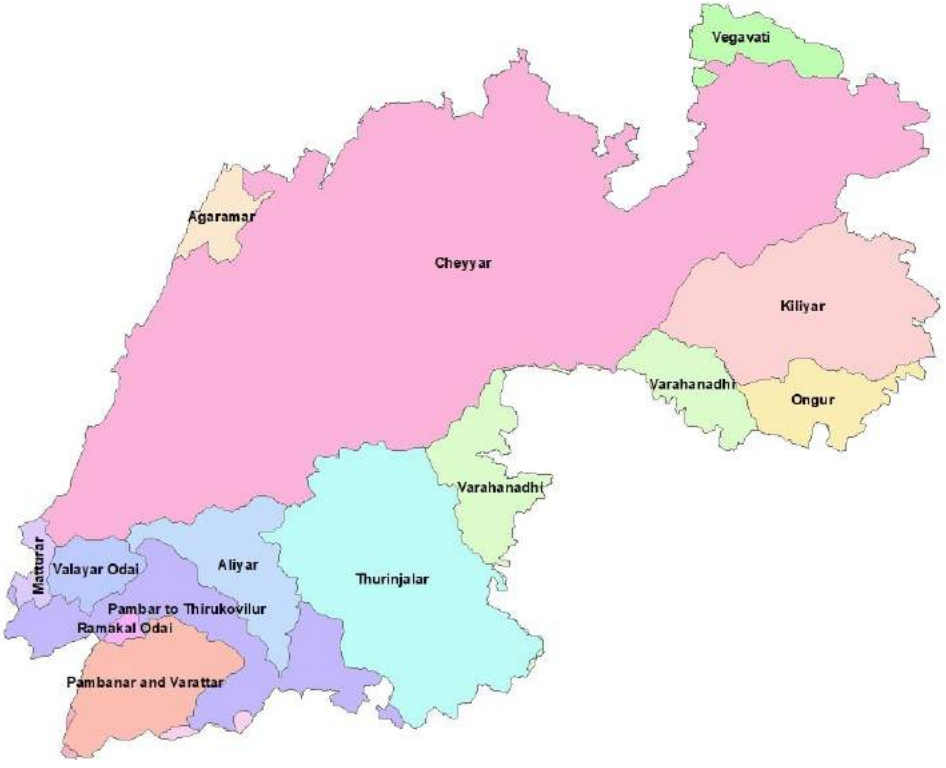
Ministry of Rural Development

Ministry of Jal Shakthi

Water Security and Climate Adaptation in Rural India - Tamil Nadu



District Composite Water Resource Management Plan Report

15 February 2021

District Rural Development Agency (DRDA),Tiruvannamalai

Published by:
Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

District Rural Development Authority
Tiruvannamalai

Registered offices:
Bonn and Eschborn, Germany
Water Security and Climate Adaptation in Rural India
A2/18, Safdarjung Enclave
New Delhi 110 029, India
T : +91 11 4949 5353. F : + 91 11 4949 5391
E : info@giz.de
I : www.giz.de

Responsible:
Rajeev Ahal
Director, Natural Resource Management and Agroecology
E: rajeev.ahal@giz.de
GIZ India

Ms.P.Jeyasudha
Project Director
Tiruvannamalai
E:drdatvm@nic.in

Authors:
GIZ
Mr. V.R. Sowmithri, Dr P.Radha Priya

MSSRF
Dr R. Rengalakshmi, Mr.R.Nagarajan, Mr.P.Nandeesa, Mr.Samu Jebaraj, Ms.Madumita, S.Kannappan, Ms.R.Yogalakshmi, Ms.S.Punitha, Mr. Sivakumar, Mr.Arun Siddharth, Mr.M.Karunamoorthi, R.Srinivasan

State Ground and Surface Water Resources Data Centre, Taramani, Chennai
Mr. S. Raja

Content Review and Support:
District Rural Development Authority, Tiruvannamalai
Er. S. Thanikachalam, Er A. Sundaresan, Er K.Harikrishnan

GIZ, New Delhi
Ms. Regler Astrid, Ms. Aravalli Rajasindhura

Technical Partner: M S Swaminathan Research Foundation

Design and Layout: GIZ, New Delhi

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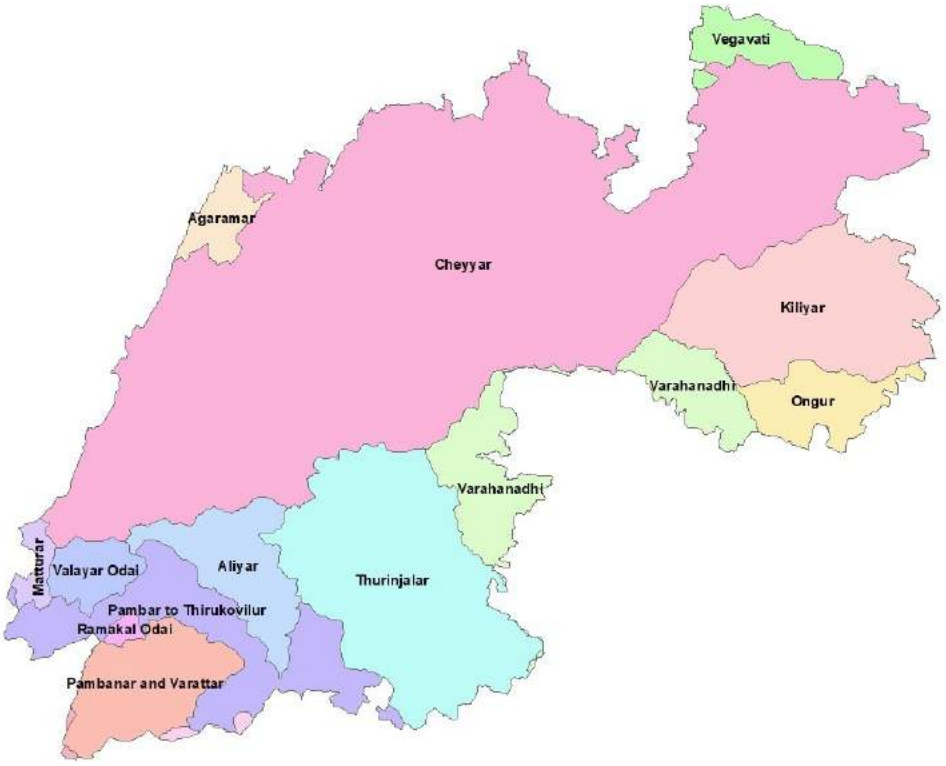
On behalf of
German Federal Ministry for Economic Cooperation and Development (BMZ)

GIZ is responsible for the content of this publication.
New Delhi, India

February 2021



District Composite Water Resource Management Plan Report

15 February 2021

District Rural Development Agency (DRDA),Tiruvannamalai

Foreword

Agriculture is the primary livelihood of more than 75% of the district population and about 95% of the farmers are marginal and small holders. It is important to note here that 69% of the total cultivated area is under irrigated condition using ground water. However, as the district has more than 70% of the firkas under over exploited category of ground water development careful planning of water harvesting, storage and use dimensions are important in the water resources management. In the context of increasing climate variability and climate change, the available surface runoff, ground water, soil moisture and management of evapotranspiration are to be considered in an integrated manner for arriving water budget on the supply side.

The WASCA, the Indo-German project on Water Security and Climate Adaptation in Rural India is in partnership with Ministry of Rural Development and Ministry of Jal Shakti and is implemented in five states namely, Tamil Nadu, Rajasthan, Madhya Pradesh, Uttar Pradesh and Karnataka. In Tamil Nadu, the project is implemented in two districts; Ramanathapuram and Tiruvannamalai. The duration of the project is for three years (2019-2022) and in Ramanathapuram it was started in Dec 2019. The core objective of the initiative is to accelerate the climate-resilient water resource management practices in the district.

In Tiruvannamalai district the Composite Water Resources Management (CWRM) planning framework is adopted in the project and recently 860 Gram Panchayat based plans have been developed. The planning process followed a bottom-up approach in identifying appropriate actions based on scientific analysis from Gram Panchayat level using social, hydrological and bio-physical data sets and further integrated and consolidated at block and district levels.

I hope this CWRM based planning will be of great use in strengthening the water resources of the district and ensure access to water to all sectors in the district.

Best wishes,

Sandeep Nanduri, I.A.S.
District Collector,
Tiruvannamalai

Foreword

The Water Security and Climate Adaptation in Rural India (WASCA), a bi-lateral project commissioned by the German Federal Ministry for Economic Cooperation and Development in partnership with the Ministry of Rural Development (MoRD) and Ministry of Jal Shakti (MoJS) has been implemented in Tiruvannamalai district of Tamil Nadu. The project was initiated in February 2020 in the district with the consultations at district levels. WASCA is implemented in the state of Tamil Nadu by Department of Rural Development and Panchayat Raj at state level through MGNREGS and District Rural Development Agency (DRDA) at the district level. GIZ providing technical cooperation through capacity development.

The main objective of WASCA is to enhance the water resources of the district by improving the planning, financing and implementation mechanisms in convergence and participation of all stakeholders, including private sector to achieve water security and adapt to the changing climate. The key strategies and pathways planned to achieve the objectives of WASCA in the district are for enhancing financial investments in water resources and promoting climate resilient, water efficient production systems, ground water recharge and strengthening livelihoods of rural marginalised poor, especially women and small farmers.

WASCA, is promoting a scientific and innovative approach of planning in water resources management at the Gram Panchayat level using hydrological and geo-spatial data and tools across all GPs in the district. The project completed 860 Composite Water Resources Management Plans and implementation of these plans will be taken up shortly with technical support of GIZ and partnering agencies – M.S. Swaminathan Research Foundation, Prime Meridian and CCCDM, Anna University and active participation of line departments and directions of District and State Level Steering Committees on WASCA. The CWRM plans will provide opportunity for undertaking convergence works in water harvesting, recharge benefiting current demands, future water requirements and natural resources development. The augmentation of water resources will also inspire and motivate farmers to sustain in farming and achieve higher production and income.

Best wishes,

P. Jeyasudha, M.Sc., B.Ed.,
Joint Director/Project Director, District Rural Development Agency
Tiruvannamalai, Tamil Nadu

Contents

Acronyms and Abbreviations

ADRD - Additional Director for Rural Development
BMZ - German Federal Ministry for Economic Cooperation and Development
CCCDM - Centre for Climate Change and Disaster Management
CII - Confederation of Indian Industries
CVI - Cumulative Vulnerability Index
CWRM - Composite Water Resources Management
DLSC - District Level Steering Committee
DRDA - District Rural Development Agency
GIS - Geographical Information System
GIZ - Deutsche Gesellschaft für Internationale Zusammenarbeit
Ha M - Hectare Metre
IWRM - Integrated Water Resources Management
MCM - Million Cubic Metre
MGNREGA - Mahatma Gandhi Rural Employment Guarantee Act
MOJS - Ministry of Jal Shakti
MORD - Ministry of Rural Development
MSSRF - M.S. Swaminathan Research Foundation
NABARD - National Bank for Agriculture and Rural Development
NGO - Non-Governmental Organization
RDPR - Rural Development and Panchayati Rai
SDG - Sustainable Development Goal
SDMRI - G Suganthi Devadasan Marine Resources Institute
SE - Superintendent Engineer
SLSC - State Level Steering Committee
TCM - Thousand Million Cubic feet
TN SAP - Tamil Nadu State Action Plan for Climate Change
WASCA - Water Security and Climate Adaptation in Rural Areas

Chapter 1. WASCA project overview

1.1 WASCA: An Introduction

Better water management needs comprehensive planning, and management at all levels is a crucial part in sustainable water security. The Indo-German Project Water Security and Climate Adaptation in Rural India (WASCA), is a bi-lateral project commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ) in partnership with the Ministry of Rural Development (MoRD) and Ministry of Jal Shakti (MoJS) is implemented by GIZ (Represented by Govt of Germany).

The project period is three years from April 2019 to March 2022. As part of this project, water resources management is enhanced through an integrated approach at National, State and Local level and is operational in five States – Madhya Pradesh, Rajasthan, Tamil Nadu, Uttar Pradesh and Karnataka – in 13,000+ villages in 10 districts (Fig 1.1). The project includes land and soil development, water harvesting and conservation, and protection against extreme weather events, such as drought and flooding, thus creating significant climate adaptation and mitigation co-benefits. The Ministry of Jal Shakti, the nodal ministry for water in India, brings together National agencies working on water including National Water Mission, Central Water Commission, Central Ground Water Board, River Boards, Department of Drinking Water and Sanitation, Atal Bhujal Yojana for groundwater management and Jal Jeevan Mission to enhance the scope for WASCA interventions in rural India.

Figure 1.1. Locations of WASCA project

The project aims to improve water resource management through an integrated approach, Composite Water Resources Management (CWRM) Planning at national, state and local levels with respect to water security and climate adaptation (Fig 1.2).

The Project WASCA seeks to address planning, financing and implementation mechanisms developed in the field of rural water resource management and climate change adaptation. It aims for the following three output areas:

1) Improved convergence of existing planning and financing approaches to strengthen water security.
2) Demonstration of convergent planning, financing and implementation at local level and
3) Co-operation with the private sector.

1.2) WASCA scoping study and Climate Vulnerability Indicators

In the state of Tamil Nadu, GIZ conducted a scoping study during July-Oct 2019, with the technical support of Centre for Climate Change and Disaster Management (CCCDM), Anna University, which studied the State's rural water security through a systematic analysis via availability, accessibility of water and its governance through climate lens at the district scale. At present, the State is one of the water deprived states in India, which is clearly evident from the fast decline in the per capita availability of water in Tamil Nadu and the current per capita water availability is well below the National average of 1,544 cubic meters.

Fig. 1.2 Components of CWRM approach

The scoping study used 18 different biophysical, socio-economic indicators under 4 dimensions via climate (5), water (5), agriculture (4) and socio-demographic (4) and have been composed and categorised into adaptive capacity, sensitivity and exposure indicators for the analysis. Following are the details of the 18 indicators used in the vulnerability assessment at the scale of district level (Table 1.1).

Table 1.1. List of Biophysical and socio-economic indicators used in vulnerability assessment Vis-a- vis CWRM data

Water Security & Climate Adaptation: Tamil Nadu: Vulnerability Index & Key Water Action				
S NO	**Climate Vulnerability Area for WASCA**	**WASCA Climate Vulnerability Indicators**	**Climate Vulnerability Indicator**	**Unit for Assessment**
(1)	**(2)**	**(3)**	**(4)**	**(5)**
1	**Climate**	changes in max T	C1	Degree Celsius
2		changes in min T	C2	Degree Celsius
3		changes in RF	C3	%
4		Excess rainfall years	C4	No. of Years
5	**Water Resource**	Deficient rainfall years	W1	No. of Years
6		Ground water extraction	W2	%
7		Ground water Recharge	W3	in cubic meter
8		surface water availability	W4	Mm
9		water gap	W5	MCM
10		% of contamination	W6	%

11	**Agriculture**	Rainfed area	A1	%
12		Cropping intensity	A2	%
13		Soil moisture	A3	kg/m2
14		Evapotranspiration	A4	kg/m2/s
15	**Socio-economic**	Rural proportion	S1	%
16		Multidimensional poverty index	S2	Index Value
17		source of drinking water within premises in rural	S3	%
18		marginal farmer_ landholdings	S4	%
Source: Scoping study, GIZ, CCCDM, Anna University, Chennai for WASCA- TN, GIZ, Nov 2019				

The Composite Vulnerability Index was prepared using the above 18 indicators and ranked the different districts (Table 1.2).

Table 1.2 WASCA - TN: Climate Vulnerability Indicator: CWRM Planning Tiruvannamalai District

Climate Vulnerability Area	Climate Vulnerability Indicator	Computed Composite Index Value	
		Functional Relationship with Climate Vulnerability	CVI Value
(1)	(2)	(3)	(4)
Socio Economic Vulnerability	Rural proportion	A	0.73
	Multidimensional poverty index	A	0.794
	source of drinking water within premises in rural	B	0.98
	Small & marginal Farmer landholdings	A	0.822
Agriculture Vulnerability	Rainfed area	A	0.656
	Cropping intensity	B	1
	Soil moisture	B	0.808
	Evapotranspiration	A	0.714
Water Resources Vulnerability	Ground water extraction	A	0
	Ground water Recharge	B	0.687
	surface water availability	B	0.992
	water gap	A	0.379
	% of contamination	A	0.565

Climate Vulnerability	changes in maxT	A	0.817
	changes in minT	A	0.437
	changes in RF	A	0.731
	Excess rainfall years	A	0.5
	Deficient rainfall years	A	1
WASCA - TN: Climate Vulnerability Index Range for all Districts of TN: 0-1			
A : Higher Value high vulnerability			
B : Lower Value High vulnerability			
Source: Scoping Study, CCCDM, Anna University for WASCA-TN, GIZ, Nov, 2019			

The districts; Ramanathapuram, Dharmapuri, Perambalur, and Tiruvannamalai are ranked high in cumulative vulnerability index (CVI) and the CVI values are 0.7, 0.64, 0.62 and 0.61, respectively (Table 1.3).

Table 1.3. Ranking of Highly Vulnerable districts in the states based on CVI values

Districts	Climate	Water Resource	Agriculture	Socio-economic
(1)	(2)	(3)	(4)	(5)
Ramanathapuram	4	16	1	13
Dharmapuri	28	1	9	11
Perambalur	18	12	6	7
Tiruvannamalai	6	11	17	5
Source: Scoping Study, CCCDM, Anna University for WASCA-TN, GIZ, Nov, 2019				

Meeting with CCCDM, Anna University, Chennai team with ADRD and SE (MGNREGS), DRD, Chennai

Of the four highly vulnerable districts in the State, Ramanathapuram and Tiruvannamalai districts were prioritized for WASCA interventions (Fig 1.3) through approval by State Level Steering Committee on WASCA, headed by Additional Chief Secretary, Department of Rural Development & Panchayat Raj and Heads of all line department.

Of the two districts, Tiruvannamalai is the most vulnerable district in terms of

* exposure to climate extremities was very high during 1951-2015;
• wide gap between supply and demand - availability of water resources for productive and domestic use;
• agriculture vulnerability is very high and
• high socio-economic vulnerability.

The vulnerability will be further exacerbated in the changing climate scenarios in both mid (2050) and end century (2080). It is projected that there will be an increase in annual rainfall by 2050s and 2080s it will be +1.0% with respect to baseline (1970-2000) of 821 mm along with sharp increase in both minimum and maximum temperatures.

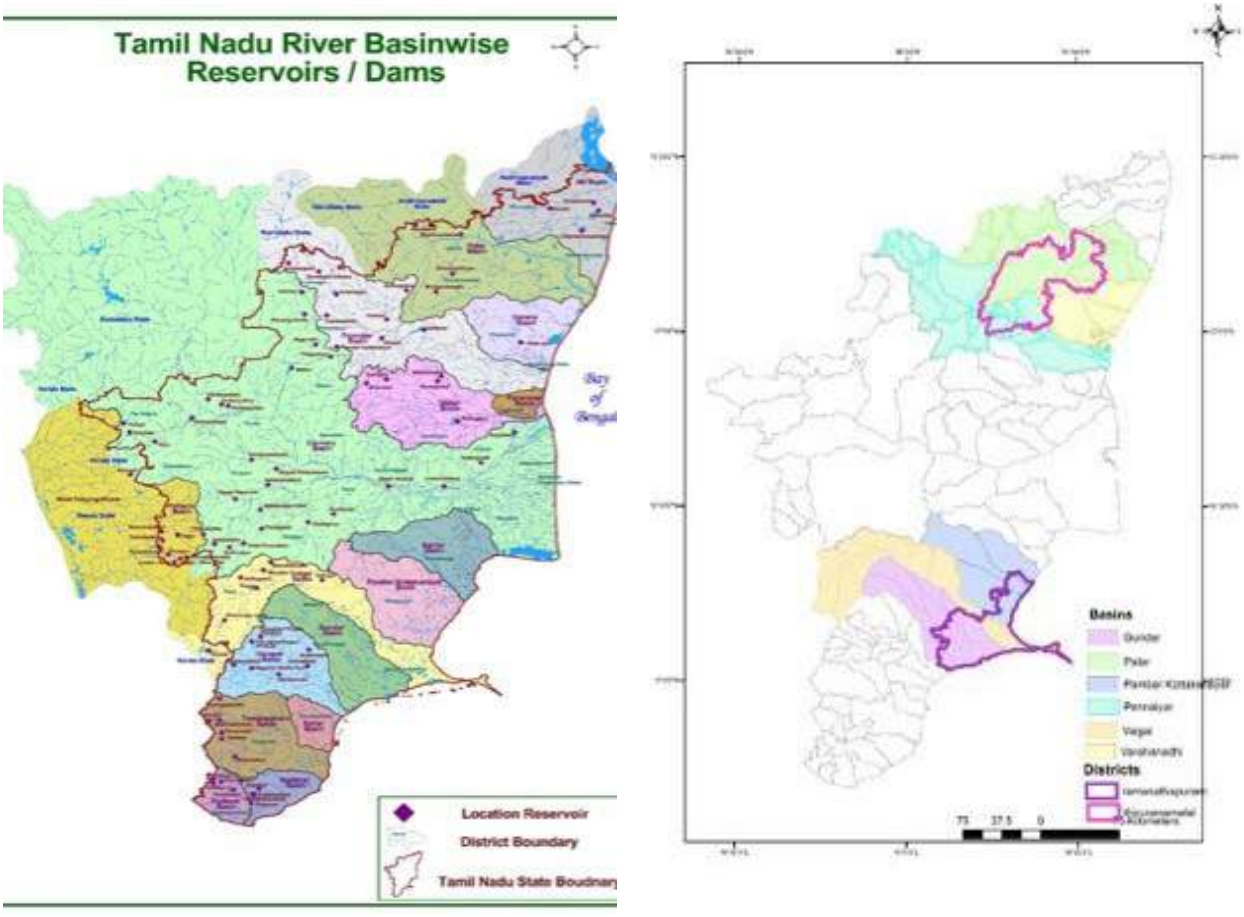


Fig 1.3. District boundary with the identified districts for WASCA- TN

In this backdrop, implementation of WASCA in Tiruvannamalai district is planned to strengthen its water resources and build context specific climate resilient models to build better resilience under this bilateral support. Effective water management strategies are to be adopted while using the surface runoff and groundwater for drinking, domestic, irrigation and industrial purposes. In order to take proper management action, a detailed study was undertaken to estimate the extent of groundwater availability and potential for augmentation for the entire district.

1.3) Profile of Tiruvannamalai District

The Tiruvannamalai District geographically lies between 11.55° and 13.15° North latitude and 78.20° to 79.50° East longitude. The total geographical area of the district is 6188 sq km (Fig 1.4). The administrative and natural resources boundaries in the district is given in Table 3.

The total population of the district is 24.64 lakhs (12.35 lakhs male and 12.28 lakhs female), of the total population, 79.9 % of its population living in rural and 20.08 % in urban region. The average population density is 399 per sq.km.

The overall literacy rate of the district is 74.21%, of which 83.11% for male and 65.32% female.

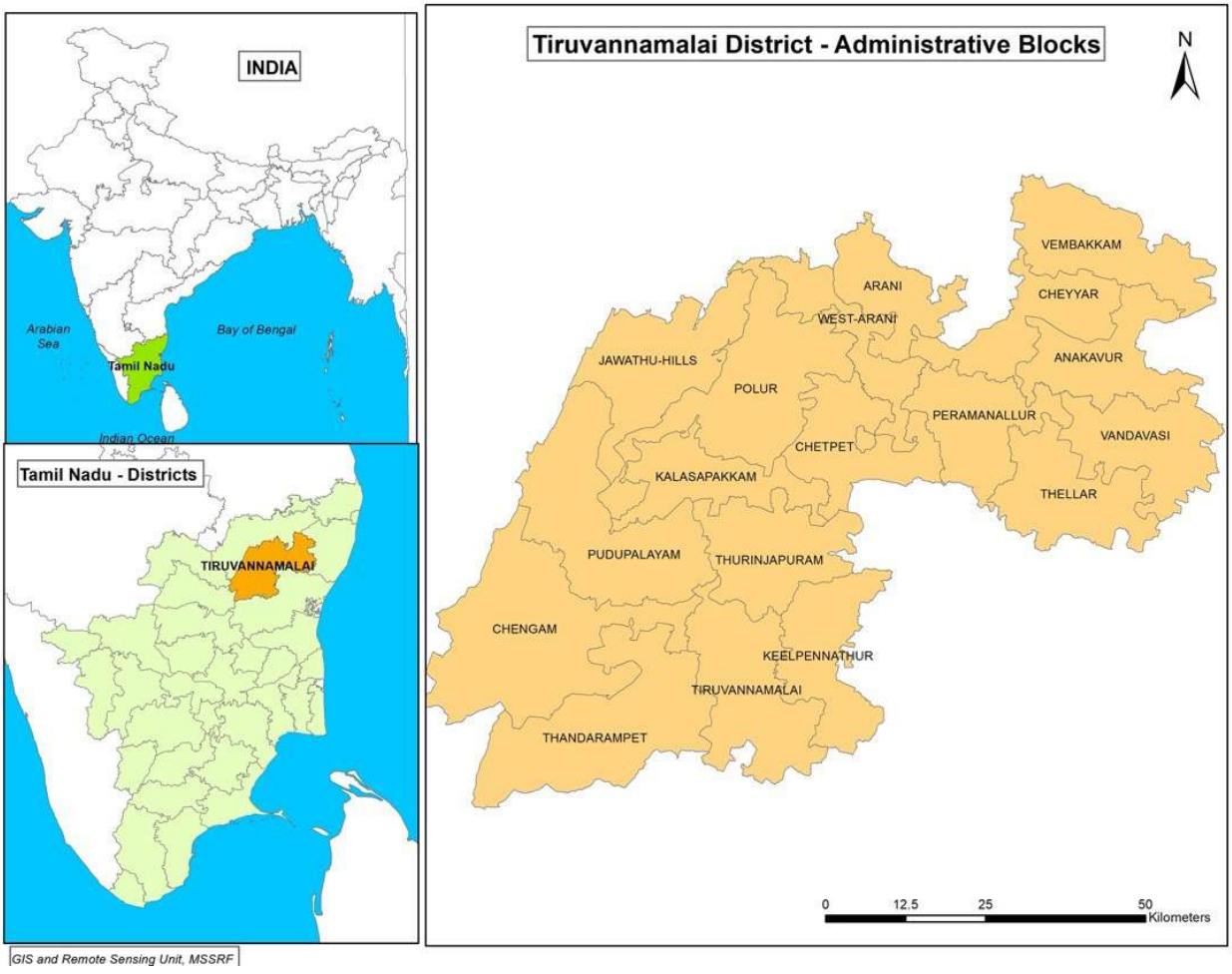


Fig 1.4. Location and block map of Tiruvannamalai District

Table 1.4. Administrative units and water resources in the district		
Sl No.	**Details**	**Numbers**
(1)	**(2)**	**(3)**
1	Revenue division	3
2	Taluks	12
3	Firkas	54
4	Revenue villages	1067
5	Blocks	18
6	Gram Panchayats	860
7	Hamlet villages	4775
8	No of river basins	3
9	No of river sub basins	15
10	No of catchments	3
11	No of watersheds	13
12	No of Micro watersheds	1849
Sources: District Human Development report 2017; official web site of Tiruvannamalai Dist 2018; District Agricultural Plan Tiruvannamalai district, 2008 and Census of India 2011		

* The total geographical area of the district is 6.31 lakh Ha. The total gross cropped area of the district was 3.14 lakh Ha and net area sown was 1.77 lakh Ha in 2017-18.

* The area under forest is 24.20% and the net area sown is 33% of the total geographical area. The district has 2,14,243 wells and 1,966 tanks based on the G returns of 2018-19(https://cdn.s3waas.gov.in/s318997733ec258a9fcaf239cc55d53363/uploads/2019/10/2019101872.pdf)

* So far to improve the sustainability of drinking water resources, 546 check dams, 39 percolation tanks, 9 ooranies, 24 defunct borewell recharge and 30 roof top rainwater harvesting structures were in place in the district(https://www.twadboard.tn.gov.in/content/tiruvannamalai)

* The area sown more than once has increased from 0.4 lakh Ha in 2016-17 to 1.06 Ha in 2017-18.

* The dominant soil type is red loam followed by black loam in river bed regions of the district. The annual rainfall is 1047 mm and distributed fairly both in SW and NE monsoon season.

* Paddy and sugarcane, the high-water requiring crops are the primary crops followed by groundnut, vegetables and flowers. The area under irrigated agriculture is 69% while remaining 31% of the total cultivated area is under rainfed agriculture. The Gross area under cultivation is 1,66,289 Ha. and the cropping intensity is 136%.

* The area under irrigation supported by canals is 8074 Ha (0.44%)., Tanks is 1864 Ha (0.1%)., and wells is 18,35,504 Ha(99.5%),

* The area irrigated more than once is 59,455.80.5 Ha. Due to the large-scale extraction of ground water though wells and Tube wells, the ground water availability is depleting at a faster rate. Majority of the irrigation tanks, which were intensively used for irrigation has now degraded, reduced their storage capacity, water is not used for irrigation fully and require urgent repairs and renovation.

* According to the CGWB study, 2018-19, on the ground water status, out of 18 blocks, five are semi critical, two are critical, nine are over exploited and remaining two blocks are under safe category. The table 1.5 and Fig 1.5 shows the definition for the different ground water development status in the district.

Table 1.5 Status of ground water development category				
Sl.No.	**GW Development Category**	**No of blocks**	**Level of Ground Water Development**	**Explanation**
(1)	**(2)**	**(3)**	**(4)**	**(5)**
1	Safe	Thellar and Pernamallur	0-70%	Areas which have ground water potential for development
2	Semi critical	Anakavur, Arni, Chetpet, Cheyyar and Vembakkam	70-90%	Areas where cautious ground water development is recommended
3	Critical	West Arni and Jawadhi hills	90-100%	Areas which need intensive monitoring and evaluation for ground water development
4	Overexploited	Chengam, Kalasapakkam, Kilpenathur, Polur, Pudupalayam, Thandaranpattu, Thiruvannamalai, Thurinjipuram, Vandavasi	>100%	Areas where future ground water development is linked with water conservation measures
Source: CGWB Survey, (2017)				

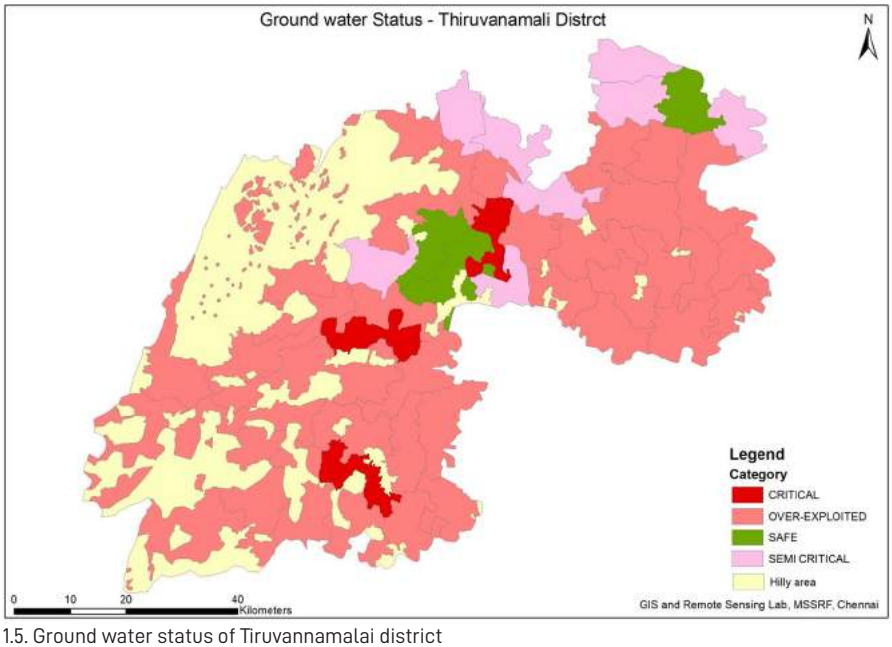


Fig 1.5. Ground water status of Tiruvannamalai district

1.3) Launch of WASCA TN and Steering Committee meetings

The launch and the first district level steering committee (DLSC) meeting was convened by the Project Director, DRDA and District Administration Chaired by District Collector, Tiruvannamalai in partnership with GIZ on 31 Jan 2020. The key points discussed are

* Dr K.S. Palanisamy, IAS, Commissioner, Dept of Rural Development and Panchyat Raj was Chief Guest for the launch workshop.

* Concept of Four Waters, Water budget, Watershed model of development, Rajasthan was explained

* Use of GIS in GP level planning was explained using Bhuvan NRSC

* Main challenges and opportunities in different sectors – Agriculture, horticulture, animal husbandry, agriculture engineering, forestry, water management, ground water studies, improved technologies in the above areas were discussed in detail

Launch and the first district level steering committee with all stakeholder

The second DLSC was conducted during May 2020 which was combined with Joint Field visits by State Nodal Officers of WASCA by Additional Director (MGNREGS), and Superintendent Engineer, MGNREGS from department of Rural Development, Govt of TN and all line departments from the district, EEs, AEEs, AEs of DRDA participated.

* The different potential climate resilient model locations and discussed with the district collector and additional collector.

* The meetings with the officials and discussion with the user groups helped to understand the about seven different climate resilient actions that are in priority to effective water management and adapt to climate change.

* Categorization of GPs for CWRM Planning

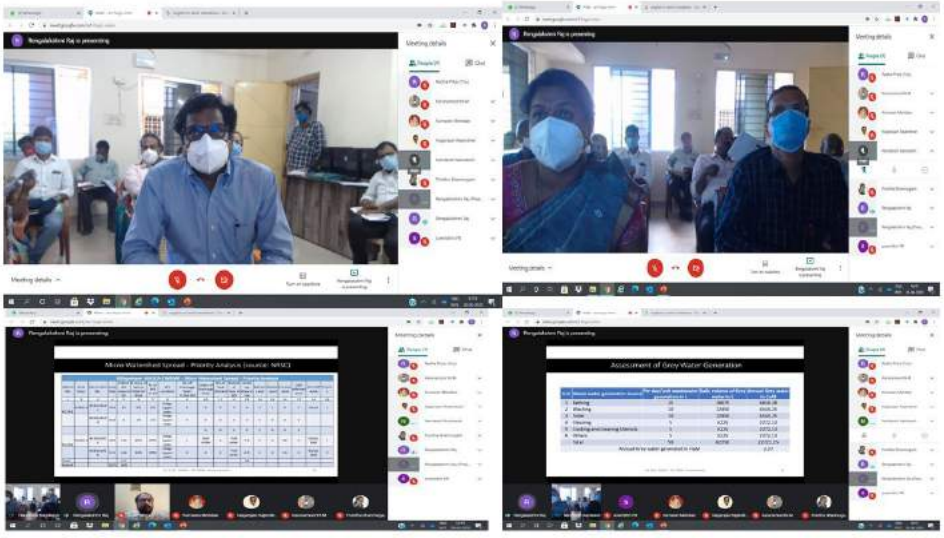
* Targets for CWRM Planning phase -1

* Model GPs for Climate Resilience works for livelihood promotion

Field visit and interaction with communities and line departments on climate resilient measures

The third DLSC meeting was conducted on 28th Aug 2020. The representatives of the partnering institutions have joined the meeting in virtual mode. Following are the key highlights of the meetings

* District Level steering committee meeting for Tiruvannamalai was conducted on 28th Aug 2020
* Different Line Departments like Agri, Agrl. Engg., Animal Husbandry, horticulture, Sericulture, PWD and scientists from various Research Institutions were participated
* From Line departments Agriculture Dept., Agriculture Engineering,
* Completion of the four GP plans per block and make it ready for implementation by adopting convergence mode with relevant departments.
* Completion of the CWRM plan as per the given target of 200 GPs every month and ensure the completion of 860 GPs by mid-November 2020
* Brining the ownership of the Village community in water conservation
* Water literacy for farmers to understand and act/ practice
* Sub-Basin approach in planning and identification of appropriate actions
* Build Public Private sector partnership for strengthening water sector: recommended to prepare a framework on why they should invest in Tiruvannamalai and planned to have the partnership of CII and working with private sector for partnerships and sustainability for the water resources management in the district
* Inclusion of Non-NRM works in all approved CWRM plans GPs and uploaded NREGA soft for GIS Planning



Third DLSC meeting at Tiruvannamalai

1.4) WASCA Project Focus in Tamil Nadu

The main motto of the WASCA Tamil Nadu is "Climate Resilience for Future Livelihoods"

The project is guided by the State Level Steering Committee (SLSC) under the chairpersonship of Additional Chief Secretary, Department of Rural Development & Panchayat Raj Department, Commissioner, Rural Development & Panchayat Raj as Member Secretary. The members of SLSC are Heads of Line Departments (Public Works Department (PWD), Tamil Nadu Water Supply and Drainage Board (TWAD Board), Department of Agriculture, Horticulture, Fisheries Department, Animal Husbandry, Forest Department, NABARD etc.), M.S. Swaminathan Research Foundation, Madras School of Economics, Confederation of Indian Industry, Research institutes and academia represented by CCCDM and, Department of Water Resources from Anna University, Tamil Nadu Agriculture University, Indian Institute of Soil and Water Conservation, as members. For the formation of SLSC, the Government of Tamil Nadu has issued a GO (Ms.) No. 170 dated 25.11.2019 given in Annexure 1.

At the District, District Level Steering Committee (DLSC) is headed by District Collector as Chairperson and Project Director, DRDA as Convener, line departments, local NGOs as members. Close monitoring mechanism has been in place to assess the progress and get the inputs for the necessary actions (Table1.7).

Table 1.7. Monitoring systems at different levels

Sl. No.	Monitoring Mechanism	Level	Periodicity
(1)	(2)	(3)	(4)
1	State Level Steering Committee	State	Bi-Monthly
2	State Level Review DRD	State	Monthly
3	District Steering Committee	District	Bi-Monthly
4	Convergence Meeting - Block Level Line departments	Block Level	Monthly

Approach and Strategies: The whole initiative adopts the following approach and strategies in planning, facilitating and piloting the interventions/ actions in the field:

• At the overall level, the initiative intends to adopt the "area saturation approach" to treat all four types of actions depending upon the context so that all types of land and soil related issues within the geographical units are addressed comprehensively.

• Following this at the implementation level, it adopts a comprehensive approach by integrating water conservation using multi-dimensional measures backed up with scientific evidence in planning, execution and ensuring the stakeholders participation.

Strategies at different phases of the intervention

A. Scientific Planning

(a) Evidence Based Planning: GIS, Hydrology, Statistical data analysis along with socio-economic parameters of the village/block

(b) Adopts Ecosystem Based Approach (EBA) for Natural

Resources Management and Sustainable Livelihoods: The data analysis as well as planning follows EBA to reduce the vulnerability by building appropriate risk reduction measures, enhance the systems productivity by conserving all forms of natural resources and achieve sustainable livelihoods.

(c) Capacity building of the planners: Building the capacity of the government officials who work at GP level in water budget estimation, use scientific evidence-based inputs for planning water conservation initiatives.

B. Nature Based Solutions are considered in identification of works

(a) Blue: Conservation and enhancement of Four Waters (Rain Water, Surface, Ground and Soil Moisture)

(b) Green: Nature Based Solutions and vegetative Improvement (on farm, off farm and public and private lands)

(c) Grey: Civil Structures (Earthen and CC) for water storage, re-charge, recycling and conservation

C. Saturation and Area Based Project Approach for enhancing results, provisions under Mahatma Gandhi NREGA

• The provision under sub Para (2) of Para 4 of Schedule 1, Mahatma Gandhi NREGA, lays down that, "at least 60% of the works to be taken up in a district in terms of cost shall be for creation of productive assets directly linked to agriculture and allied activities through development of land, water and trees." With the thrust on development of livelihoods, works prioritised in the convergent planning process for individual beneficiaries will be given priority

• In pursuance of Schedule-I of Mahatma Gandhi NREGA, 262 kinds of works/ activities have been identified as permissible works, of which 182 kinds of works relate to NRM alone and out of the 182 NRM works, 85 are water related. 164 of the total works are related to Agri and Agri-Allied works.

• The works taken up in Mahatma Gandhi NREGS should change from taking up individual, standalone works in a typical 'relief works mode' to an INRM perspective. Planned and systematic development of land and harnessing of rainwater following watershed principles should become the central focus of Mahatma Gandhi NREGS work across the country to sustainably enhance farm productivity and income of poor people. Even the works on private lands should be taken up following the principles of watershed management in an integrated

Box 1. MGNREGA Convergence guidelines salient points from MGNREGA annual master circular 2020-21

* "Convergence both at State and District level with departments / schemes like agriculture, forest, horticulture, fisheries, sericulture, animal husbandry, FFC/SFC grants to Panchayat, irrigation, minerals, NRLM, PMAY, MPLADS, Railways, DWS, School education etc.

* There can be two kinds of convergences

(1) Where the converging department provides its technical know-how to MGNREGS,

(2) Where the converging department also provides funds for convergence with MGNREGS e.g. AWC buildings.

* Even in this case, there are two ways of converging funds. In one method, the converging department can deposit its funds with SEGF and complete the works using both the funds. In the second method, the converging department and MGNREGS clearly identify the items to be completed by their own funds respectively such that the work can be completed.

* Works identified under convergence plan shall be approved by the competent Panchayat i.e. the Gram Panchayat/ Intermediate Panchayat/ District Panchayat level, before being included in the Shelf of Projects.

* If the work identified for convergence is to be taken up after the appropriate Panchayat has approved the Annual Action Plan, then such works can be placed before the competent Panchayats for their approval. After such approval, the works will become part of the Annual Action Plan".

manner.

D. Community Participation: Through Gram Sabha organised by Department of Rural Development with the support of government officials at the district and block levels.

E. Convergence: Convergence at the Block and district levels for the MGNREGA work Implementation along with other line department schemes including Department of Agriculture, Horticulture, Animal Husbandry, Agricultural Engineering, Adi Dravidar and Tribal welfare etc. Given below the convergence guidelines as mentioned in the Annual Master Circular of MGNREGA 2020-21 adopted to bring synergy in technical, financial and other resources.

F. Capacity Development: At the district level, to promote the common awareness, working in technical cooperation as a team on WASCA project framework, series of virtual and face to face training workshops were organised from Jan 2020-Dec 2021 for facilitating GP level planning, execution of works as per guidance of SLSC, DLSC (Table 1.8).

Table 1.8 . Details of the training programmes organised

Sl. No.	Details	No of Persons Trained	Key learning outcomes
(1)	(2)	(3)	(4)
1	Orientation to the WASCA – CWRM planning, Tiruvannamalai	86	• Framework of Composite water Management Plan • Capacity development and institutional mechanism
2	Cross learning - Exposure visit to Rajasthan- learning Rajiv Gandhi Jal Sanchay Yojana (formerly MJSA), Four Water Concepts, Water Conservation, Model GP, Eco Parks etc, 3-8 March 2020	6	• Four water concept and implementing ridge to valley approach • Developing degraded community lands to pasture and silvi-pastures • Convergent planning and financing mechanisms and state flagship Programs • Innovations in Water Conservations (Tankas, Kadims, Lining of Ponds etc) • Innovations in Plantations (Floriculture, horticulture, road side plantations, silviculture) • Innovation in asset creation (Mini stadium, Model Crematorium, Food Grain storage structures)
3	Online sessions – CWRM plan preparation – three sessions May to June 2020	90	Spatial and Non spatial data sets necessary for CWRM planning Identifying Key water challenges Identifying appropriate actions and how to do the planning - using a model GP

4	Cascading of tanks – Experience from Andhra Pradesh	60	How to identify the cascade systems and the processes required for restoring it
5	Ground water Management – Prime Meridian	60	Status of the saline water issues and possible measures to address
6	Discussion on Greening of Hillocks to identify the key activities with the experts	25	To identify the potential restoration practices of different types of coastal water resources in the three different pilots

Simultaneously efforts are undertaken to convey the key messages of the project through a communication plan which is jointly evolved by stakeholders of WASCA-TN in line with the key objectives and outputs of WASCA. The communication materials were shared using social media and online platforms to ensure:

1. Strengthened knowledge and capacity of public and private institutions, as well as stakeholders at different levels, to plan and implement integrated water resources management
2. Collaboration between various government departments and other stakeholders promoted to improve financing of climate adapted water security
3. Holistic pilot measures at district/ sub-catchment level in selected districts for successful approaches to be scaled-up at the state and national levels

As an initial step, series of four e-posters developed and disseminated to the district level officials

Fig 1.5. E-posters- Strategy to build awareness among stakeholders

1.5) WASCA District Resource Centre:

To facilitate participatory planning, implementation and coordination, GIZ in collaboration with Director, Rural Development & Panchayat Raj, Additional Collector, DRDA, Tiruvannamalai established WASCA District Resource centre at DRDA Office, Tiruvannamalai. The WASCA district resource centre was inaugurated by District Collector, Tiruvannamalai on 14 Feb 2020.

District Level Water Security & Climate Adaptation Resource Centres: These Centre's will provide the required knowledge and tools for IWRM & Climate Adaptation in planning and financing works for the river sub-basin or district and convergence framework with as per existing guidelines of state and central governments. The WASCA Resource centre has hardware equipped with resources useful for GIS and conduct short batches trainings. Hardware with high end computers (3 number), GPS, Projector, TV Screen (large) etc. The WASCA Resource Centres provides the following support to DRDA for implementation of WASCA:

1) Establishment of GIS lab

- o Computers
- o Trained human resources
- o Technical agency supporting GIS based planning
- o Scanner, printers, GPS
- o Material useful for GIS planning

2) Modules Development

- o Planning module for water and climate for GP to district / sub-basin level using GIS tools
- o CWRM Frame-work for the river sub-basin and district
- o Module on Climate Resilience measure
- o Hand Book on Potential Financing water security and Climate Adaptation: Projects, Programmes and schemes

3) Assessments and studies

- o Training Needs Assessment
- o Capacity building needs assessment
- o Potential for Artificial recharge to rejuvenate river basin
- o Climate Adaptation strategies and innovations

4) Trainings and Workshops

- o Conduct trainings on understanding water sector useful for the district
- o Conduct Training for the officers concerned (RDPR, MGNREGS and other line departments) on GIS based tools for effective participatory planning.
- o Conduct Workshop and Trainings on Water Security, Ground Water Recharge, Pollution Control, Climate Change etc.
- o Organize workshops for increasing technical capacities of staff under RPPR and other line departments

5) Generating IEC material for the project

- o Connect each resource centre with Technical Agency and CSR for sustained inputs
- o Facilitate in preparation of DPR at GP and district for River Sub-basin
- o Any other inputs as per suggestion by RDPR will be included in the resource centre.

WASCA adopted CWMR Planning as per guidelines of National Level Workshop held in Feb, 2020. Mahatma Gandhi NREGS is the key partnership for WASCA. Hence, the basic unit of planning for CWRM is identified as Gram Panchayat (GP). There are 860 GPs in the district spread over in 18 blocks (Table 2.1 and Fig 2.1).

2.1) Categorization of GP for CWRM planning in the district

CWRM uses spatial and non-spatial data for developing plans. Most of the data for non-spatial are available at revenue village level. To synchronise planning at Gram Panchayat keeping data availability and boundary for GIS planning, various Gram panchayat are categorised based on revenue village boundaries, for collecting and organizing the datasets. Based on the boundary alignments between GPs and revenue villages five different categories or types were observed (table 2.1 and Fig 2.1.)

1) **Type 1:** GP and Revenue Village data and boundary match

2) **Type 2:** Having more than one GPs in one Revenue Village

3) **Type 3:** One GP is falling under more than one Revenue Village

4) **Type 4:** GPs having more than one GP, one Revenue Villages data, boundary

5) **Type 5:** Missing GP and data in census 2011

The above categorization was discussed and approved during second DLSC meeting and various GPs, block details are submitted to DLSC, accordingly type wise distribution of the GPs planning process initiated as given in the table below.

Table 2.1 Category of GPs block wise adopted under CWRM Planning

	Name of the block	No.of Gram Panchayts	Type 1	Type 2	Type 3	Type 4	Type 5	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	Anakkavoor	55	47	2	6	0	0	55
2	Arni	38	12	22	1	1	2	38
3	Chengam	44	32	2	10	0	0	44
4	Chetpet	49	34	4	11	0	0	49
5	Cheyyar	53	38	2	12	0	1	53
6	Jawadumalai	11	1		10	0	0	11
7	Kalasapakkam	45	25	9	9	2	0	45
8	Kilpennathur	45	29		15	0	1	45
9	Peranamallur	57	47	4	6	0	0	57
10	Polur	40	27	2	11	0	0	40
11	Pudupalayam	37	25	6	6	0	0	37
12	Thandrampet	47	31	3	13	0	0	47
13	Thellar	61	46	5	10	0	0	61
14	Thurinjapuram	47	29	4	12	2	0	47
15	Tiruvannamalai	69	48	2	18	0	1	69
16	Vandavasi	61	43	5	11	2		61
17	Vembakkam	64	38	0	23	2	1	64
18	West Arni	37	14	19	0	0	4	37
	Total	860	566	91	184	9	10	860

Source: Derived from Census of India, 2011 and District records

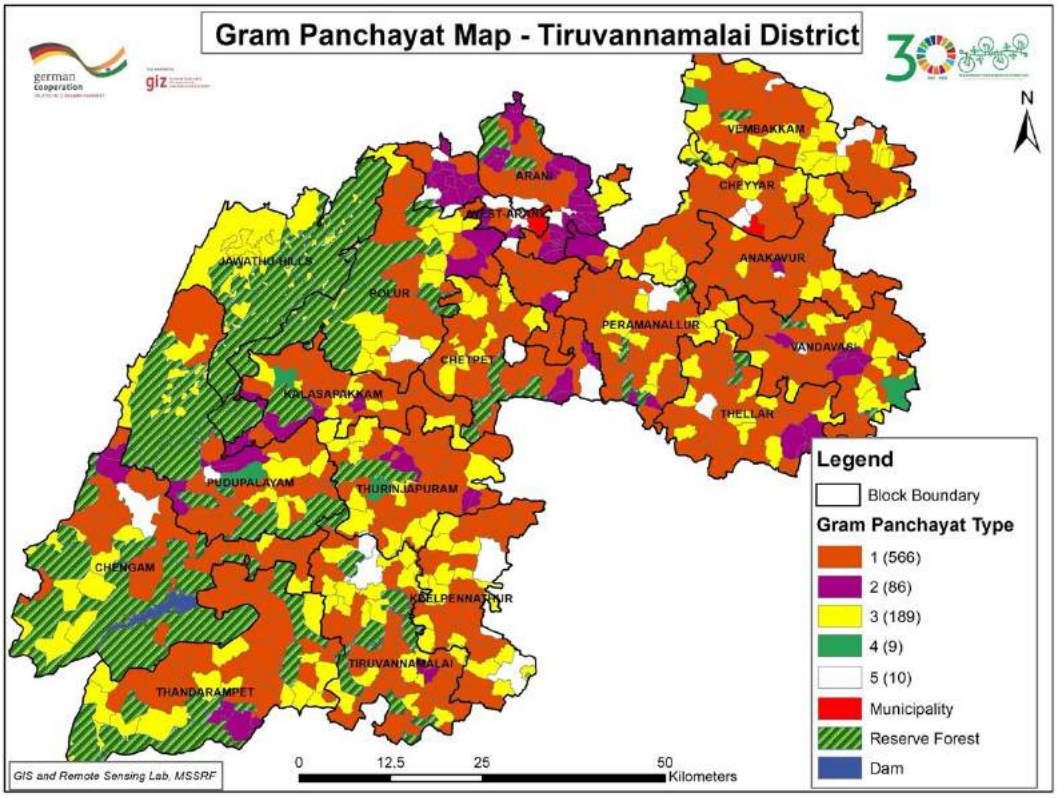


Fig 2.1. Distribution of different types of GPs in the district

2.2 Salient features of CWRM planning

Composite Water Resources Management Planning (CWRMP) designed at a National Level Workshop organised by GIZ in Feb 2020 with participation of all WASCA implementing states and approved by MoRD and MoJS.

The principles of CWRM are based on national and internationally approved approaches on Four Waters, approaches set under Sustainable Development Goal number 6 and Nationally Determined Contributions (NDCs) on Climate Change, namely Integrated Water Resources Management (IWRM) principles, for which Indian Government is also a signatory

There are three stages for CWRM Planning for WASCA based on above national and international approaches:

1) Developing Plans at lowest administrative level: GP level plans

2) Integrating GP level plans at Block level

3) Integrating GP plans at Watershed and Sub-basin (Catchment) level on natural resources

4) Integrating GP plans to develop WASCA District CWRM Plan

* The CWRM Plan comprise of analysing of both spatial and non-spatial data. Spatial data is taken from open source (Bhuvan – NRSC) and Non-spatial data from published data of government of India as well as data from the records of the respective state, district and GPs information.

* The non-spatial data including socio-economic, bio-physical and hydrological data to identify the key water challenges. While analysing key water challenges both water supply and side sources have been taken in to consideration and arrived at a GP based water budgeting.

* Identification of Key water challenges,

* Identification of location specific actions

* Results are developed on the identified to augment the water resources and promoting efficient use for a positive water budget.

* Baseline for assessing the impact

Table No: 2.2 Details of the Non-spatial data sets used		
Sl.No	**Climate Vulnerability Area**	**Key Variables used in analysing the key water challenges**
(1)	**(2)**	**(3)**
1	**Socio-economic**	1) Demography from Census and
		2) SECC data for identifying vulnerable population
		3) Active Job Cards and expenditure in MGNREGA
		4) Drinking water demand
		5) Grey water management
2	**Climate**	1) Identification of the Agro-ecological and Agro-climatic zones as a larger level characteristic of the region at the regional level along with sub basin
		2) Understanding the climate trends –in the past 30 years as well as last year (2018-19) on Annual Rainfall, Maximum and Minimum Temperature
3	**Water resources (Hydrological)**	1) Watershed profile including the natural drainage lines
		2) Existing Water Recharge or Storage structures - Tank system details and canal network
		3) Status of the ground water
		4) Run-Off estimation
		5) Water Demand estimation - Sources, Use, Demand for human use, agriculture, livestock etc from primary and secondary sources
		6) Water budgeting
4	**Agriculture and Allied sectors**	1) Soil profile – macro and micro nutrients, physical properties as well as soil texture
		2) Land use classification
		3) Agriculture – Cropping pattern
		4) Livestock
		5) Irrigation Profile
Source:CWRM Plan framework, GIZ		

Spatial data

Table No: 2.3.Spatial Data utilised in CWRM Planning			
No	**Thematic Layer**	**Description**	**Relevance**
1	**Satellite map**	The aerial view from satellite in True Colour Composite gives a real time picture of any geographic area. The landforms and its characteristics can be easily visualised and provide objective understanding of the context	The satellite image provides the overview of the village, how the habitations and other land use forms are distributed within the total geographical area of the village

2	**Location map and Hybrid map**	The map shows about the location in which the GPs is present in the district	It provides the geographical area of the GP and its location in the district.
3	**Soil erosion map**	The erosion map shows the soil erosion capacity with respect to rainfall, soil physical properties, terrain slope, land cover.	It provides the soil capacity of erosion. Based on this map , the improvement of soils activities can be taken. For instance, if the GP has sheet erosion, it shows that the region is going to erode vastly. So the steps can be taken to arrest further erosion.
4	**Wasteland map**	The map shows the available wasteland in the GP which can be used for any restoration or plantation.	The wastelands can be used to raise the Mini forest plantation or any other greenery activities in the GP
5	**Land use Land cover**	The map shows the actual Land use and their land cover of the GP which will be useful for the planning. The land coverage that includes unused or barren lands is called land cover. However, land use shows nature human interaction such as settlements, road networks, crop land, mining and irrigation networks, etc.	The land use pattern affects all parameters as the run-off, rate of erosion, etc. are affected by the state of land use. The information of the existing land use and land cover helps the decision maker in choosing the type, mode and site of activities. The barren areas can be made productive by terracing and plantation. The vegetation cover indicates the status of infiltration and nature of erosion. Vegetation reduces the peak flow.
6	**Salt Affected Area map**	The map shows the regions which are salt affected. While planning the GP, this area can be treated specially and give alternative cropping or any other steps to reduce the Salinization. Salinization can result from improper management of canal irrigation water, resulting in rise of water table and consequent accumulation of salt in the root zone in arid, semi-arid and sub- humid (dry) conditions. It also results due to sea water ingression in coastal regions and/or use of high-salt containing ground water. Salt- affected soils have been identified as one of the main hurdles against crop production.	Assessment of salt-affected and water-logged areas is an important prerequisite for planning reclamation and improving land productivity. Salinity can be controlled in some situations once the specific causes are understood. In the recharge area, improved drainage and water-efficient crop management practices will reduce the amount of water that enters the groundwater system. In the discharge area, where salinity appears, it is important to enhance the vegetative cover.

7	**Geomorphology map**	This map is the graphical inventories of a landscape depicting landforms and surface as well as subsurface materials. It determines the character of soil, vegetation, water percolation and land cover. Geomorphology deals with landforms which help in understanding erosion processes and hazards. The geomorphology of this area is very conspicuous and guided by the composition of the rocks. There are four major divisions in geomorphology i.e. structural hill, denudation hill, pediment, alluvial plain and aeolian plain. Structural hills are formed as the result of regional deformation.	Suitability of any intervention will have definite influence on geomorphological conditions. Hence, it needs to be closely examined. Geomorphology determines character of soil, vegetation, water percolation and land cover. The geomorphic and geologic conditions guide us to undertake appropriate work in a particular location to reap maximum benefits.
8	**Ground water prospectus**	It provides the required information on geological parameters connected to ground water exploration and the probable ground water prospects.	The map helps to identify the prospective Ground Water Zones for conducting site specific investigations. The map helps in identification of sites for planning recharge structures to address water scarcity in a more effective manner. The map facilitates identification of prospective groundwater zones for systematic selection of appropriate sites for drilling. The map also reveals the stage of groundwater development and scope of extracting groundwater for critical purposes. Groundwater map plays an important role as it examines suitability of proposed actions in a particular location and determines expected outcomes. Through analysis of this map, the decision maker can provide inputs on suitable sites and structures
9	**Lineament**	A lineament map shows the linear feature in a landscape that is an expression of an underlying geological structure such as a fault, fracture, or joint. The structural features are useful to make decisions to decide the suitable water conservation, harvesting and recharge measures.	As Lineament decides the runoff percentage, it is an important parameter to be considered for artificial recharge structures. If the density is higher there is a good scope for ground water recharge, if not focus should be mostly on the surface storage measures.
10	**MGNERGA works map**	This map shows the MGNERGA works carried out in the GP	This will be useful to understand the past works and to propose the future works to avoid duplication.

11	**Watershed map**	It shows how the micro watersheds are distributed in the village geographical area	Adopt the watershed approach. For GP level planning, it is important to analyze the relationship between administrative boundaries and natural boundaries and plan accordingly to harmonize both the scalers: The micro-watershed boundaries explain the extent and run-off characteristics in given conditions. The drainage lines and the size of the watershed reveal the kind of interventions that need to be undertaken The map guides the prioritization of interventions based on ridge to valley concept and sequencing the plan accordingly
12	**Drainage (base hydrology) map**	The drainage patterns and texture seen on images are good indicators of landform and bedrock type. For example, dendritic drainage patterns are the most common drainage pattern found in nature. The drainage pattern indicates the water flow direction. As the water flows from higher to lower level, the contour helps us in marking the uplands from where the water flows and lowlands where water accumulates.	Since the drainage directly affects the run-off, infiltration and land management condition: The drainage map shows the drainage order, pattern and destiny It also shows spread and extent of surface water bodies Different water harvesting structures are suitable for different drainage orders. For instance, temporary check dams are put on mall streams and larger or permanent gabion structures are suitable for rivers (See Annexure).
13	**Terrain Map**	A terrain map shows an area of land divided into terrain map units defined by similar elevation, slope, landform	This map will be useful to understand the terrain of the project area to identify the water and soil conservation related activities.
14	**Contour map**	Contour map is also called as a topographic map which shows the elevation of land on a flat paper surface. A contour map is illustrated with contour lines which shows valleys and hills, and the steepness or gentleness of slopes. The contour interval of a contour map is the difference in elevation between successive contour lines.	The contour map plays a vital role in planning and identifying the recharge structures, farm ponds

15	**Slope map**	Slope map illustrates the measure of steepness or the degree of inclination of a feature relative to the horizontal plane. Slope is typically expressed as a percentage, an angle, or a ratio. The average slope of a terrain feature is calculated from contour lines on a topo map or DEM	The slope map will be used for analysing the soil conservation measures and construction of the water recharge structures such as check dam, farm ponds etc.,

2.3 The Key themes of WASCA TN, relevant illustrative indicators and the measure

The above non-spatial data and spatial data helps to identify the key water challenges and identify the appropriate actions to augment the supply and managing the demand. The action areas are broadly categorised in to four and the key indicators and expected outcomes are given in table 2.4

Table 2.4. The Key themes of WASCA TN, indicators, measures

S . No.	Climate Vulnerability Area	WASCA CWRM Action Plan	Indicator	Measure
(1)	(2)	(3)	(4)	(5)
1	**Socio Economic**	Rural Infra-structure	1) No of water bodies and streams freed from waste dumping	Establishment of systems for grey water management and Creating additional person days for additional employment opportunities
			2) No of Villages having complete solid and liquid waste management systems	
			3) Creating additional employment opportunities to strengthen the rural livelihoods of vulnerable population	
2	**Climate vulnerability**	Climate Resilient and Adaptation	1) Varies based on the kind of hotspot area (Area of Interest)	Pilot models showing the climate resilient models in the sub- basin
3	**Water**	Development of degraded, Public lands	1) Number of water bodies ready for use in the village	Total quantum of water harvested and green cover
			2) Quantum of water harvested/recharge	
			3) Proportion of land is treated	
			4) Reduction in the annual runoff percentage	
			5) Area under afforestation	

4	**Agriculture**	Production Systems Enhancement (Agriculture and allied sector development)	1) Baseline data for agriculture crop requirement and major crops	Additional area brought under productive use with climate resilience and also livestock production
			2) Identification of areas for implementing water use efficiency	
			3) Identify intervention areas for bringing in water use efficiency with climate resilience	
			4) Water requirement for livestock is assessed	
			5) Special site-specific works for meeting the water demands for livestock are identified for demonstration.	

2.4) Steps in CWRM planning under WASCA in Tamil Nadu

1. Pre-Planning Stage:

a. Categorizing Villages for planning as per MGNREGS guidelines

b. Identification of GP, Block, District officers for planning facilitation

c. Capacity Building and district specific CWRM frame work and indicators suitable to the terrain and geography

d. Identification of Phases for planning (4 GP Plans per block) as per DLSC and SLSC

2. Planning Stage:

a. Collection on Non-Spatial Data as per MoRD guidelines and CWRMP

b. Collection of Spatial as per MoRD guidelines and CWRMP

c. Water Budget Estimation (CWRMP)

d. Conducting district specific studies on Ground Water Assessment as per CWRM

e. Inclusion on Non-NRM activities under MGNREGS with CWRMP

f. Identification of Key Water Challenges - CWRMP

g. Identification of Key Water Actions- CWRMP

3. Review and Verification Stage:

a. Matching spatial data as per MGNREGA- MoRD guidelines on GIS based planning

b. Field Verification, GP level Meetings for inclusion in labour budget 2021-22

c. Regular review on progress at all levels

4. Integration and Approval Stage:

a. Preparation of Integrated plans (Block, Watershed)

b. District Level WASCA Plan

c. Approval at GP level for preparation of Labour budget using CWRM frame work outcomes

d. Approval of District plan at DLSC

e. Submitting approved District WASCA plan from DLSC to SLSC for financing

Chapter 3: WASCA TN: Composite Water Resources Management Plan Analysis

The deeper analysis of the key water challenges under the four identified vulnerability themes support to identify appropriate water actions adopting science-based approaches.

3.1 Socio-Economic vulnerability area

The population, households, extend of marginal and small holders, access to MGNREGA works and drinking water, generation of grey water etc were the key indicators used in the study to assess the vulnerability status under this theme.

3.1.1 Population and Household information

The district has the total population of 19.6 Lakhs, of which the proportion of men and women are almost equal. While the SC and ST populations are socio-economically in the lower run, considered as vulnerable categories. In this district about 25 percent of the total population are under vulnerable category proportionate to the number of GPs in the block and population as well (Table 3.1 and Fig 3.1). With regard to gender, almost equal number of male and female population is there in the district.

Table 3.1. Population and Household Information

S. no	Name of the block	Population			Total House Holds	Category wise vulnerable Population		Total Vulnerable population
		Female	Male	Total		SCs	STs	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	Anakkavur	39013	39786	78799	19919	20848	10571	31419
2	Arni	48015	47978	95993	23193	23059	451	23510
3	Chengam	70139	71975	142114	33740	50814	2458	53272
4	Chetpet	47115	47272	94387	23192	11570	364	11934
5	Cheyyar	43587	43760	87347	21289	25781	1127	26908
6	Jawadhu Hills	25516	26483	51999	12622	1071	47081	48152
7	Kalasapakkam	59831	60781	120612	29286	32571	440	33011
8	Keelapennathur	51625	52591	104216	24231	27399	2477	29876
9	Peranamallur	42924	42551	85475	21114	19068	1145	20213
10	Polur	67736	67609	135345	33079	27332	476	27808
11	Pudupalayam	44038	45453	89491	20966	28306	1118	29424
12	Thandrampet	88990	89658	178648	41639	41825	17018	58843
13	Thellar	48973	48965	97938	24424	29911	2229	32140
14	Tiruvannamalai	80253	81408	161661	35741	43372	3580	46952
15	Thurinjapuram	61293	61920	123213	29814	28031	1662	29693
16	Vandavasi	55320	55670	110990	27204	34271	2172	36443
17	Vembakkam	60973	61202	122175	29652	32600	1300	33900
18	West Arani	44808	44601	89409	21740	16082	329	16411
Total		980149	989663	1969812	472845	493911	95998	589909
Percentage to the total population		49.8	50.2			25	0.05	

Source: Census of India, 2011

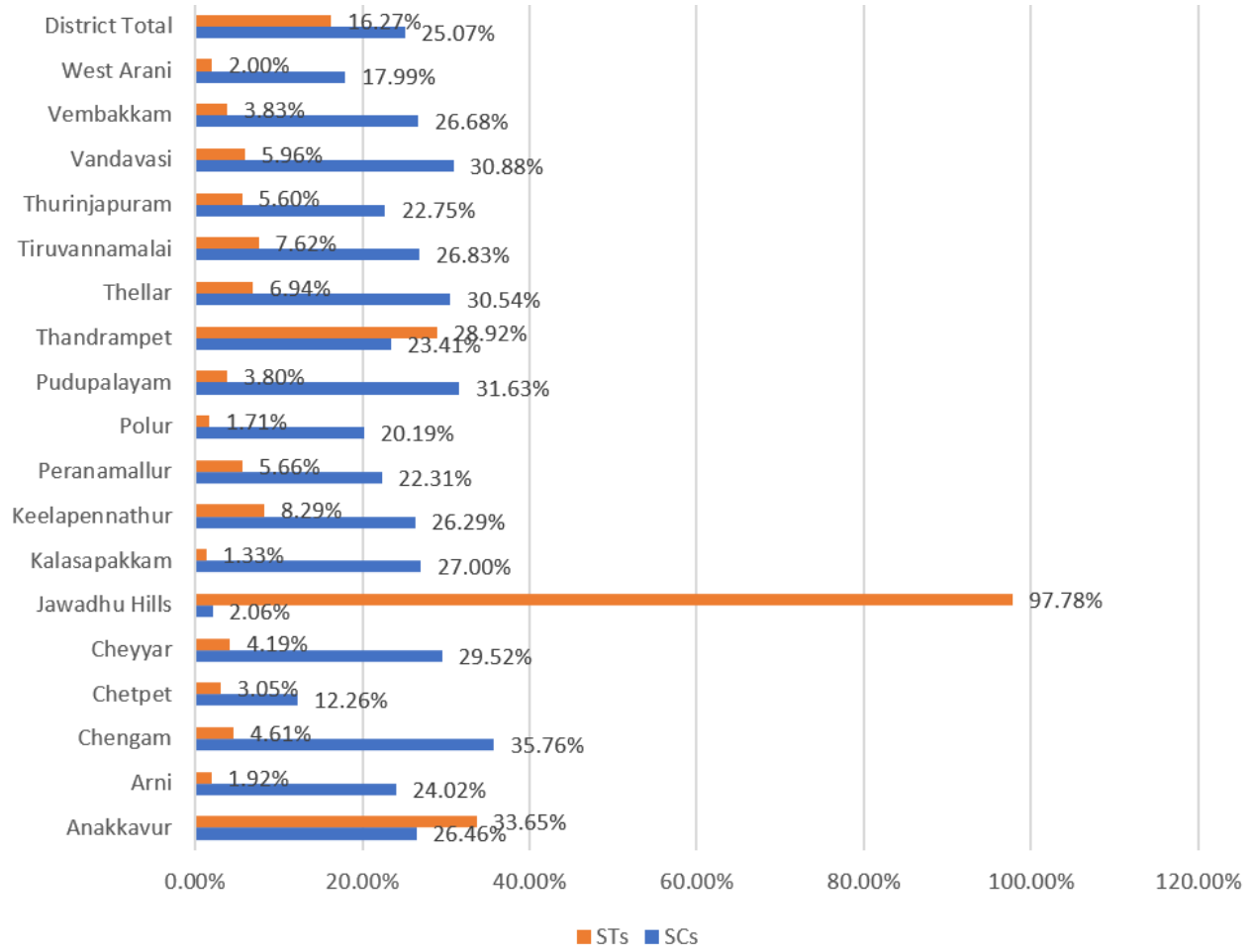


Fig 3.1. Percentage of SC&ST Population: Tiruvannamalai

3.1.2. Proportion of Marginal farmers and operational holdings in the district

Besides, SC and ST population, the district has highest number of farmers under marginal category (81%) owning less than one ha of land. This is 47 % of the total land in the district. Also, of the total holdings only 12% are from SC and 2% from ST communities (Table 3.2 and Fig 3.2).

Table 3.2 Marginal Farmers and operation holding

Category	All- Total Holdings		% to the total for all		SC- Total Holdings		ST- Total Holdings	
	Number	Area (Ha)	Number	Area	Number	Area (Ha)	Number	Area (Ha)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Marginal	364010	134853	81%	47%	46453	16834	7310	3194
small	64520	88411	14%	31%	6558	8925	2133	2972
Semi medium	17843	46641	4%	16%	1222	3091	873	2348
medium	2844	15301	1%	5%	101	541	209	1145
large	172	3151	0%	1%	9	122	5	74
Total	449389	288357			54343	29513	10530	9733

Source: Agriculture Census 2015-16

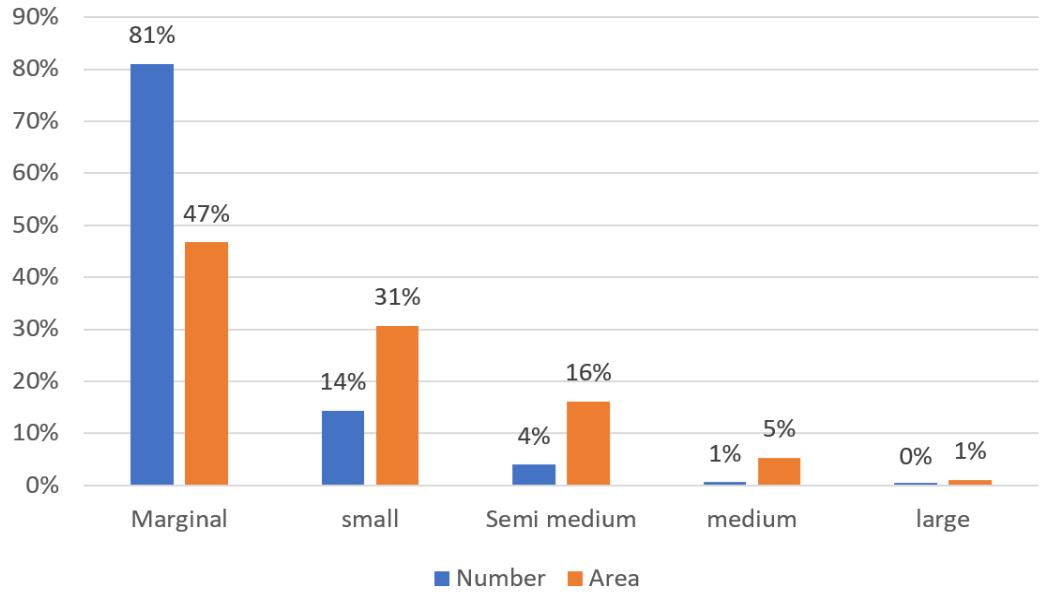


Fig 3.2. Catagories of farmers & operational area to total (%)

3.1.3. Status of Mahatma Gandhi NREGA

In the district, of the total population of 19,69,812 persons, 42.08% are registered for job cards in MGNREGA scheme. Among the registered job card holders, 74.66% of the job cards are in active category (Fig 3.3). With reference to the expenditure, the amount incurred during 2018-19 is 2.6 times higher than the expenditure spent in the past years since its inception. The expenditure incurred is high in Thellar block and low in Jawadhu hills block (Table 3.3).

Table 3.3.Mahatma Gandhi NREGA Job card Holders

S.No	Block	Registered Job cards		Active Job Cards		Expenditure Since Inception. in Lakhs	Expenditure Last Year in lakhs
		HHs	Person	HHs	Person		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Anakavur	23388	36244	20846	21517	2137	5950
2	Arni	29567	40419	26520	30657	2144	5832
3	Chengam	38998	65560	34764	49520	2357	5947
4	Chetpet	26883	41221	24776	29829	1921	6302
5	Cheyyar	25893	35539	24042	26575	3023	7052
6	Jawadhu hills	14876	24101	12903	17843	1986	3895
7	Kalasapakkam	34950	56601	32693	47370	2870	7189
8	Kipennathur	29053	42411	25777	29317	1963	5217
9	Pernamallur	24444	36673	22740	26739	2633	6739
10	Polur	36153	55665	33136	39336	2075	6255
11	Pudhupalayam	24053	40608	22085	32879	1828	4535
12	Thandarampet	46165	70617	40240	52916	1976	5557
13	Thellar	29208	43049	26938	31807	3049	7937

14	Thiruvannamalai	44149	64745	39742	44776	2774	7270
15	Thurinjapuram	35527	55692	32754	44173	2327	5726
16	Vandavasi	29183	42712	27211	30956	2945	7418
17	Vembakkam	33293	44144	30332	36214	2611	7193
18	West arni	25270	32869	23166	26443	1904	4875
Total		5,51,053	8,28,870	5,00,665	6,18,867	42,523	1,10,889
Source: http://mnregaweb4.nic.in/netnrega/MISreport4.aspx							

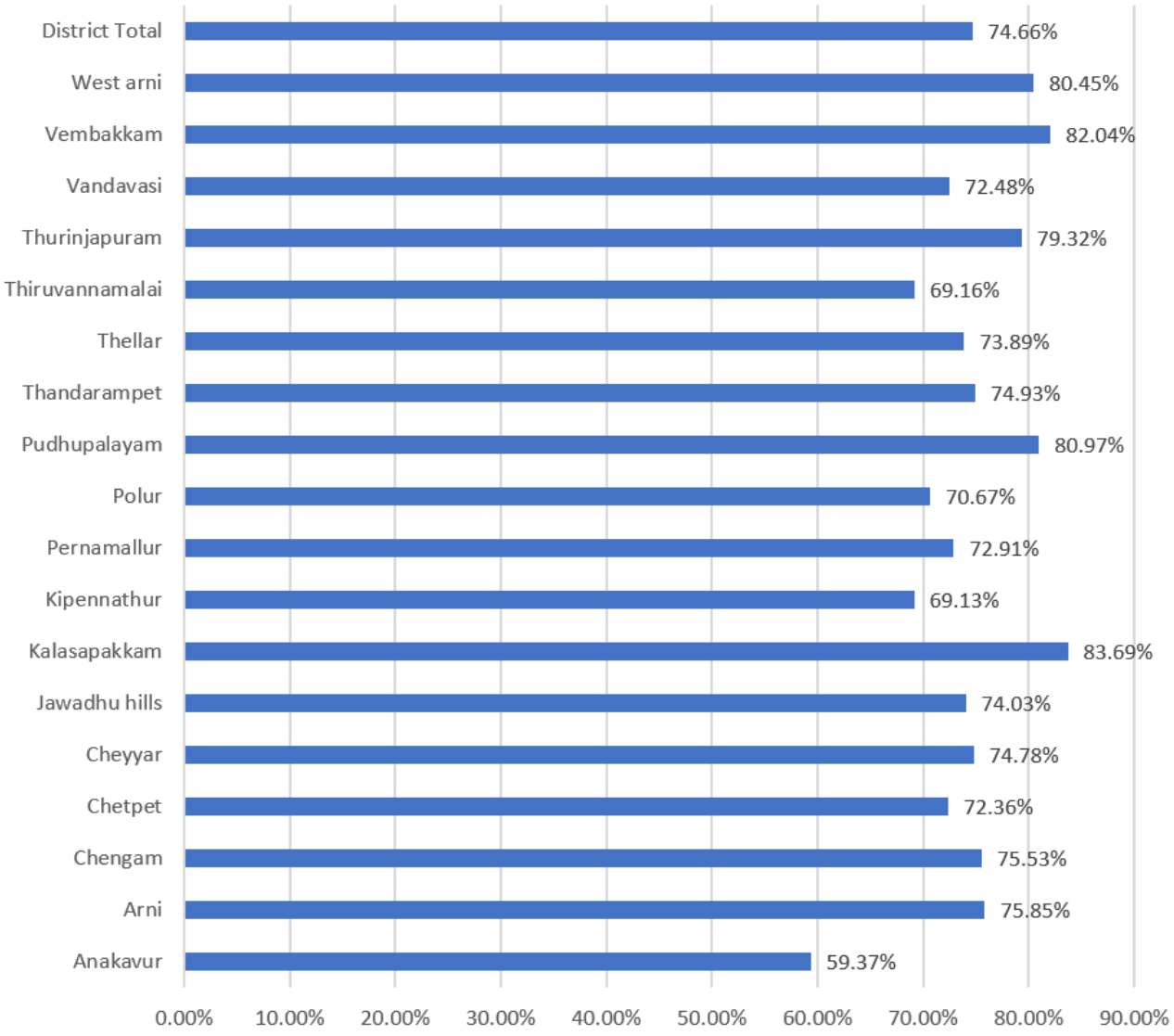


Fig 3.3. Percentage of Active Job Card Holders: Tiruvannamalai

3.1.4. Estimation of Annual Grey water Generation

The grey water generation estimated across the GPs indicated that 3595 Ha M is being available for reuse or recycle. Also, data was collected on the status of safe disposal of the grey water for recycle/reuse at the GP level which is necessary for the liquid waste management systems in rural areas (Table 3.4 and Fig 3.4).

Table 3.4 Estimated Annual grey water generation

Sl. No	Block	Annual Grey water in HaM	Annual Grey water in MCM
(1)	(2)	(3)	(4)
1	Anakkavur	143.8	1.44
2	Arni	175.2	1.75
3	Chengam	259.4	2.59
4	Chetpet	172.3	1.72
5	Cheyyar	159.4	1.59
6	Jawadhu Hills	94.9	0.95
7	Kalasapakkam	220.1	2.2
8	Keelapennathur	190.2	1.90
9	Peranamallur	156.0	1.56
10	Polur	247.0	2.47
11	Pudupalayam	163.3	1.63
12	Thandrampet	326.0	3.26
13	Thellar	178.7	1.79
14	Tiruvannamalai	295.0	2.95
15	Thurinjapuram	224.9	2.25
16	Vandavasi	202.6	2.03
17	Vembakkam	223.0	2.23
18	West Arani	163.2	1.63
Total		**3595**	**35.95**

Source: CWRM- TN- Tiruvannamalai Plan, 2020-21

Fig 3.4. Estimation Rural Areas Grey Water Generation: Tiruvannamalai

3.1.5 Drinking Water Status

The drinking water requirement to the total population is 5392.36 Ha m, of this 85% is met through ground water resources and remaining 15% is met by surface water sources (Table 3.5 and Fig 3.5).

Table 3.5. Drinking water requirement in Ha M

S.No	Block	Drinking water requirement (Ha.m)
(1)	(2)	(3)
1	Anakkavur	215.71
2	Arni	262.78
3	Chengam	389.04
4	Chetpet	258.38
5	Cheyyar	239.11
6	Jawadhu Hills	142.35
7	Kalasapakkam	330.18
8	Keelapennathur	285.29

9	Peranamallur	233.99
10	Polur	370.51
11	Pudupalayam	244.98
12	Thandrampet	489.05
13	Thellar	268.11
14	Tiruvannamalai	442.55
15	Thurinjapuram	337.30
16	Vandavasi	303.84
17	Vembakkam	334.45
18	West Arani	244.76
	Total	5392.36
Source: CWRM- TN- Tiruvannamalai Plan, 2020-21		

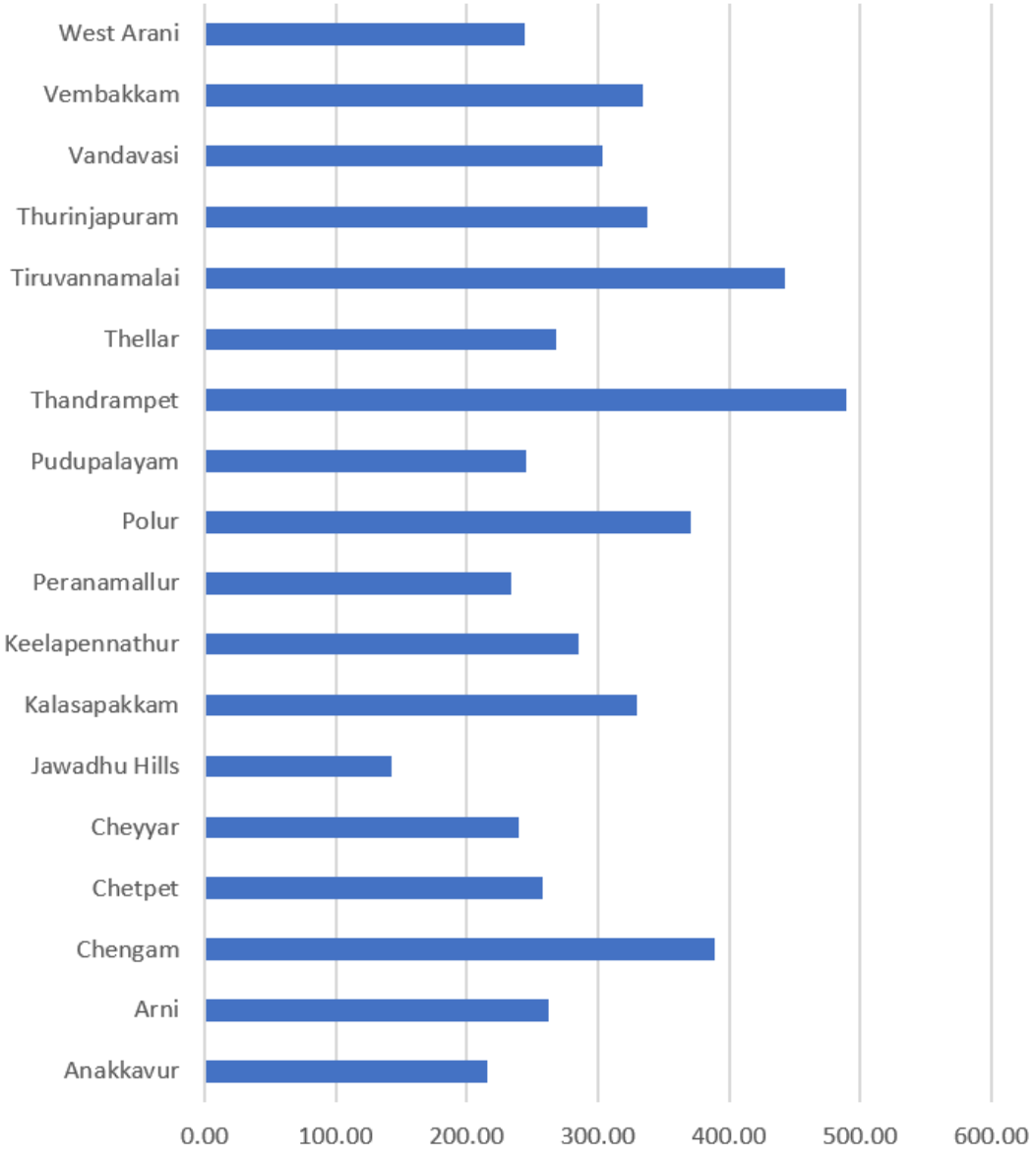


Fig 3.5. Drinking water requirement of human(Ha.m)

3.2 Climate Vulnerability area (rainfall and maximum and minimum temperature)

3.2.1) Past and existing climate: The climatic profile considered for the analysis is at the district scale. The monthly average rainfall of last 30 years and 2018-19 monthly rainfall and maximum and minimum temperature are the primary climatic parameters used in the analysis. The annual normal rainfall and annual actual rainfall of the Tiruvannamalai district are 1041 mm and 651.1 mm respectively and the average annual mean temperature of the is 28 °C (Table 3.6 and 3.7). Within the rainfall, number of rainy days and its distribution within the given season plays a crucial part in both water storage and efficient use for productive purposes. More than 67% of the cultivated land is under rainfed condition, efficient water storage and use practices are crucial here.

Table 3.6. Month wise distribution of Rainfall in mm

S.NO	Month	Normal Rainfall (mm)	Actual rainfall (mm)	No of rainy days during the season
(1)	(2)	(3)	(4)	(5)
1	Jun-18	62.40	50.25	89
2	Jul-18	96.00	48.15	
3	Aug-18	142.30	70.14	
4	Sept-18	167.40	94.92	
5	Oct-18	194.26	156.73	72
6	Nov-18	170.20	169.16	
7	Dec-18	82.10	18.28	
8	Jan-19	14.70	0.19	0
9	Feb-19	11.80	0.33	
10	Mar-19	11.40	0.13	
11	Apr-19	19.30	16.83	11
12	May-19	68.20	26.08	
TOTAL		**1041.00**	**651.19**	**171**

Source: WRIS, CWC, MoJS, GoI, https://indiawris.gov.in/wris/

Table 3.7.Monthwise maximum and minimum temperature in °C

S.NO	Months	Minimum Temperature	Maximum Temperature	Average Temperature
(1)	(2)	(3)	(4)	(5)
1	Jun-18	26.4	35	30.7
2	Jul-18	27.5	36	31.75
3	Aug-18	27.3	34.5	30.9
4	Sept-18	26.7	33.7	30.2
5	Oct-18	26.1	32.8	29.45
6	Nov-18	25.7	32.8	29.25
7	Dec-18	24.5	30.9	27.7
8	Jan-19	23	28.6	25.8

9	Feb-19	22	27.6	24.8
10	Mar-19	21.1	28.5	24.8
11	Apr-19	22.2	30.3	26.25
12	May-19	23.8	33.5	28.45
TOTAL		296.3	384.2	340.35
Source: WRIS, CWC, MoJS, GoI, https://indiawris.gov.in/wris/				

3.2.2) Climate projections for the district

The climate projection study carried out by the CCCDM, has indicated that there has been changes in the maximum and minimum temperature as well as rainfall quantity compared the annual normal (1970-2000) of the district.

3.2.2.1) Maximum temperature

The maximum temperature, the annual normal value of the district is 33.2°C, The average maximum temperature range in the district is predicted to 2.1°C mid of the century. For End- century, this increase would be of 3.2°C.

Table 3.8. Projected Future Changes in Annual Maximum Temperature by PRECIS, Reginal climate model projections for Mid and End Century with Base line of 1981-2010 for Tiruvannamalai District

Projection year with respect to baseline	Projection period	Maximum Temperature (projected)
2020	2010-2040	1.1°C
2050	2040-2070	2.1°C
2080	2070-2100	3.2°C
Source: Scoping Study, CCCDM, Anna University for WASCA-TN, GIZ, Nov 2019)		

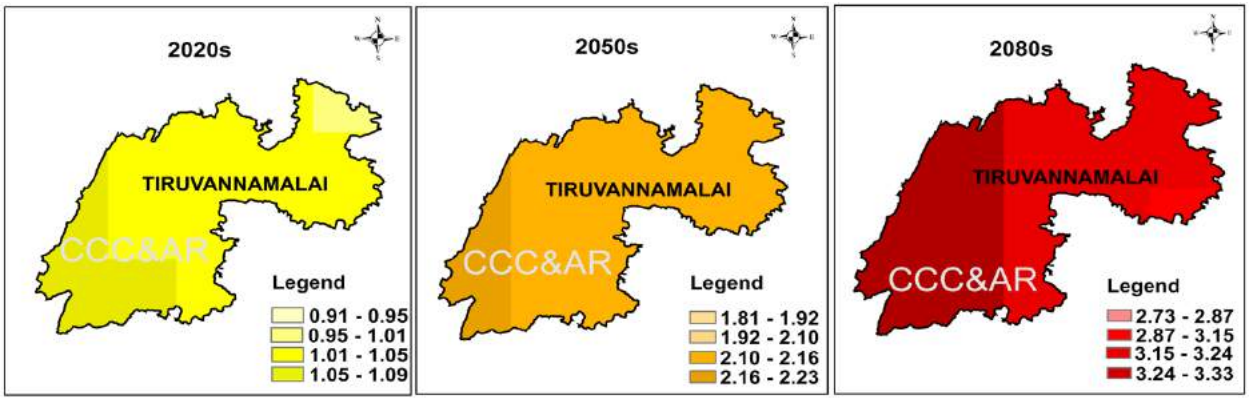


Fig 3.6. Projected Future changes in Annual Maximum Temperature by PRECS, Reginal climate model projections for Mid and End Century with Base line of 1981-2010 for Tiruvannamalai District

Source: Scoping Study, CCCDM, Anna University for WASCA-TN, GIZ, Nov 2019

3.2.2.2)Minimum temperature

While for the minimum temperature, the annual normal value of the district is 23.5°C. The average minimum temperature in the district is predicted to 2.4 oC mid of the century. For End- century, this increase would be of 3.7 oC.

Table 3.9. Projected Future Changes in Annual Minimum Temperature by PRECIS, Reginal climate model projections for Mid and End Century with Base line of 1981-2010 for Tiruvannamalai District	
Projection with respect to baseline (projection Period)	**Minimum Temperature (projected)**
2020 (2010-2040)	1.10°C
2050 (2040-2070)	2.40°C
2080 (2070-2100)	3.70 °C
Source: Scoping Study, CCCDM, Anna University for WASCA-TN, GIZ, Nov 2019	

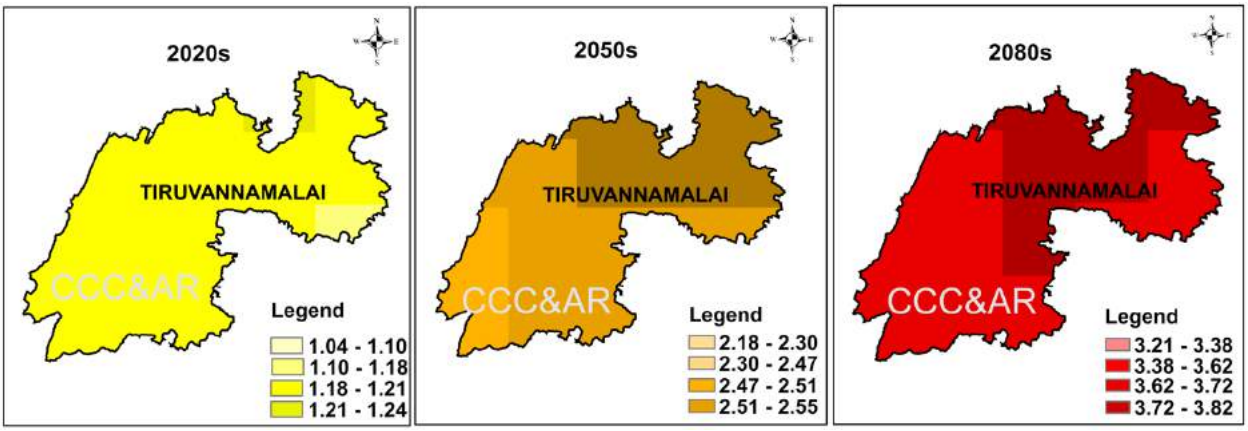


Fig 3.7 Projected Future Changes in Annual Minimum Temperature by PRECIS, Reginal climate model projections for Mid and End Century with Base line of 1981-2010 for Tiruvannamalai District

Source: Scoping Study, CCCDM, Anna University for WASCA-TN, GIZ, Nov 2019

Rainfall

The annual rainfall of the district is 1041mm, the estimated projections for the period is there will be a decrease in 5% and 4% of rainfall in both the century (Mid and End).

Table 3.10.Projected Future Changes in Annual Average rainfall by PRECIS, Reginal climate model projections for 2020, Mid and End Century with Base line of 1981-2010 for Tiruvannamalai District	
Projection with respect to baseline (projection Period)	**Average Annual Rainfall (Projected)**
2020 (2010-2040)	- 2.0%
2050 (2040-2070)	- 5.0%
2080 (2070-2100)	- 4.0 %
Source: Scoping Study, CCCDM, Anna University for WASCA-TN, GIZ, Nov 2019)	

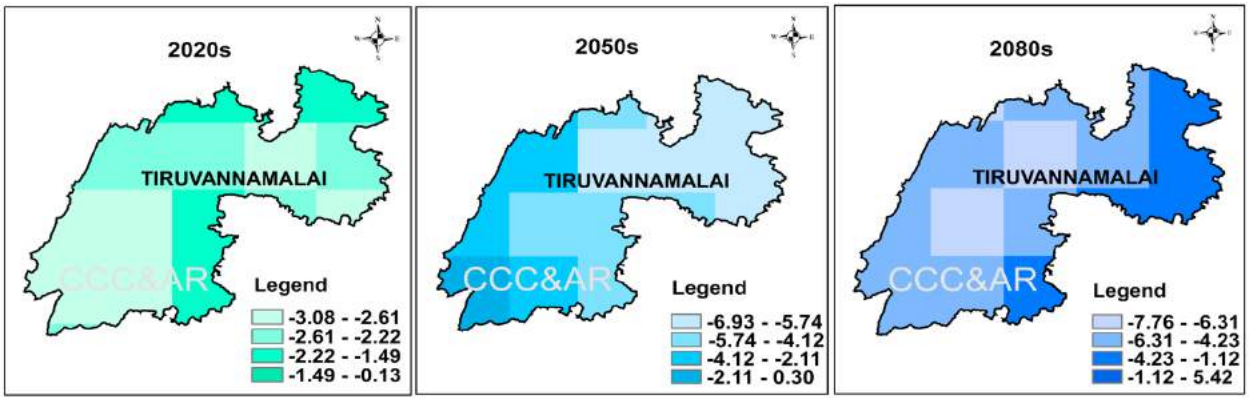


Fig 3.8. Projected Future Changes in Annual Average rainfall by PRECIS, Reginal climate model projections for 2020, Mid and End Century with Base line of 1981-2010 for Tiruvannamalai District

Source: Scoping Study, CCCDM, Anna University for WASCA-TN, GIZ, Nov 2019

3.3 Agriculture and Allied sectors

Agriculture is the primary livelihood for more than 60% of the households in addition to livestock resources. Water is the critical component for farming and the district receives rain from both south west and north east monsoon 45 and 42% respectively.

3.3.1) Soil resources

The predominant soil type is vertisol occupying 65% of the total cultivated area of the district followed by alfisol soil to an extend of 27% in the southwestern part of the district. Remaining area is characterized by loam in 8% of the total area. The detailed analysis of its physical and chemical properties indicates that the poor soil health status.

3.3.2) Soil analysis – Macro nutrients

The macro soil nutrients such as nitrogen and phosphorus are very low to low category in the total number of soil samples tested, while potassium is medium to high. Also, the content of the organic carbon also ranges between very low to low category (Table 3.11 to 3.14 and Fig 3.9 to 3.12) . This indicates that the soil fertility is very poor and further intensive cultivation practices makes soil more vulnerable to soil erosion and land becomes degraded over a period of time. In addition the organic carbon content of the soil is also very low to low which is an essential part in maintaining the soil structure and porosity. Ultimately it is linked with water holding capacity as soil moisture content and permeability rate in the soil.

Table 3.11. Organic carbon -Percentage of the soil samples tested

S.no	Block name	Very Low (VL)	Low (L)	Medium (M)	High (H)	Very High (VH)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	Anakavoor	28%	71%	0.3%	0.00%	0.0%
2	Arni	74%	15%	10.3%	0.14%	0.3%
3	Chengam	30%	68%	1.9%	0.07%	0.1%
4	Chetpet	42%	55%	2.4%	0.12%	0.9%
5	Cheyyar	19%	80%	0.9%	0.02%	0.0%
6	Jawathu hills	27%	71%	1.5%	0.46%	0.3%
7	Kalasapakkam	19%	81%	0.2%	0.03%	0.1%
8	Keelpennathur	39%	58%	2.5%	0.38%	0.1%
9	Pernamallur	16%	84%	0.7%	0.06%	0.0%

10	Polur	32%	65%	3.2%	0.13%	0.1%
11	Pudupalayam	28%	70%	1.6%	0.05%	0.1%
12	Thandarampattu	22%	78%	0.1%	0.00%	0.1%
13	Thellar	22%	74%	3.8%	0.11%	0.1%
14	Thiruvannamalai	30%	64%	4.0%	0.47%	1.4%
15	Thurinjapuram	30%	66%	2.5%	1.14%	0.8%
16	Vandavasi	42%	57%	1.0%	0.10%	0.1%
17	Vembakkam	39%	60%	0.4%	0.06%	0.5%
18	West Arni	25%	74%	0.1%	0.04%	0.0%
	Total	31%	66%	2.1%	0.19%	0.3%

Table 3.12. Available N - Percentage of the soil samples tested

S.no	Block name	Very Low (VL)	Low (L)	Medium (M)	High (H)	Very High (VH)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	Anakavoor	32%	68%	0.0%	0.00%	0.0%
2	Arni	20%	66%	14.0%	0.00%	0.0%
3	Chengam	28%	70%	1.6%	0.00%	0.0%
4	Chetpet	29%	66%	4.8%	0.00%	0.0%
5	Cheyyar	7%	91%	1.8%	0.00%	0.0%
6	Jawathu hills	26%	72%	2.6%	0.00%	0.0%
7	Kalasapakkam	4%	94%	1.8%	0.00%	0.0%
8	Keelpennathur	14%	80%	5.3%	0.00%	0.0%
9	Pernamallur	20%	80%	0.0%	0.00%	0.0%
10	Polur	28%	65%	7.3%	0.00%	0.0%
11	Pudupalayam	23%	74%	3.3%	0.00%	0.0%
12	Thandarampattu	14%	85%	0.4%	0.00%	0.0%
13	Thellar	17%	66%	17.0%	0.00%	0.0%
14	Thiruvannamalai	26%	66%	8.3%	0.04%	0.0%
15	Thurinjapuram	20%	73%	7.2%	0.00%	0.0%
16	Vandavasi	33%	62%	4.7%	0.00%	0.0%
17	Vembakkam	27%	73%	0.0%	0.00%	0.0%
18	West Arni	3%	96%	1.1%	0.04%	0.0%
	Total	21%	75%	4.5%	0.00%	0.0%

Table 3.13. Available soil P Status -Percentage of the soil samples tested

S.no	Block name	Very Low (VL)	Low (L)	Medium (M)	High (H)	Very High (VH)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	Anakavoor	16%	13%	45%	25%	0.9%
2	Arni	3%	17%	69%	10%	1.6%

3	Chengam	4%	13%	52%	29%	1.3%
4	Chetpet	5%	26%	55%	11%	2.8%
5	Cheyyar	18%	15%	49%	17%	0.6%
6	Jawathu hills	3%	22%	55%	14%	6.3%
7	Kalasapakkam	8%	14%	46%	28%	3.3%
8	Keelpennathur	7%	19%	49%	21%	3.4%
9	Pernamallur	14%	23%	36%	26%	0.2%
10	Polur	4%	36%	50%	9%	1.6%
11	Pudupalayam	4%	20%	57%	15%	3.8%
12	Thandarampattu	9%	25%	39%	27%	0.6%
13	Thellar	8%	28%	54%	9%	1.6%
14	Thiruvannamalai	4%	26%	59%	9%	2.1%
15	Thurinjapuram	3%	18%	63%	15%	1.1%
16	Vandavasi	3%	34%	59%	3%	0.8%
17	Vembakkam	7%	20%	37%	32%	3.7%
18	West Arni	4%	30%	42%	24%	0.2%
	Total	7%	22%	51%	18%	2.0%

Table 3.14. K Status - Percentage of the soil samples tested

S.no	Block name	Very Low (VL)	Low (L)	Medium (M)	High (H)	Very High (VH)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	Anakavoor	1.5%	2%	96%	0.1%	0.0%
2	Arni	0.4%	5%	85%	9.8%	0.0%
3	Chengam	1.1%	22%	69%	8.3%	0.3%
4	Chetpet	1.5%	12%	80%	6.8%	0.1%
5	Cheyyar	0.7%	28%	68%	3.2%	0.0%
6	Jawathu hills	0.3%	17%	80%	3.2%	0.0%
7	Kalasapakkam	0.8%	30%	68%	1.3%	0.1%
8	Keelpennathur	2.2%	18%	72%	7.1%	0.0%
9	Pernamallur	0.2%	26%	74%	0.1%	0.0%
10	Polur	1.0%	5%	89%	5.1%	0.0%
11	Pudupalayam	2.5%	8%	86%	3.3%	0.0%
12	Thandarampattu	0.5%	18%	80%	1.1%	0.0%
13	Thellar	2.1%	9%	76%	12.3%	0.0%
14	Thiruvannamalai	1.1%	9%	81%	8.6%	0.0%
15	Thurinjapuram	3.0%	14%	78%	5.2%	0.0%
16	Vandavasi	1.1%	6%	91%	1.6%	0.0%
17	Vembakkam	1.3%	26%	68%	4.7%	0.0%
18	West Arni	0.9%	23%	75%	1.0%	0.0%
	Total	1.2%	16%	79%	4.6%	0.0%

Source: https://soilhealth.dac.gov.in/NewHomePage/NutriPage

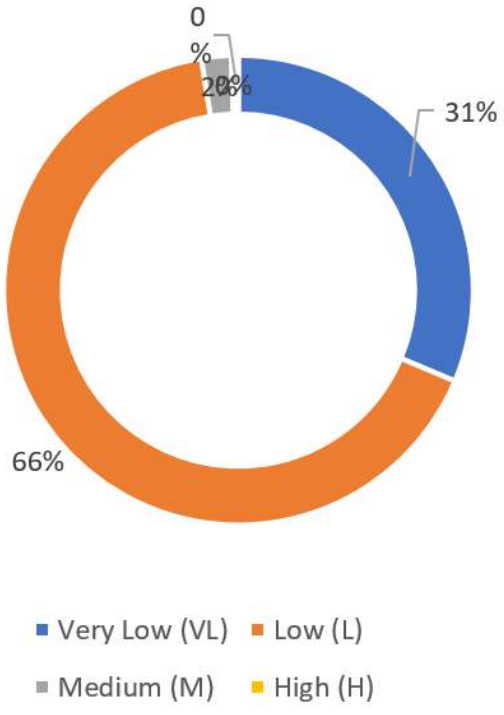


Fig 3.9 Status of OC Category

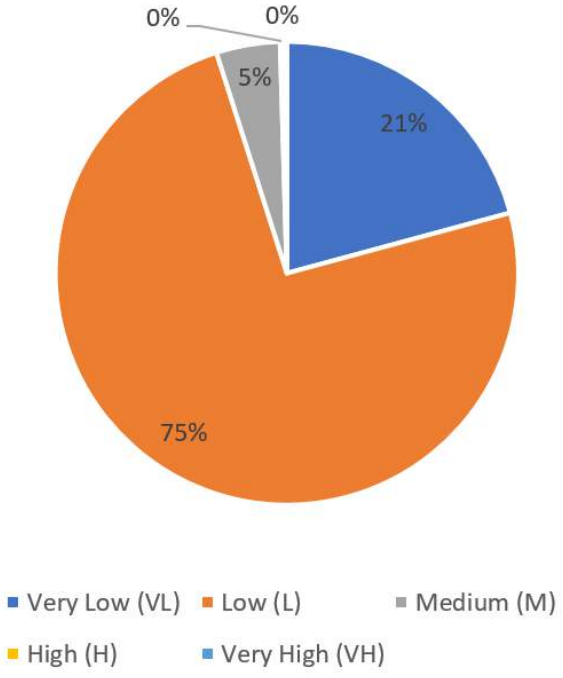


Fig 3.10 Status of Available N category

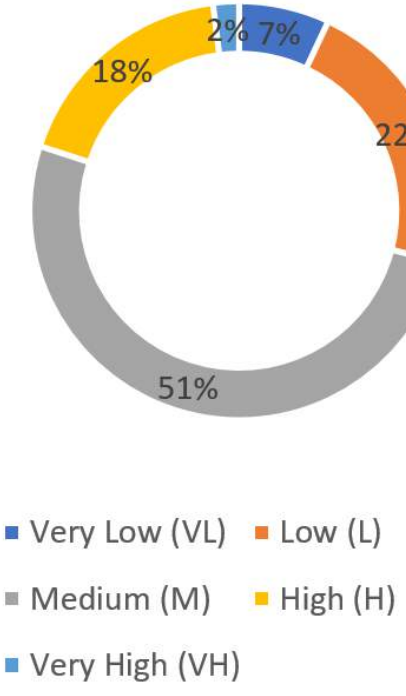


Fig 3.11. Available P category

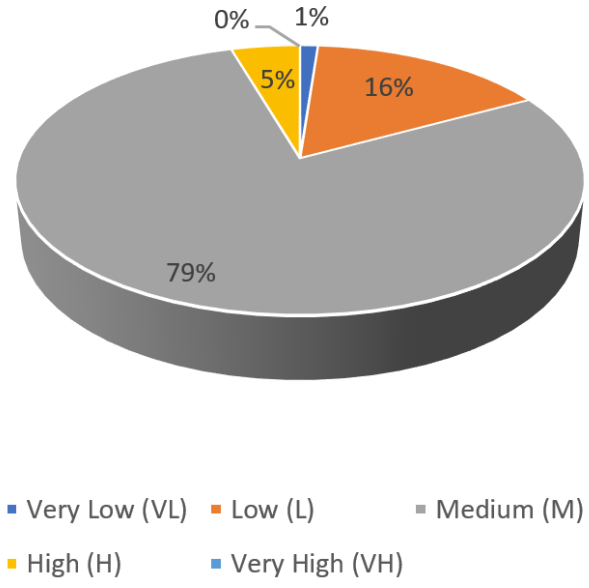


Fig 3.12.Available K category

3.3.3) Soil Analysis – Status of the soil micro nutrients

The micro nutrient status of the soil with specific reference to Manganese, Boron and Zinc are deficient in more than 91.34, 59.33 and 54.52% respectively of the soils tested. Remaining other nutrients such as Fe, Cu, Mn and S are sufficient in the soil.

Table 3.15. Status of the soil Micro Nutrients Status - Block Wise

		Soil Deficiency in terms of micro nutrients in					
S.No	Block	Zn	Fe	Cu	Mn	B	S
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Anakavoor	51.8	28.66	3.69	85.91	25.06	26.13
2	Arni	62.79	6.07	2.07	97.88	90.21	39.67
3	Chengam	38	19.91	5.32	67.72	24.44	15.67
4	Chetpet	61.03	14.6	1.58	98.42	78.81	39.65
5	Cheyyar	64.35	30.84	10.63	90.32	39.41	22.07
6	Jawadhu hills	62.14	6.85	2.11	87.63	56.75	18.8
7	Kalasapakkam	46.11	30.44	8.88	88.27	41.31	16.63
8	Kipennathur	48.15	20.84	2.59	98.52	79.91	19.26
9	Pernamallur	44.3	42.61	1.52	83.82	24.38	26.05
10	Polur	72.85	10.11	1.38	98.74	83.06	47.71
11	Pudhupalayam	53.28	11.57	2.21	93.63	81.36	29.95
12	Thandarampet	55.09	29.16	6.67	84.94	31.94	30.44
13	Thellar	45.09	7.68	1.22	93.52	90.2	43.62
14	Thiruvannamalai	53.71	15.3	2.08	97	86.18	27.23
15	Thurinjapuram	57.26	9.64	1.07	97.42	84.16	37.03
16	Vandavasi	70.41	6.66	2.1	98.68	80.48	64.63
17	Vembakkam	43.77	33.63	4.36	89.09	28.34	17.27
18	West Arni	51.19	17.64	5.92	92.69	41.96	13.41
Total		54.52	19.01	3.63	91.34	59.33	29.73

Source: https://soilhealth.dac.gov.in/NewHomePage/NutriPage

3.3.4) Physical parameters – pH status

With reference to the physical parameters, more than 40% of the soils are moderately acidic to moderately alkaline in nature.

3.3.5) Soil texture

The district has diverse soil types and predominant in vertisol and alfisol, with reference to soil texture the proportion of fine, coarse and fine loamy types are in higher in proportion (Table 3.16 and Fig 3.13 and Fig 3.14).

Table 3.16 Soil Profile Status - Block Wise (Ha)												
S.No	Block/Mandal	Fine	Fine loamy	Coarse loamy	Loam Skeletal	Loamy	Fine silty	Clayey	Clayey Skeletal	Contra-sting Particle Size	Sandy	None
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1	Anakavoor	11719	6405	1006	43	0	0	876	1326	0	0	4524
2	Arni	13177	3093	356	468	0	0	120	370	0	0	3398
3	Chengam	7290	13086	4541	295	1776	38	6468	14457	0	0	4385
4	Chetpet	9656	8285	331	2867	18	0	762	2166	0	0	3817
5	Cheyyar	9099	5195	1988	0	0	0	162	3727	269	0	5101
6	Jawadhu hills	6709	6714	48898	928	130	0	194	17	0	0	234
7	Kalasapakkam	9728	7596	4045	610	243	1649	0	3427	0	0	2967
8	Kilpennathur	11394	5927	259	3240	1787	0	626	1524	0	0	3216
9	Pernamallur	9668	7822	2140	263	69	0	653	2328	0	0	4564
10	Polur	12306	4757	4334	2675	761	0	0	7934	0	0	4167
11	Pudhupalayam	7221	6105	4764	3002	1293	6	2717	1081	0	0	3389
12	Thandarampet	12758	8411	216	4635	5193	0	6585	16397	0	0	11328
13	Thellar	10595	6730	28	608	1202	41	668	5660	0	0	4806
14	Thiruvannamalai	13656	8415	778	1957	6328	81	1393	1720	0	0	4273
15	Thurinjapuram	13192	10029	156	1641	220	163	2048	65	0	0	3018
16	Vandavasi	11384	7053	230	284	15	0	715	5122	0		5233
17	Vembakkam	11013	7989	2756	20	0	0	2159	1995	436	1224	6026
18	West arni	11554	3536	1827	239	0	0	0	265	0	0	3157
Total		**192119**	**127148**	**78653**	**23775**	**19035**	**1978**	**26146**	**69581**	**705**	**1224**	**77603**

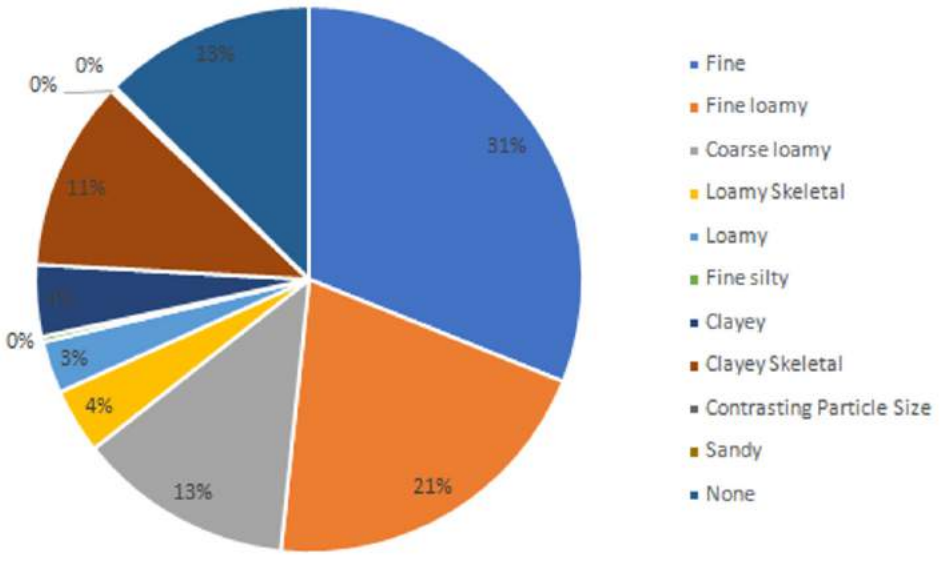


Fig 3.13.Types of Soil in Trivuannamalai (extent in ha)

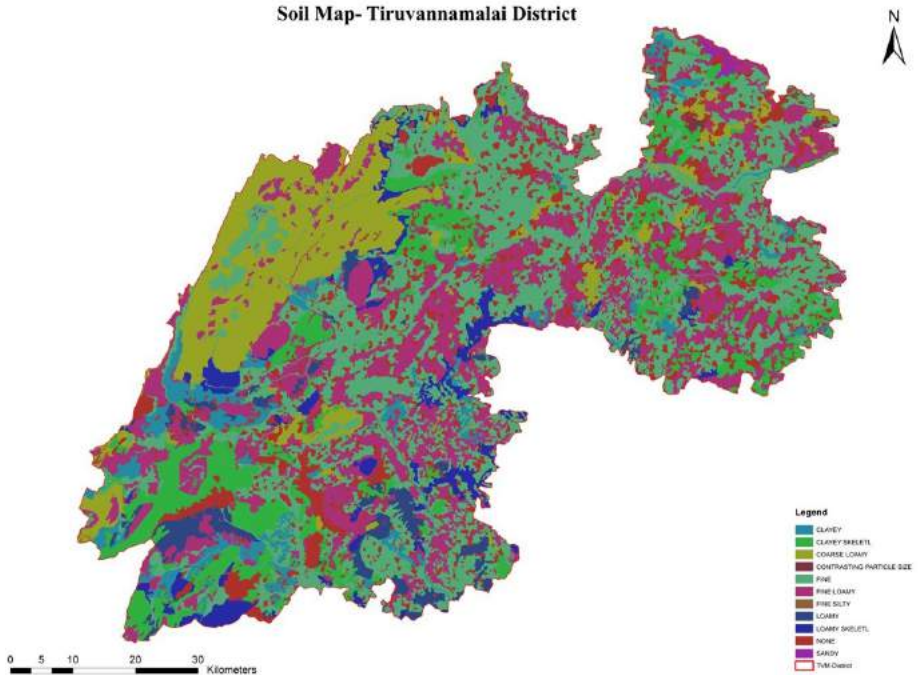


Fig 3.14. Distribution of soil types - textural classification, Tiruvannamalai

3.4) Land Use Analysis

The standard land use classification helps to understand the distribution and the extend of different land use categories. As the runoff and water harvesting actions are linked to the land use systems, its distributions across the geographical boundary (GP/block/watershed/sub-basins) are necessary to take the decisions.

The table 3.17 and 3.18 and Fig 3.15 shows the area under different land uses. From the table it is evident that

- 27.05% of the land is under public and degraded land
- 72.9% of the land is under individual ownership
- Of the individual ownership land, 30.7% is under fallow land other than current fallow and the fallow land
- 42.18% of the total area is currently under cultivation.
- Under public and degraded land, the district has negligible area under permanent pastures, however the district has considerable number of small ruminants which are normally open grazed

Table 3.17.Land use classification of the district

S.NO	Classification	Area in ha
(1)	(2)	(3)
1	Forest Area	1010.12
2	Area under Non-Agricultural Uses	90862.75
3	Barren & Un-cultivable Land Area	19303.45
4	Permanent Pastures and Other Grazing Land Area	2907.76
5	Land Under Miscellaneous Tree Crops etc. Area	1797.5
6	Culturable Waste Land Area	8442.24
7	Fallows Land other than Current Fallows Area	25998.92
8	Current Fallows Area	115371.95
9	Total Unirrigated Land Area	55970.74
10	Area Irrigated by Source	137883.43
	Total area	**459542**
Source: Census of India, 2011		

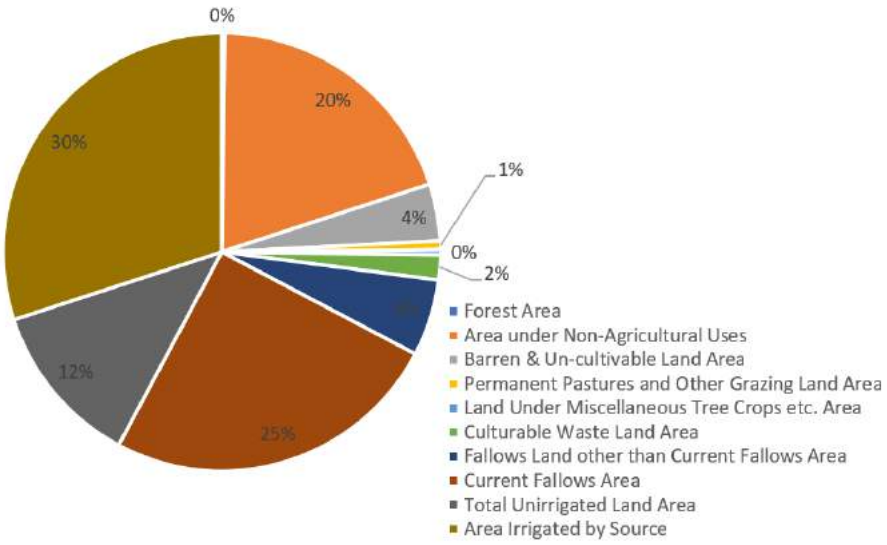


Fig 3.15. Land use classification of the district, 2011

Table 3.18. Block wise distribution of land area in different land use category

Name of the block	Forest Area	Area under Non-Agricultural Uses	Barren & Un-cultivable Land Area	Permanent Pastures and Other Grazing Land Area	Land Under Miscellaneous Tree Crops etc. Area	Culturable Waste Land Area	Fallows Land other than Current Fallows Area	Current Fallows Area	Total Un-irrigated Land Area	Area Irrigated by Source
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Anakkavur	497.72	7953.59	81.54	305.76	224.5	83.41	1165.39	7653.83	2709.95	5414.61
Arni	0	3587.53	5712.25	36.42	2.81	230.51	752.75	4477.36	1695.82	4325.28
Chengam	0	3565.75	1825.98	2.64	2.77	691.75	1833.05	9879.15	1697.23	9921.09
Chetpet	2.35	5409.72	544.04	479.5	73.08	199.47	993.31	4975.08	2844.93	7915.52
Cheyyar	0	5705.38	178.44	251.62	409.81	288.5	1833.59	7498.86	3348.73	4566.09
Jawadhu Hills	331.66	811.95	1096.01	15.12	0.35	856.05	1604.03	2157.63	6094.12	829.12
Kalasapakkam	0	4690.50	678.46	83.18	167.15	211.66	962.18	3928.2	1528.26	9932.03
Keelapennathur	0	3939.29	913.65	2.92	46.13	65.27	19.45	7289.13	4473.25	7468.71
Peranamallur	0	6076.04	361.16	292.11	185.94	396.84	889.12	5498.2	4116.02	6604.56
Polur	44.33	5262	1155.17	77.15	43.88	1989.09	714.74	4229.4	2231.61	10768.51
Pudupalayam	0	4213	67.93	0	32.27	264.01	1177.13	5794.16	337.01	7840.97
Thandrampet	97.17	5789	3628.85	11.05	16.41	876.49	6861.37	2957.47	1831.4	17244.02
Thellar	24.96	5661	633.87	310.9	95.54	397.89	1416.82	7934.56	4970.93	7616.92
Tiruvannamalai	0	4554	1187.17	142.94	54.7	392.77	596.24	9279.03	2676.73	10875.56
Thurinjapuram	11.93	5014	277.53	69.58	17.15	265.43	797.9	6164.6	6255.74	9579.62
Vandavasi	0	7139	384.66	412.65	188.52	571.63	1095.97	7025.82	4637.23	7434.7
Vembakkam	0	7793	334.68	335.77	203.2	496.02	2686.97	12475.73	2024.46	5427.03
West Arani	0	3698	242.06	78.45	33.29	165.45	598.91	6153.74	2497.32	4119.09

Source: Census of India, 2011

3.4.1) Area proposed under WASCA for treatment

Of the total area in the district, 29% of the total area is proposed for different actions to conserve water across different land use systems. The proportion of the area varies from 21 to 44%. The highest percentage of the area is in Arni block and the lowest in Pudupalayam and West Arni blocks (Table 3.19 and Fig 3.16)

Table 3.19 Area under different land use categories - Total area to the proposed area for treatment under WASCA

S. No	Block	Total area in Ha	Treatment under WASCA area in ha	Area proposed for treatment in WASCA (%) to total area
(1)	(2)	(3)	(4)	(5)
1	Anakavur	26090	5790	22%
2	Arni	20820	9093	44%
3	Chengam	29419	9517.25	32%
4	Chetpet	23437	5321.53	23%
5	Cheyyar	24081	5368.33	22%
6	Jawadhu hills	13796	4482.5	32%
7	Kalasapakkam	22181	4996.34	23%
8	Kipennathur	24217	7552.73	31%
9	Pernamallur	24419	7173.37	29%
10	Polur	26516	9583.88	36%
11	Pudhupalayam	19726	4117.44	21%
12	Thandarampet	39313	13556.13	34%
13	Thellar	29063	9402.9	32 %
14	Thiruvannamalai	29759	9466.87	32%
15	Thurinjapuram	28453	8682.65	31%
16	Vandavasi	28890	6552	23%
17	Vembakkam	31777	7032.51	23%
18	West Arni	17585	3769.05	21%
Total		**459542**	**131458**	**29%**

Source: CWRM- TN- Tiruvannamalai Plan, 2020-21

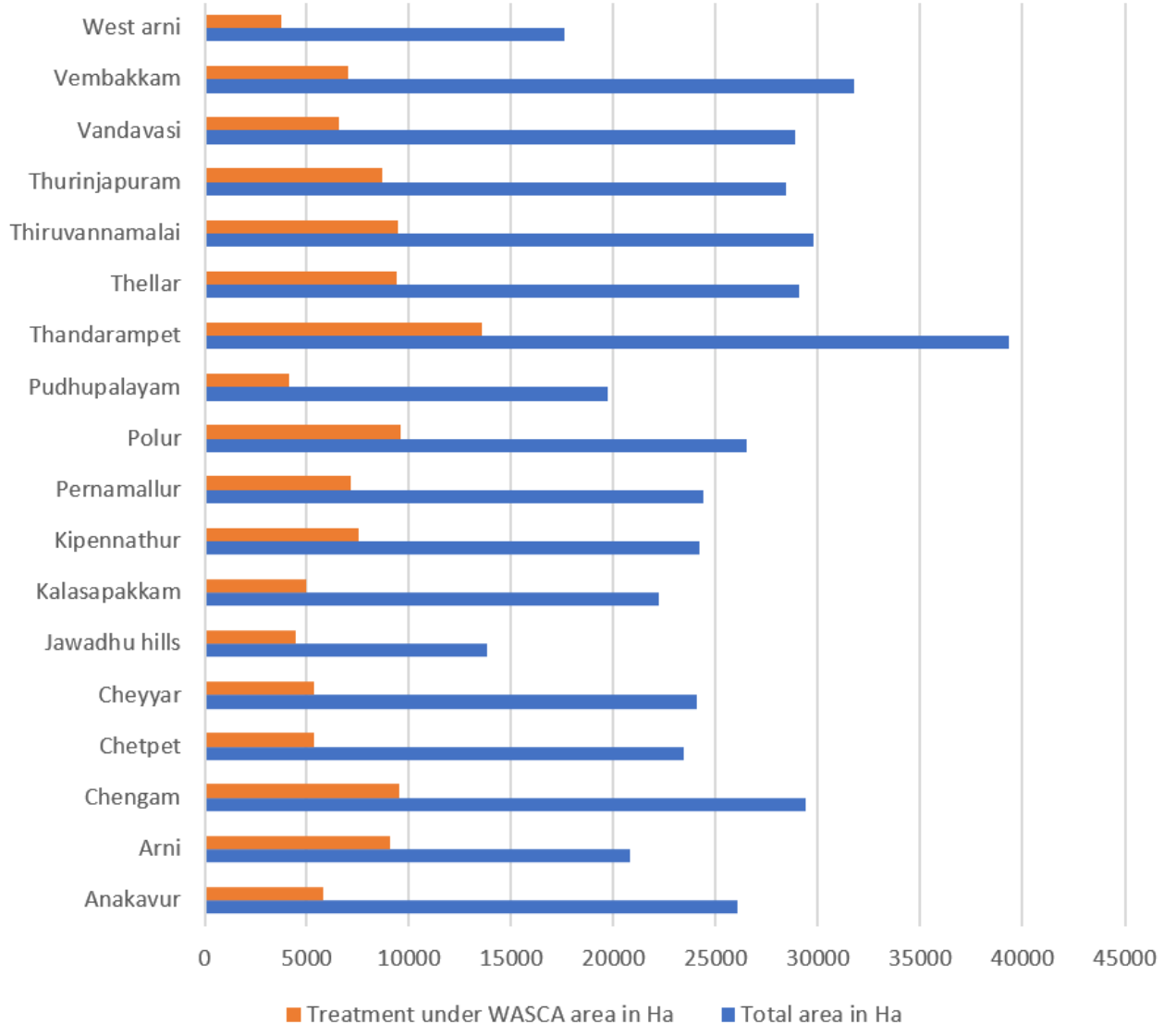


Fig 3.16. Proposed area under treatment in WASCA to the total area in Ha

3.5) Agriculture – Cropping pattern and the irrigation

3.5.1) Cropping

Paddy is the primary crop cultivated in 39.3% of the total area cultivated, groundnut (25.73%), sugarcane (9.14%), pulses (3.7%) and other crops in 4.62% of the area. Of the total crops, 89% is cultivated under irrigated condition and 11% is under rainfed cultivation (Table 3.20 and Fig 3.17).

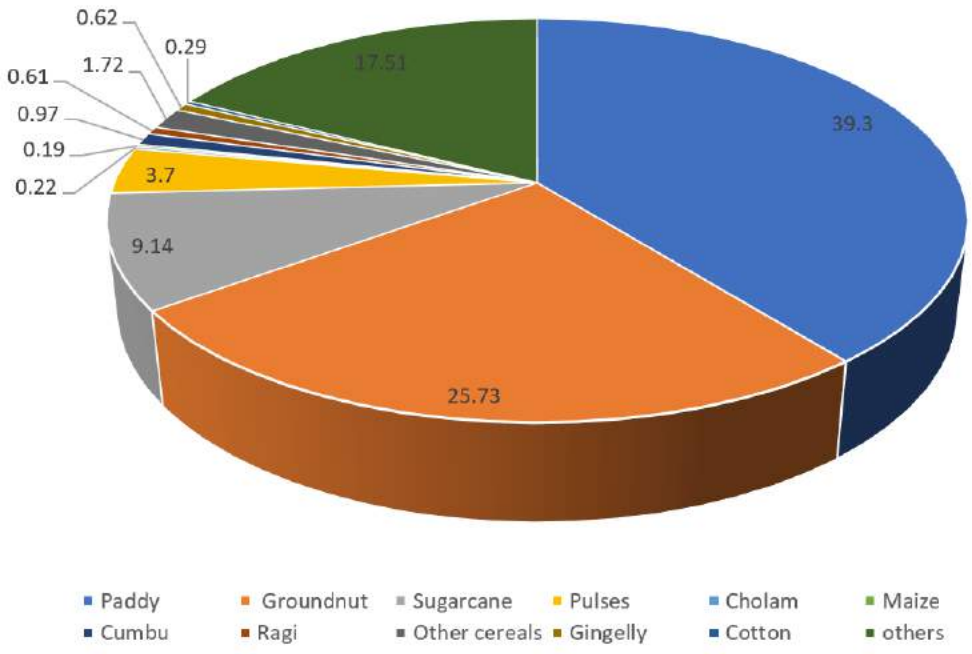


Fig 3.17. Proportion of different crops cultivated in Tiruvannamalai district

Table 3.20. Major crops and the percentage area under cultivation

S.No	Crops	Percentage of the area to the total cultivation
	(1)	(2)
1.	Paddy	39.3
2.	Cholam	0.22
3.	Maize	0.19
4.	Cumbu	0.97
5.	Ragi	0.61
6.	other cereals	1.72
7.	pulses	3.7
8.	sugarcane	9.14
9.	Groundnut	25.73
10.	Gingelly	0.62
11.	Cotton	0.29
Source: G returns, 2018-19, Tiruvannamalai district		

3.5.2) Sources of water for Irrigation and type of irrigation

The analysis indicates that of the total water used for irrigation, 89% is through ground water resources followed by remaining 11% through surface water resources (Table 3.21). Increasingly bore wells are used to draw ground water resources and nearly 16 out of 18 blocks are in different type of ground water category which needs ground water development activities. The total water demand for agriculture is 244307 Ha m (Table 3.21 and Fig 3.18). In case of ground water resources, the predominant type of irrigation is controlled flooding.

Table 3.21. Agriculture and Water Resources

S.no	Block	Volume in HaM (Irrigated)	Volume in HaM (Rainfed)	Total volume in HaM	Surface water(%)	Ground water(%)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	Anakavur	7476	108	7584	1%	99%
2	Arni	9859	287	10145	3%	97%
3	Chengam	13155	3422	16577	21%	79%
4	Chetpet	18337	1442	19778	7%	93%
5	Cheyyar	10498	1454	11952	12%	88%
6	Jawadhu hills	2274	1760	4035	44%	56%
7	Kalasapakkam	15655	594	16249	4%	96%
8	Kipennathur	9726	3339	13065	26%	74%
9	Pernamallur	6353	965	7318	13%	87%
10	Polur	24686	1064	25750	4%	96%
11	Pudhupalayam	17256	1939	19195	10%	90%
12	Thandarampet	18584	1415	19999	7%	93%
13	Thellar	7194	855	8049	11%	89%
14	Thiruvannamalai	16332	1491	17823	8%	92%
15	Thurinjapuram	11286	3839	15125	25%	75%
16	Vandavasi	10331	886	11217	8%	92%
17	Vembakkam	10856	190	11047	2%	98%
18	West arni	8507	892	9399	9%	91%
Total		**218365**	**25942**	**244307**	**11%**	**89%**

Source: G returns for the area in year 2018-19 and CWRM analysis for water requirement

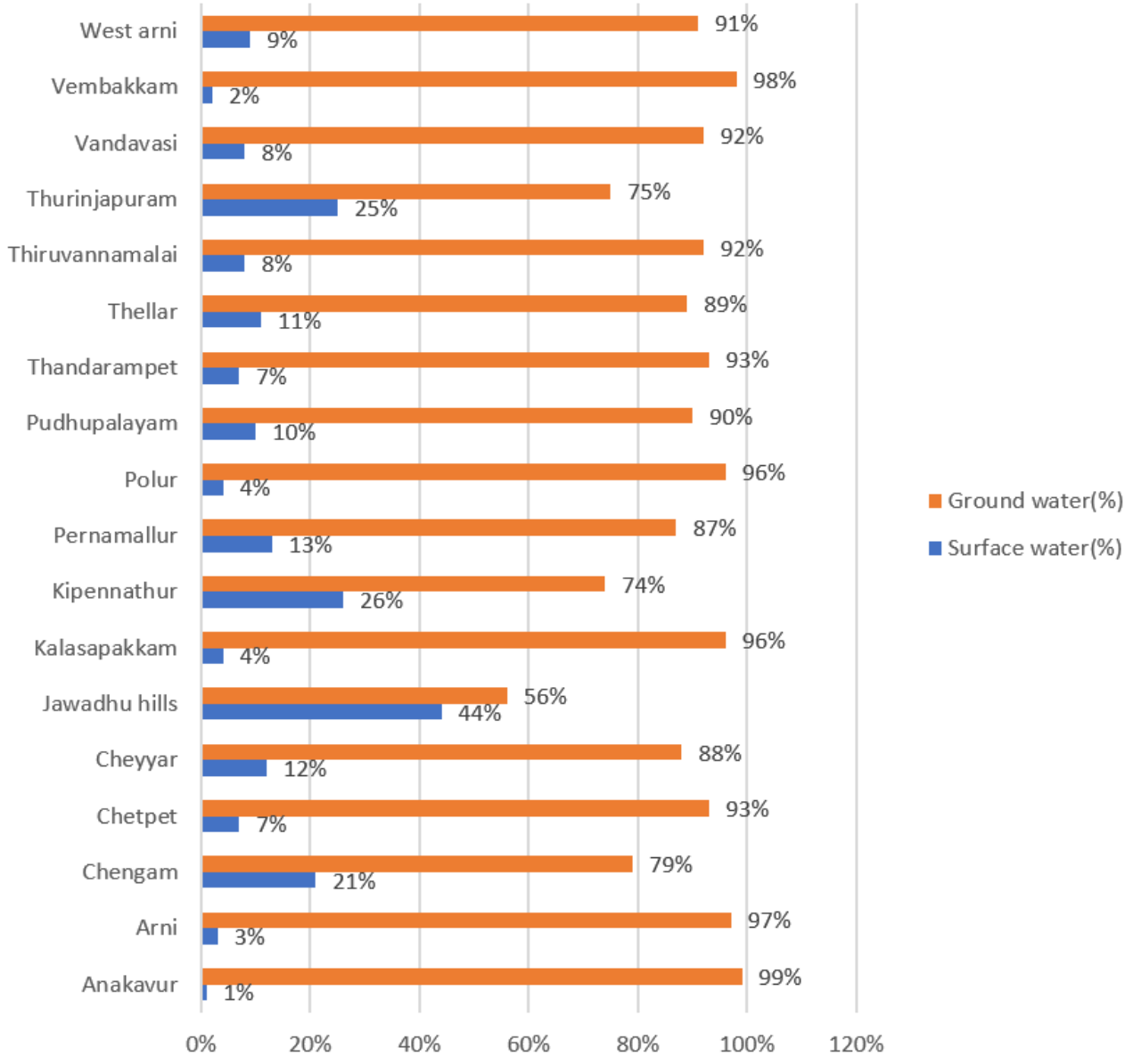


Fig 3.18. Sources of water for irrigation in Tiruvannamalai district (%)

3.5.3) Livestock resources

The district has considerable proportion of livestock resources of which small ruminants such as sheep and goat constitute 40% of the total followed by poultry (27.2%) and cow (20.9%) (Table 3.22 and Fig.3.19)

Table 3.22.Block wise details of Livestock and poultry population

S. No	Name of the Block	Cattle		Buffalo	Sheep	Goat	Pig	Dog	Rabbit	Poultry	Total
		Bullock	Cow								
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1	Anakavoor	10631	45165	3549	53685	54923	1275	0	0	56750	225978
2	Arni	5231	21693	854	28450	27510	850	2730	408	25765	113491
3	Chengam	37101	39997	537	40826	29244	3218	4987	48	45721	201679
4	Chetpet	5021	18716	58	10375	5224	106	0	0	10140	49640
5	Cheyyar	6180	39238	4079	53642	54120	1410	703	87	58250	217709
6	Jawathu hills	3949	9292	149	2442	7732	60	0	0	0	23624
7	Kalasapakkam	7250	12161	632	1157	15812	177	0	0	94500	131689
8	Keelpennathur	10139	17145	231	8903	5630	30	0	0	28000	70078
9	Pernamallur	5748	27218	1179	30768	29854	910	0	0	35780	131457
10	Polur	7250	12161	632	11570	15812	177	2565	345	94500	145012
11	Pudupalayam	10631	45165	1707	19105	5150	1175	0	0	575	83508
12	Thandarampattu	11684	26981	335	11527	9648	201	0	0	11272	71648
13	Thellar	2530	10980	21350	25650	9140	970	0	0	21485	92105
14	Thiruvannamalai	9385	10167	7948	20141	43077	3062	5223	24	0	99027
15	Thurinjapuram	12383	20436	634	8432	5773	40	1550	430	0	49678
16	Vandavasi	5660	26149	1385	32876	32190	875	1118	107	29150	129510
17	Vembakkam	10278	51119	4079	57245	55706	1452	0	0	55910	235789
18	West Arni	5807	21992	658	24350	26860	910	0	0	25175	105752
Total		**166858**	**455775**	**49996**	**441144**	**433405**	**16898**	**18876**	**1449**	**592973**	**2177374**

Source: Livestock census - http://livestockcensus.gov.in/

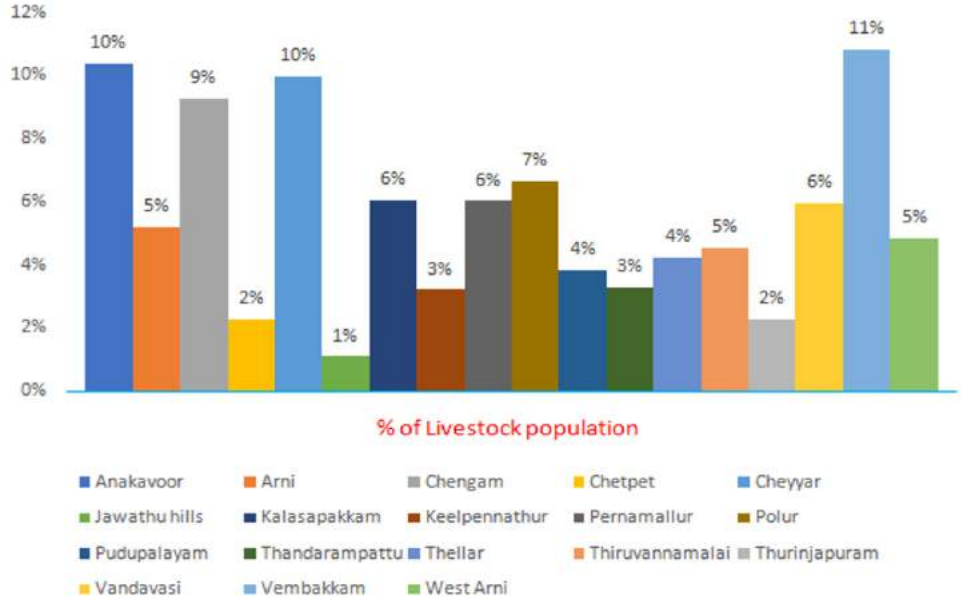


Fig 3.19 Different types of livestock resources in the district

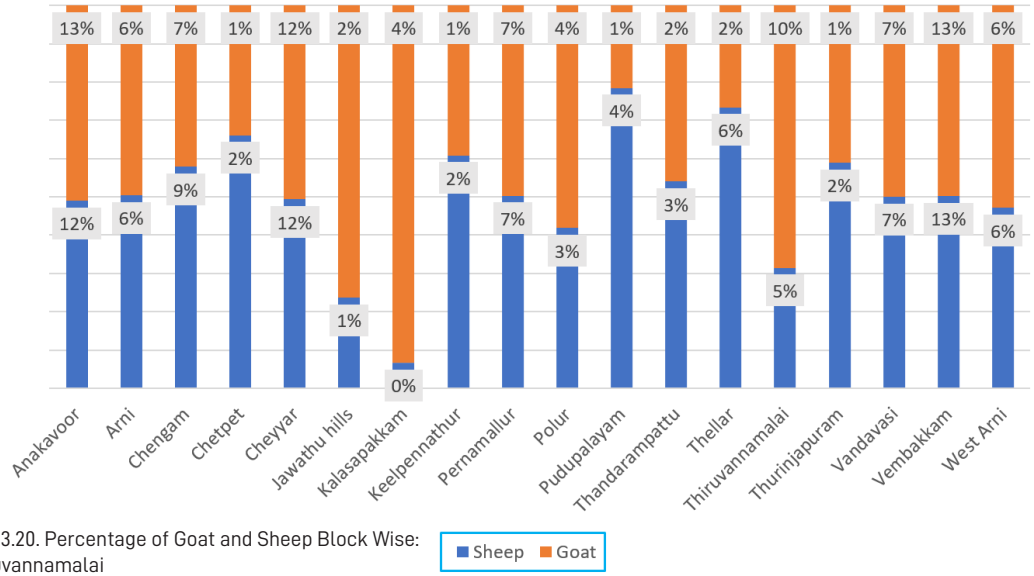


Fig 3.20. Percentage of Goat and Sheep Block Wise: Tiruvannamalai

Of the total water demand of 7947 Ha m for livestock, 42% is met through surface water and remaining 58% is met through surface water resources (table 3.23). Of the 18 blocks Kalasapakkam (87%) and Keelpenathur (79%) and Polur (79%) blocks have highest dependency on the ground water resources compared to remaining blocks. Tiruvannamalai block is the only block where dependency was least (22%).

Table3.23.Water demand for live stock

S.No	Name of the Block	Livestock Water req in Ha.m	Dependency on Ground water(%)	Dependency on Surface water(%)
(1)	(2)	(3)	(4)	(5)
1	Anakavoor	825	50%	50%
2	Arni	414	50%	50%
3	Chengam	736	65%	35%
4	Chetpet	181	68%	32%
5	Cheyyar	795	49%	51%
6	Jawathu hills	86	56%	44%
7	Kalasapakkam	481	87%	13%
8	Keelpennathur	256	79%	21%
9	Pernamallur	480	53%	47%
10	Polur	529	81%	19%
11	Pudupalayam	305	69%	31%
12	Thandarampattu	262	70%	30%
13	Thellar	336	38%	62%
14	Thiruvannamalai	361	20%	78%
15	Thurinjapuram	181	66%	44%
16	Vandavasi	473	49%	51%
17	Vembakkam	861	50%	50%
18	West Arni	386	51%	49%
Total		**7947**	**58%**	**42%**

Source: CWRM- TN- Tiruvannamalai Plan, 2020-21

3.6. Water resources vulnerability

The key indicators used for the assessment of the key water challenges under the water resources are profile of watersheds, drainage lines, canal water networks, share of groundwater, surface water, soil moisture and ET losses in to the consideration.

3.6.1) Surface Runoff - River Sub-basin and Watersheds

The district primarily falls in Gundar-Vaigai river basin. Cheyyer, Thenpennai, Kamandala, Varaganathi are only in seasonal rivers flowing in the district. As a big water storage structure, Sathanur Dam is constructed across Thenpennai River in Chengam Taluk among Chennakesava Hills. These rivers are seasonal and considerable amount of water flows during the main monsoon season from June to December. The district has 1849 micro watersheds and the details of its are given in table 3.24 and Fig 3.21. 3

3.6.1.1) Micro Watersheds

Jawadhu hills and Thandarampet blocks have the larger percentage area under microwatersheds (9%) followed by Chengam (8%) and Polur (7%). Of the remaining blocks Arni block has the lowest area under watershed area (3%).

Table.3.24.Watershed Analysis

S.No	Block	Macro Watershed name	Macro Watershed. No	Macro Watershed- Area in Ha	Number of macro watersheds	Number of micro watersheds	Micro Watershed – Area in Ha
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Anakkavur	Kiliyar	4C2A1	54885.51	2	77	39651.40
		Cheyyar	4C2A3	73282.14			
2	Arni	Cheyyar	4C2A3	73282.14	4	66	27157.77
		Cheyyar river	4C2A4	197665.98			
		Naganadi	4C2A5	57782.29			
		RB Palar	4C2A6	11533.56			
3	Chengam	Turinjalar	4C1B3	74996.28	4	146	67153.54
		Pamban	4C1B5	67673.18			
		Kallar	4C1C1	27770.02			
		Cheyyar river	4C2A4	197665.98			
4	Chetpet	Tondi	4C1D3	33365.85	2	89	43025.19
		Cheyyar river	4C2A4	197665.98			
5	Cheyyar	Cheyyar	4C2A3	73282.14	3	75	40155.59
		Cheyyar river	4C2A4	197665.98			
		Naganadi	4C2A5	57782.29			
6	Jawadhu Hills	Cheyyar river	4C2A4	197665.98	3	196	82575.65
		Naganadi	4C2A5	57782.29			
		Agaram	4C2B1	7293.290			

7	Kalasapakkam	Tondi	4C1D3	33365.85	2	101	53881.29
		Cheyyar river	4C2A4	197665.98			
8	Keelapennathur	Turinjalar	4C1B3	74996.28	3	93	37473.24
		Pamban	4C1D1	194.761			
		Tondi	4C1D3	33365.85			
9	Peranamallur	Tondi	4C1D3	33365.85	4	80	41211.69
		Kiliyar	4C2A1	54885.51			
		Cheyyar	4C2A3	73282.14			
		Cheyyar river	4C2A4	197665.98			
10	Polur	Cheyyar river	4C2A4	197665.98	2	123	60896.08
		Naganadi	4C2A5	57782.29			
11	Pudupalayam	Turinjalar	4C1B3	74996.28	3	87	45220.79
		Pamban	4C1B5	67673.18			
		Cheyyar river	4C2A4	197665.98			
12	Thandrampet	Turinjalar	4C1B3	74996.28	3	168	78786.77
		Pamban	4C1B5	67673.18			
		Kallar	4C1C1	27770.02			
13	Thellar	Tondi	4C1D3	33365.85	3	86	41272.52
		Ongur	4C1D5	10827.14			
		Kiliyar	4C2A1	54885.51			
14	Tiruvannamalai	Turinjalar	4C1B3	74996.28	2	83	54261.18
		Pamban	4C1B5	67673.18			
15	Thurinjapuram	Turinjalar	4C1B3	74996.28	3	112	42777.80
		Tondi	4C1D3	33365.85			
		Cheyyar river	4C2A4	197665.98			
16	Vandavasi	Ongur	4C1D5	10827.14	3	84	41492.67
		Kiliyar	4C2A1	54885.51			
		Cheyyar	4C2A3	73282.14			
17	Vembakkam	LB Palar	4C2A2	694.01	3	93	39800.26
		Cheyyar	4C2A3	73282.14			
		RB Palar	4C2A6	11533.56			
18	West Arani	Cheyyar river	4C2A4	197665.98	2	90	42637.78
		Naganadi	4C2A5	57782.29			
Total				**4151781.18**	**51**	**1849**	**879431.2**
Source: National Watershed Atlas, GOI							

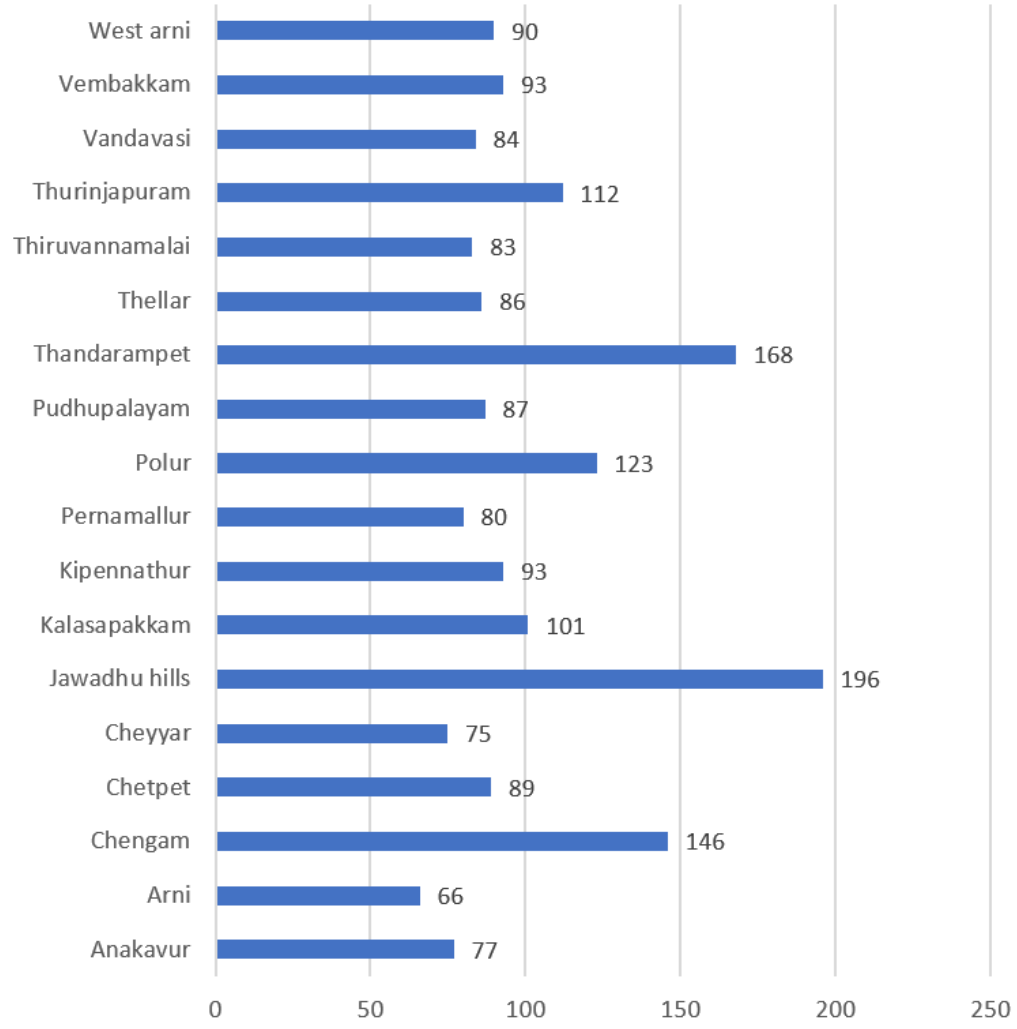


Fig 3.21. Number of micro watersheds

3.6.1.2) Natural Drainage Lines

The total length of the natural drainage lines in the district is 8488 km which is significant in regulating the water flow (Table 3.25 and Fig 3.22). Identifying the order of the drain and location in each of the GPs and micro watersheds were delineated to identify the actions. Jawadhu hills block has longest length of the drainage lines (22% of the total length in the district) followed by Thandrampet and Chengam.

Table.3.25. Drainage line analysis

S.NO	Name / Details	Length (km)
1	Anakavur	167.70
2	Arani	176.87
3	Chengam	878.63
4	Chetpet	176.61
5	Cheyyar	128.17
6	Jawadhu_hills	1888.02
7	Kalasapakkam	600.72
8	Keelpennathur	300.13
9	Pernamallur	134.64

10	Polur	637.44
11	Pudupalayam	431.29
12	Thandrampet	1350.28
13	Thellar	271.48
14	Thurijapuram	304.16
15	Tiruvannamalai	439.88
16	Vandavasi	235.65
17	Vembakkam	214.02
18	West_Arani	152.78
Total		**8488.46**
Source: Water Resources Organization, Government of Tamil Nadu		

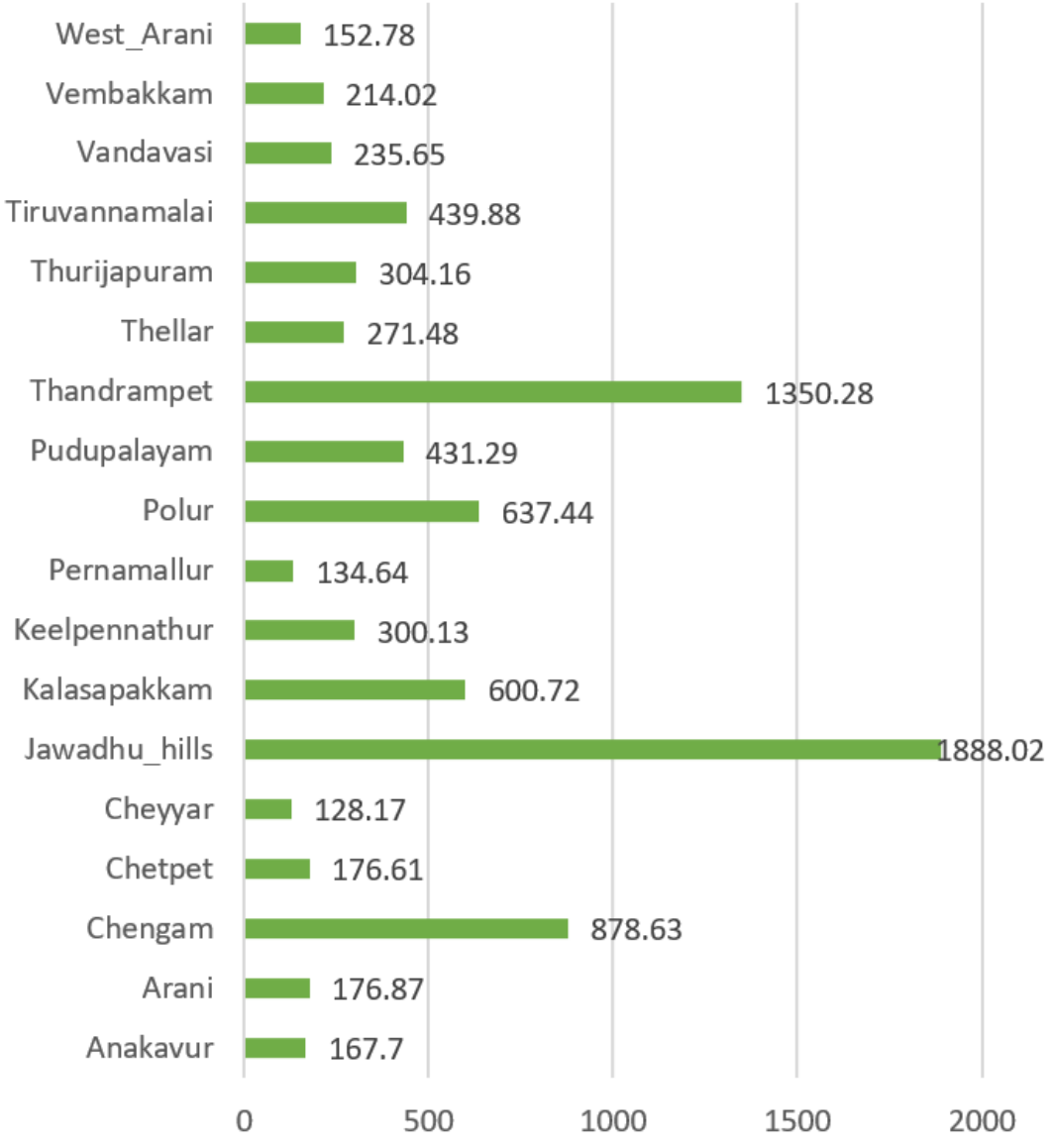


Fig 3.22 Length of the drainage canals (Km)

3.7) Surface Water Resources

The surface water resources are important for catching the rainfall and used for storage and ground water recharge. Here the existing water storage, drainage lines, type of irrigation networks are important components.

3.7.1) Existing Water Structures

The district has structured traditional water storage units as tanks, ponds and ooranis which are the life line of local communities for their lives and livelihoods. The district has 1966 tanks and 3787 ooranis with 767 Km length of field channels to distribute water to the agriculture fields (Table 3.26). Most of the water storage structures needs restoration by increasing the storage capacity and strengthening its distribution structures.

Table.3.26. Existing water structures

S.No	Name of the Block	Number of tanks	Number of ponds	Field channel length(m)
(1)	(2)	(3)	(4)	(5)
1	Anakavoor	116	304	65526
2	Arni	105	130	54030
3	Chengam	86	249	3272
4	Chetpet	116	178	109660
5	Cheyyar	121	217	0
6	Jawathu hills	0	15	0
7	Kalasapakkam	83	194	14000
8	Keelpennathur	125	279	27700
9	Pernamallur	129	294	500
10	Polur	72	108	5860
11	Pudupalayam	56	192	0
12	Thandarampet	93	144	10344
13	Thellar	149	294	113830
14	Thiruvannamalai	123	226	138250
15	Thurinjapuram	104	277	61600
16	Vandavasi	232	165	38645
17	Vembakkam	147	335	111910
18	West Arni	109	186	12490
Total		**1966**	**3787**	**767617**

Source: Primary data from the Panchayat office, 2020

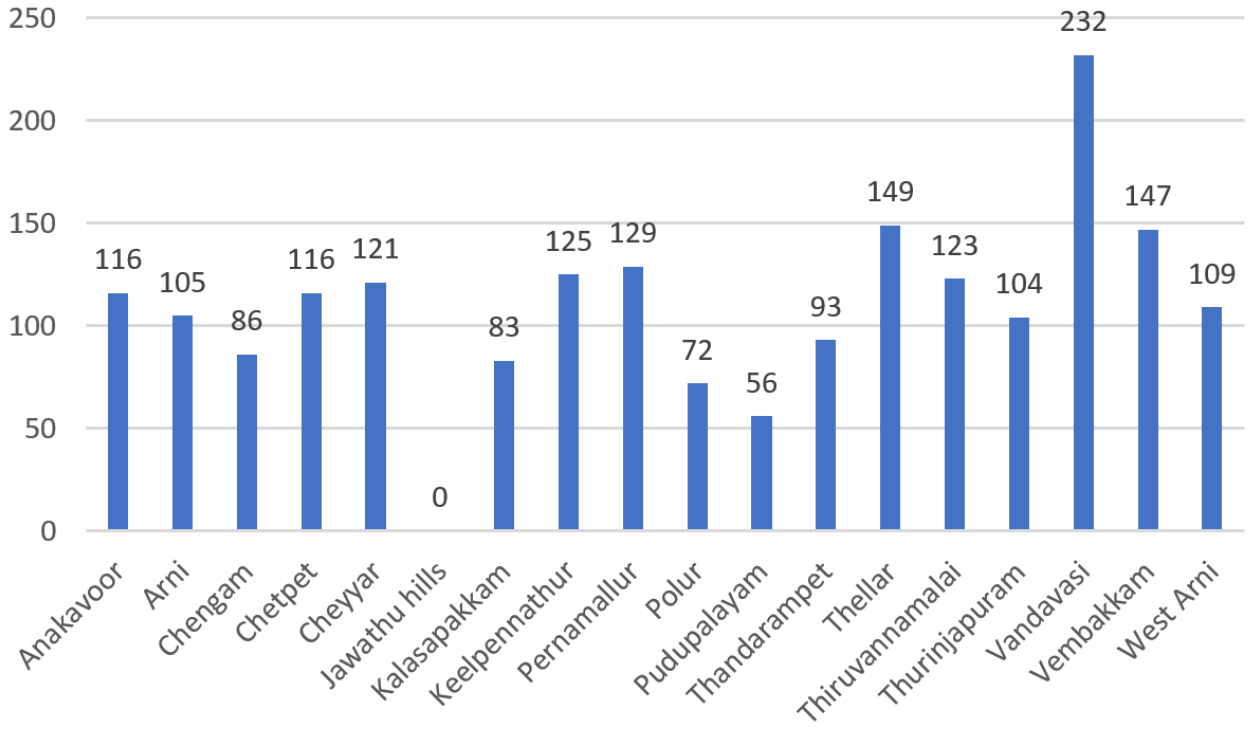


Fig 3.23. Number of tanks

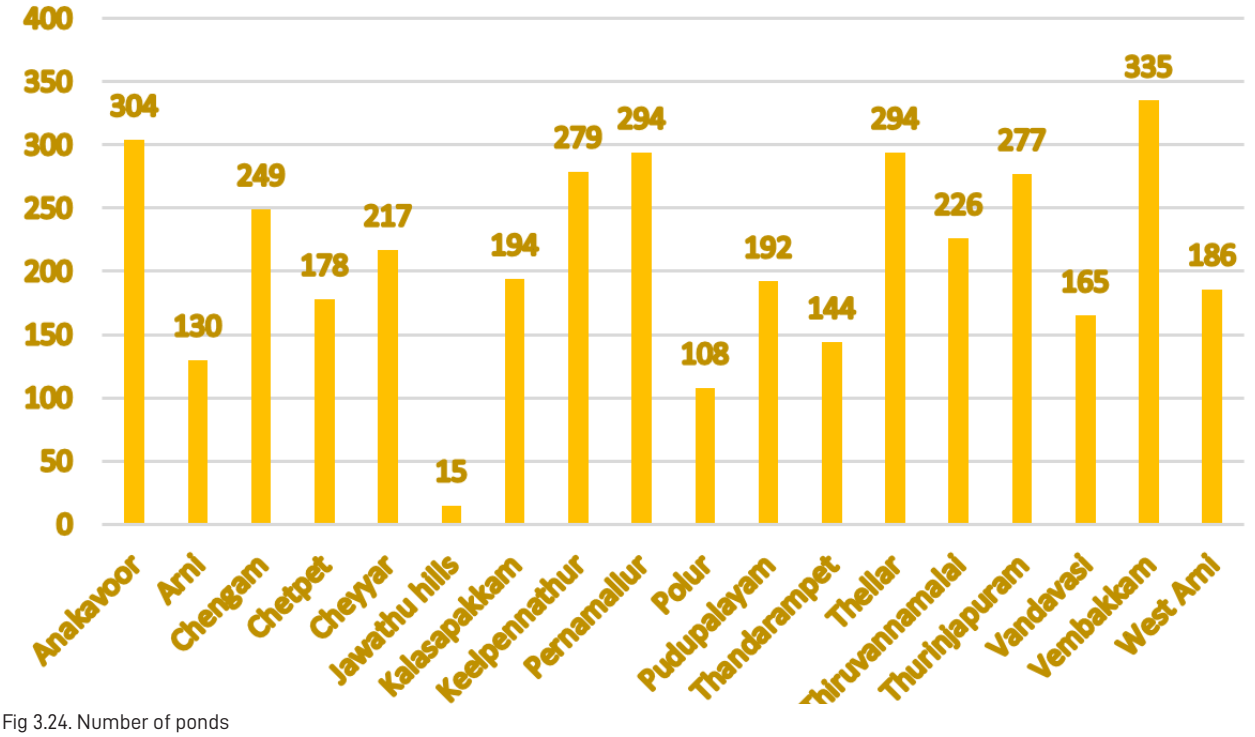


Fig 3.24. Number of ponds

3.7.1.2) Status of irrigation

The district has 1, 18,362 open/tube wells, 19,111 tanks which irrigate the cultivation area of 1,37,883 ha in the district. Block wise area under irrigation as well as irrigation sources are given in Fig 3.27 and Fig 3.26. Of the total irrigation, 85% is met through ground water and the remaining 15% through surface water resources(Fig 3.27).

Table 3.27. Area under different sources of irrigation (Ha)

S. No	Name of the Block	Canals Area (Ha)	Wells/Tube Wells Area (Ha)	Tanks/ Lakes Area (Ha)	Waterfall Area (Ha)	Other Source (specify) Area (Ha)	Total Area(Ha)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Anakavoor	0	2884.9	2529.4	0	0	5414.3
2	Arni	0	4095.2	230	0	0	4325.2
3	Chengam	0	9690.8	230.4	0	0	9921.2
4	Chetpet	0	6861.9	1053.3	0	0	7915.2
5	Cheyyar	0	4242.8	323.5	0	0	4566.3
6	Jawathu hills	0	828.9	0	0	0	828.9
7	Kalasapakkam	0	8097.3	1834.6	0	0	9931.9
8	Keelpennathur	0	6697.4	771.6	0	0	7469
9	Pernamallur	0	6604.6	0	0	0	6604.6
10	Polur	0	10139.3	628.9	0	0	10768.2
11	Pudupalayam	0	5523.8	2317.4	0	0	7841.2
12	Thandarampet	267.9	15973.9	1002.6	0	0	17244.4
13	Thellar	0	5874.7	1742.2	0	0	7616.9
14	Thiruvannamalai	135.9	10055.3	683.6	0	0	10874.8
15	Thurinjapuram	0	8389.9	1190.1	0	0	9580
16	Vandavasi	0	5373.6	2061	0	0	7434.6
17	Vembakkam	6.2	3100.2	2320.9	0	0	5427.3
18	West Arni	0	3927.9	191.5	0	0	4119.4
Total		**410**	**118362**	**19111**	**0**	**0**	**137883**

Source: CWRM- TN- Tiruvannamalai Plan, 2020-21

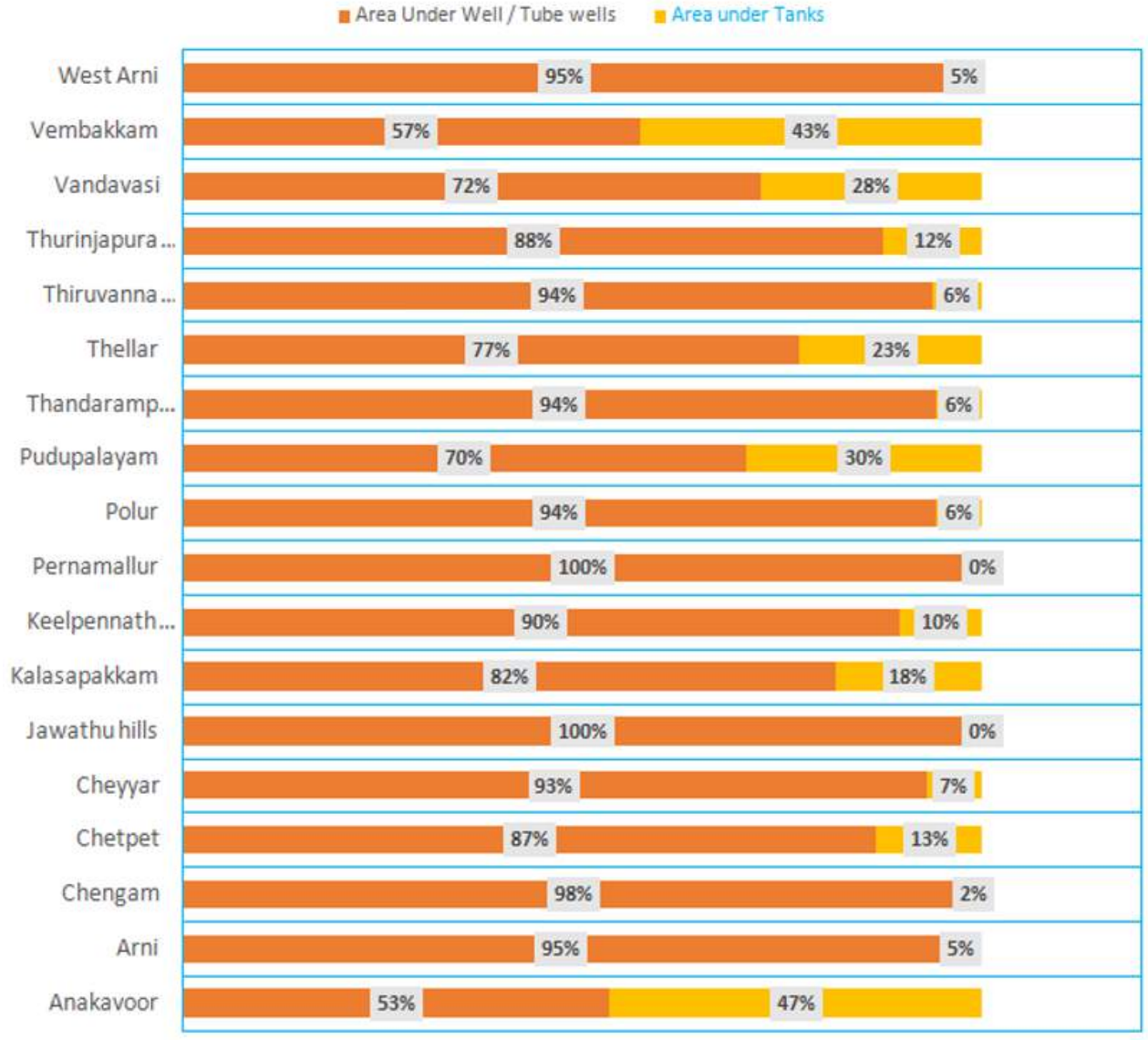


Fig 3.25. Block Wise Area Under Irrigation

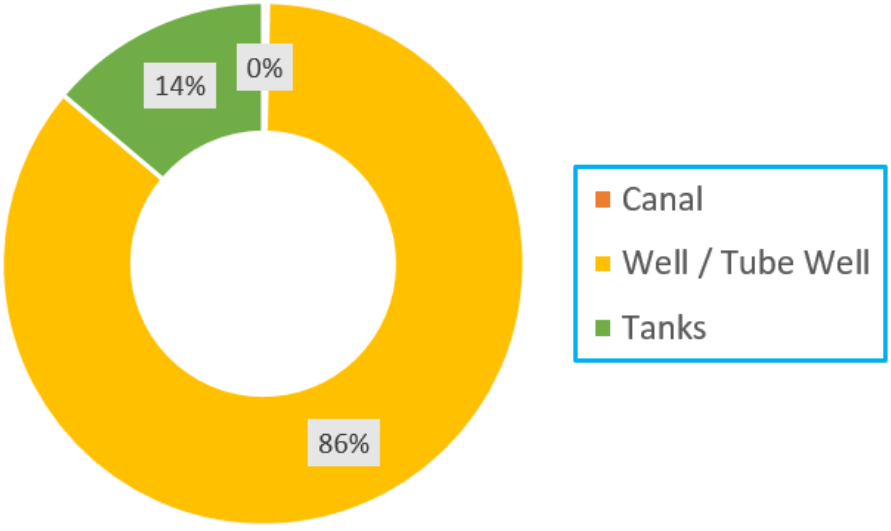


Fig 3.26. Irrigated Area in the district by different sources (%)

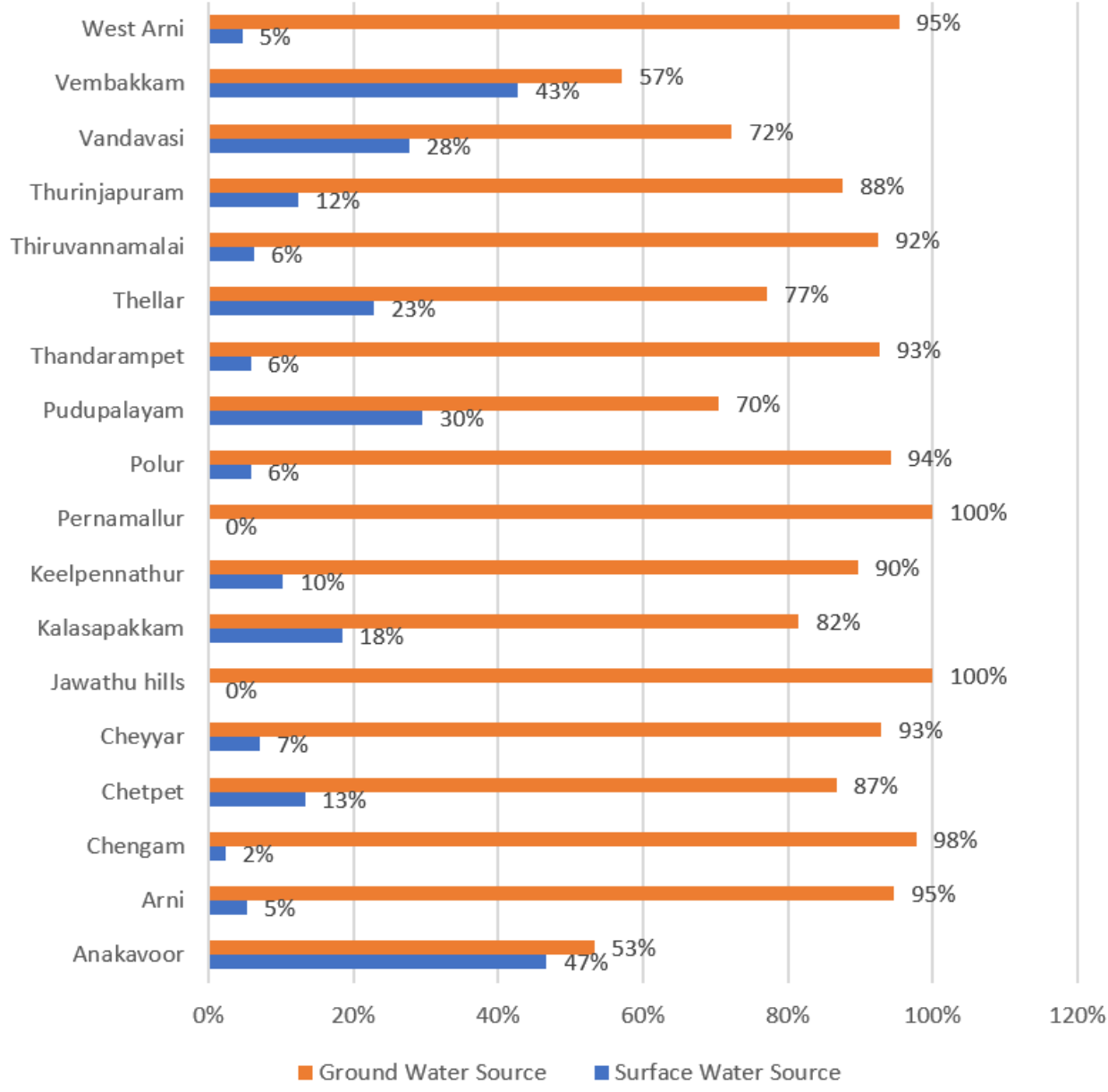


Fig 3.27. Sources of water for irrigation

3.7.2) Surface water Run-Off estimation

3.7.2.1) Catchment area classification

The total catchment area of the district is 459542 ha, of which 29% is proposed for treatment under WASCA – CWRM planning. By making interventions in the 29% of the area, it is aimed that 51% of the total runoff in the district is expected to be harvested and stored (Table 3.28 and Fig 3.28). The land use types in each of the GPs are categorised into three different types of runoff types; Good Catchment area, Average Catchment area and Bad Catchment area. Among the different blocks Arni block is estimated to be highest (68%) of the total runoff conserved and the least is Pudupalayam block which has the scope for 36% (Fig 3.29).

Table 3.28. Different catchment types and run off potential			
Sl.No	**Runoff types**	**Land use categories covered**	**Characteristics and illustrative actions**
1	Good catchment area	(1)Forest area (2)Area under Non-Agricultural Uses (3)Barren & Un cultivable Land Area	This is generally recharge area: and here priority is to be for the recharge works Works - including block plantation; afforestation and soil and water conservation works, run off management in constructed areas, water bodies management, Maintenance and drinking water bodies, bore-well, DLT etc
2	Average catchment area	(4) Permanent Pastures and Other Grazing Land Area (5) Land Under Miscellaneous Tree Crops etc. Area (6) Culturable Waste Land Area	This is also recharge area where priority is to given for recharge works related to land management and recharge structures Works: Land development, bunds, plantation, storage structures like farm pond, percolation ponds etc
3	Bad Catchment area	(7) Fallows Land other than current Fallows Area (8) Current Fallow area (9)Total unirrigated land area (10) Area Irrigated by source	This is discharge zone where importance has to be given for both storage and the charge works Works: Land development, farm bund, farm ponds, plantation- different kinds of agro-forestry systems, recharge structures for bore/open wells etc
Source: CWRM- TN- Tiruvannamalai Plan, 2020-21			

Table 3.29. Surface Runoff Analysis -Block wise						
S.NO	**Name of the block**	**Catchment Area in Ha**	**Runoff in Ha-m**	**Proposed Targeted area for Treatment under WASCA (Ha)**	**Expected Runoff treated in HaM**	**Percentage of Runoff treated**
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
1	Anakavoor	26091	6541.0	5790.5	1580.2	41%
2	Arni	20821	5667.0	9119.25	4043.8	68%
3	Chengam	29419	6581.0	9520.25	3076.0	64%
4	Chetpet	23437	5573	5322.25	1324	40%
5	Cheyyar	24081	5699	5367.25	1255.8	38%
6	Jawathu hills	13796	3083	4483	1397.4	62%
7	Kalasapakkam	22180	5200	4997	1233.8	40%
8	Keelpennathur	24217	5452	6553	1942.1	53%
9	Pernamallur	24418	5858	7172.75	2349.7	53%
10	Polur	26516	6372	9583.5	3414	63%
11	Pudupalayam	19725	4521	4117.25	870.4	36%
12	Thandarampattu	39313	9225	13556.5	4944.2	66%

13	Thellar	29063	6699	9402.75	3203.6	62%
14	Thiruvannamalai	29758	6700	9466.25	3142	64%
15	Thurinjapuram	28453	6351	8683.25	2795.4	62%
16	Vandavasi	28869	6921	6536.25	1610.1	39%
17	Vembakkam	31777	7568	7032.75	1690.4	39%
18	West Arni	17586	4055	3769	844.5	41%
Total		**459520**	**108066.0**	**130472.75**	**40717.4**	**52%**
Source: CWRM- TN- Tiruvannamalai Plan, 2020-21						

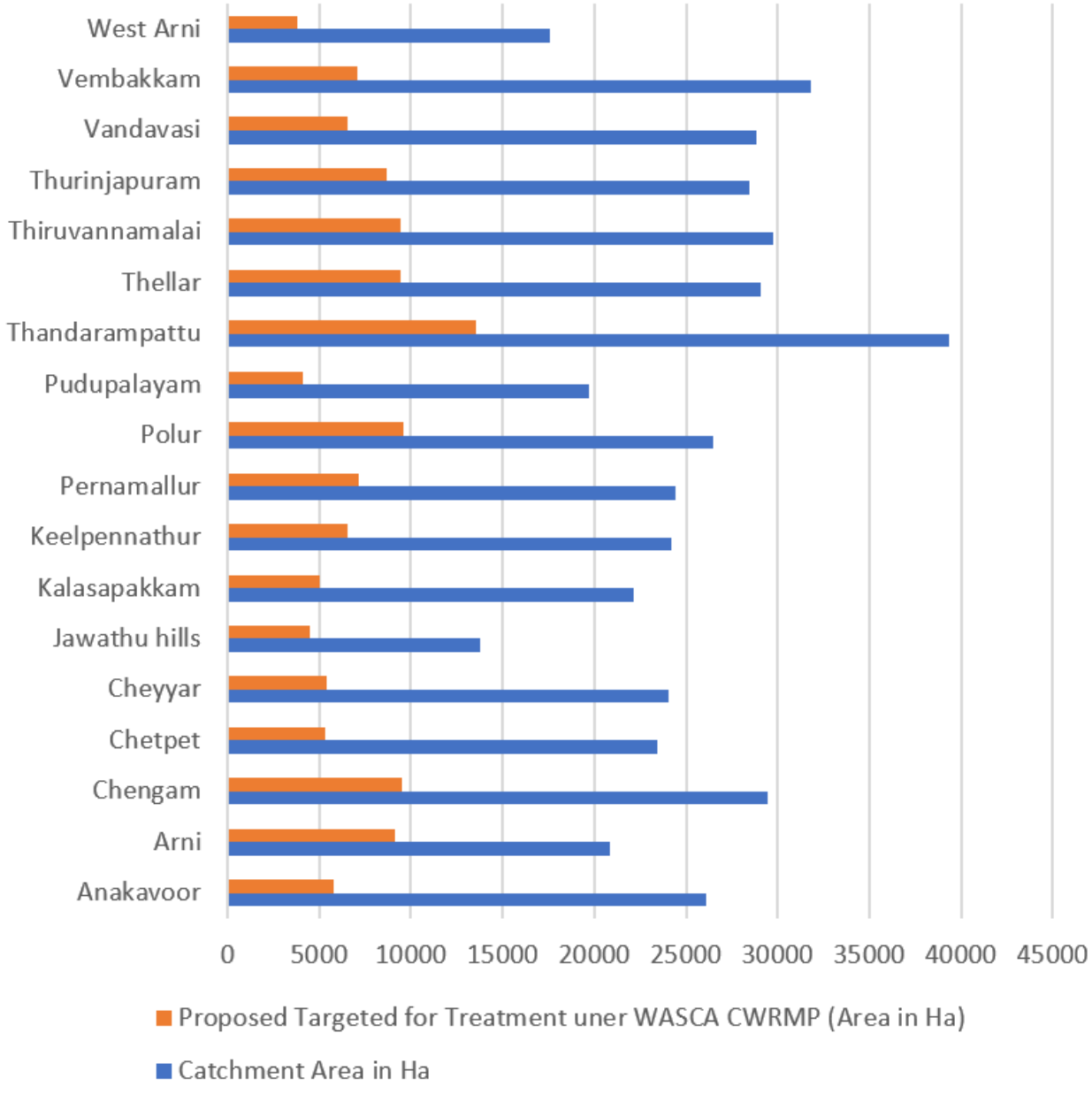


Fig 3.28 Catchment area vs proposed area under catchment (Ha)

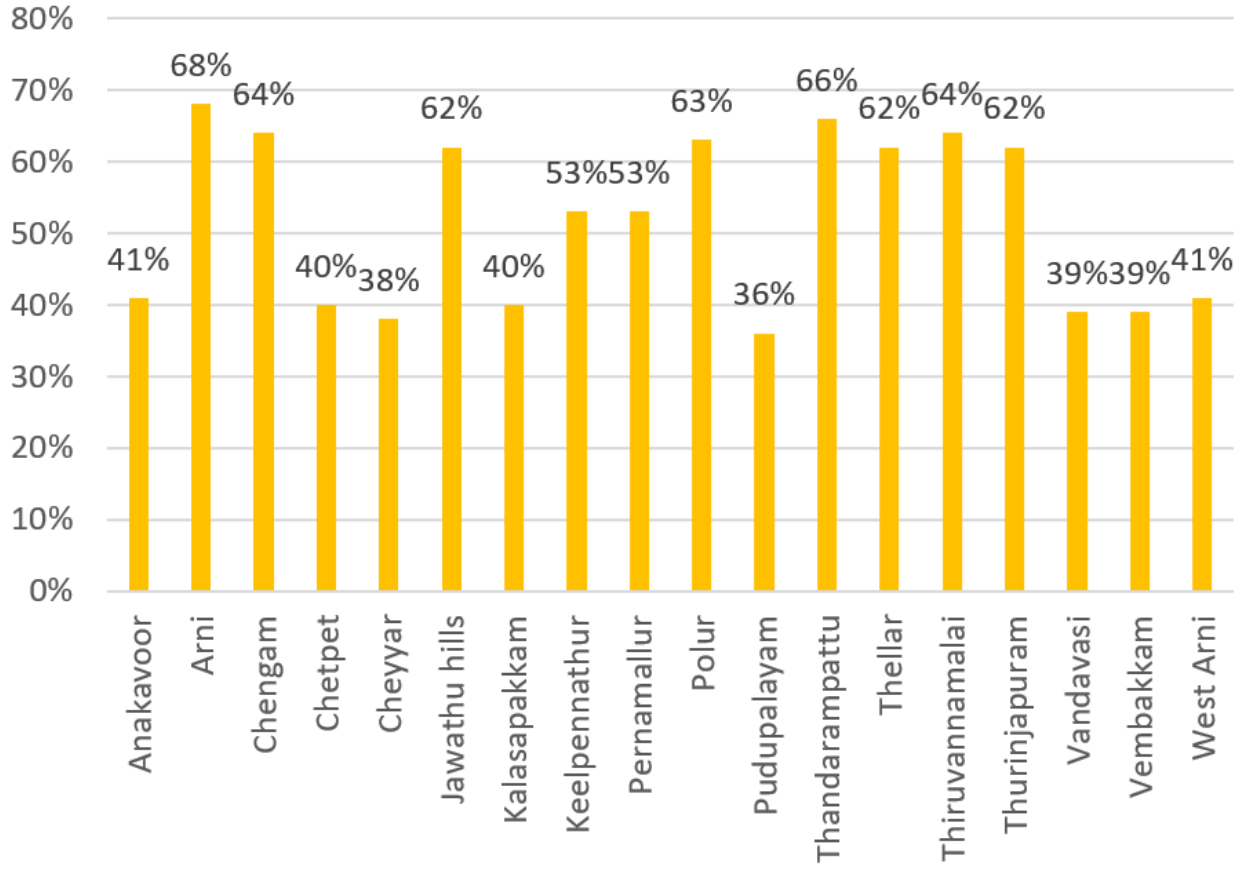


Fig 3.29. Percentage of Potential Run off Conserved under WASCA

3.7.3) Water Demand

The total demand for water including human, agriculture and livestock is 257646 Ha m and in that 88% is met through ground water while the balance proportion of 12% is met by ground water resources (Table 3.32). Agriculture is the biggest user of water which is about 94.8%, only 2.4% for human and 3.08% for livestock (Table 3.33 and Fig 3.30).

Table 3.30. Water demand estimation

S.No	Name of the Block	Total annual requirement (Ha.m)	Requirement met by Gr. Water (Ha.m)	Requirement met by S.Water(Ha.m)	Ground Water Requirement (%)	Surface Water Requirement (%)
1	Anakavoor	8624.5	7411.5	1213.0	85.9%	14.1%
2	Arni	10822.0	9492.7	1329.3	87.7%	12.3%
3	Chengam	17702.2	15511.2	2191.0	87.6%	12.4%
4	Chetpet	20217.6	17927.1	2290.4	88.7%	11.3%
5	Cheyyar	12985.8	11301.4	1684.3	87.0%	13.0%
6	Jawathu hills	4263.6	3762.2	501.4	88.2%	11.8%
7	Kalasapakkam	17059.8	15021.0	2038.8	88.0%	12.0%
8	Keelpennathur	13606.1	12018.7	1587.4	88.3%	11.7%
9	Pernamallur	8031.8	6990.2	1041.6	87.0%	13.0%
10	Polur	26649.8	23539.4	3110.4	88.3%	11.7%
11	Pudupalayam	19744.8	17468.6	2276.2	88.5%	11.5%

12	Thandarampet	20749.6	18366.5	2383.1	88.5%	11.5%
13	Thellar	8653.3	7586.5	1066.8	87.7%	12.3%
14	Thiruvannamalai	18627.0	16448.3	2178.7	88.3%	11.7%
15	Thurinjapuram	15643.6	13853.1	1790.5	88.6%	11.4%
16	Vandavasi	11993.5	10515.6	1478.0	87.7%	12.3%
17	Vembakkam	12242.1	10615.3	1626.8	86.7%	13.3%
18	West Arni	10029.8	8797.0	1232.7	87.7%	12.3%
Total		**257646.8**	**226626.2**	**31020.5**	**88.0%**	**12.0%**
Source: CWRM- TN- Tiruvannamalai Plan, 2020-21						

Table 3.31. Detailed estimates of water demand across blocks in different sectors

S. No	Block	Water req. of human (Ha.m)	Ground water Demand human	Surface water req. human	Livestock water req. ham	Ground water Demand livestock	Surface water req. livestock	Agri. water req. Ham	Ground water Demand agriculture	Surface water req. agriculture
1	Anakkavur	215.7	183.4	32.4	825	478	346	7584	6749.76	834.24
2	Arni	262.8	223.4	39.4	414	240	174	10145	9029.05	1115.95
3	Chengam	389.0	330.7	58.4	736	427	309	16577	14753.53	1823.47
4	Chetpet	258.4	219.6	38.8	181	105	76	19778	17602.42	2175.58
5	Cheyyar	239.1	203.2	35.9	795	461	334	11952	10637.28	1314.72
6	Jawadhu Hills	142.3	121.0	21.4	86	50	36	4035	3591.15	443.85
7	Kalasapakkam	330.2	280.6	49.5	481	279	202	16249	14461.61	1787.39
8	Keelapennathur	285.3	242.5	42.8	256	148	107	13065	11627.85	1437.15
9	Peranamallur	234.0	198.9	35.1	480	278	202	7318	6513.02	804.98
10	Polur	370.5	314.9	55.6	529	307	222	25750	22917.5	2832.5
11	Pudupalayam	245.0	208.2	36.7	305	177	128	19195	17083.55	2111.45
12	Thandrampet	489.0	415.7	73.4	262	152	110	19999	17799.11	2199.89
13	Thellar	268.1	227.9	40.2	336	195	141	8049	7163.61	885.39
14	Tiruvannamalai	442.5	376.2	66.4	361	210	152	17823	15862.47	1960.53
15	Thurinjapuram	337.3	286.7	50.6	181	105	76	15125	13461.25	1663.75
16	Vandavasi	303.8	258.3	45.6	473	274	199	11217	9983.13	1233.87
17	Vembakkam	334.5	284.3	50.2	861	499	361	11047	9831.83	1215.17
18	West Arani	244.8	208.0	36.7	386	224	162	9399	8365.11	1033.89
Total		**5392.4**	**4583.5**	**808.9**	**7947**	**4610**	**3338**	**244307**	**217433.23**	**26873.77**
Source: CWRM- TN- Tiruvannamalai Plan, 2020-21										

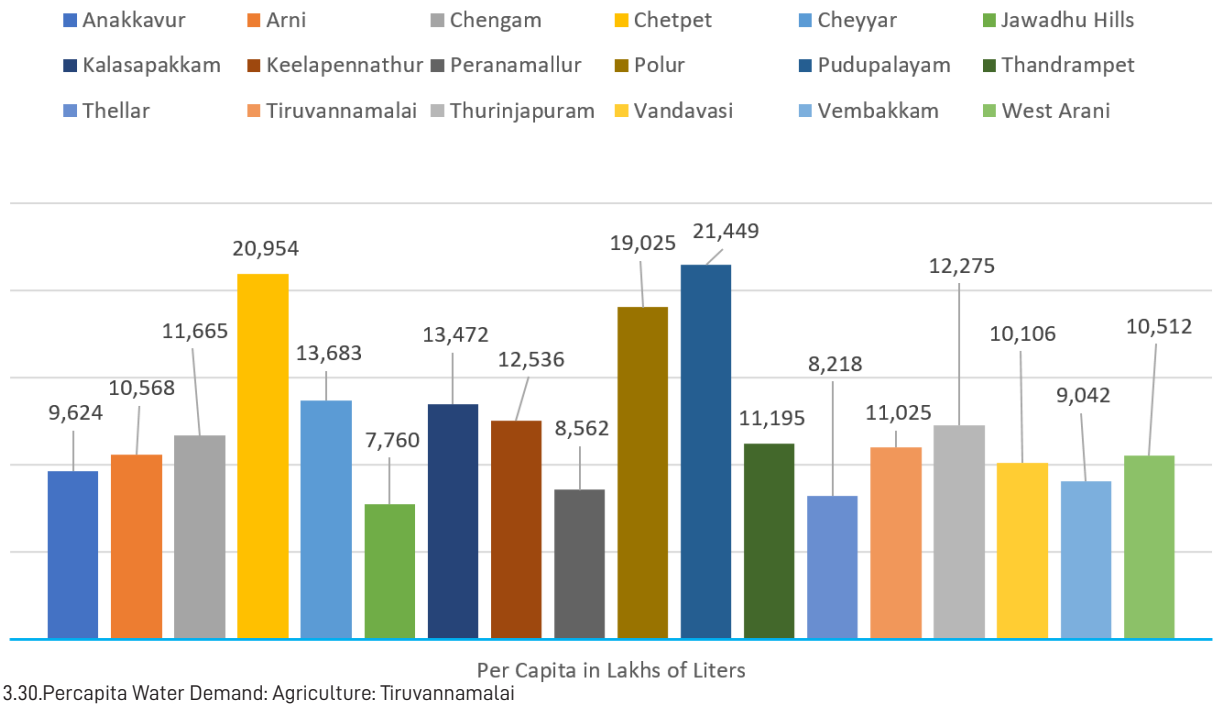


Fig 3.30.Percapita Water Demand: Agriculture: Tiruvannamalai

3.7.4) Water budget - Surface runoff

In the district, only 2% of the surface runoff is being harvested with the existing water harvesting structures. With the proposed area identified under WASCA water actions 38% of the surface runoff is estimated to be harvested. However, the water budget of all the districts are negative and consistent efforts are necessary to address it.

Table 3.32. Water budgeting

S.No	Name of the Block	Total annual requirement (Ha.m)	Available runoff from rain water(Ha.m)	Harvested runoff from water harvesting activities (Ha.m)	Potential harvesting from proposed interventions (Ha.m)	Estimated Total water harvested (Ha.m)	Water deficiency/ Surplus (Ha.m)
1	Anakavoor	8624.5	6541.0	89	1580.2	1669.2	-6955.3
2	Arni	10822.0	5667.0	196.5	4043.8	4240.3	-6581.7
3	Chengam	17702.2	6581.0	71.3	3076.0	3147.3	-14554.9
4	Chetpet	20217.6	5573	79.6	1324	1403.6	-18814.0
5	Cheyyar	12985.8	5699	85.5	1255.8	1341.3	-11644.5
6	Jawathu hills	4263.6	3083	162.3	1397.4	1559.7	-2703.9
7	Kalasapakkam	17059.8	5200	157.4	1233.8	1391.2	-15668.6
8	Keelpennathur	13606.1	5452	72.9	1942.1	2015	-11591.1
9	Pernamallur	8031.8	5858	92.34	2349.7	2442.04	-5589.8
10	Polur	26649.8	6372	64.8	3414	3478.8	-23171.0
11	Pudupalayam	19744.8	4521	59.94	870.4	930.34	-18814.4
12	Thandarampet	20749.6	9225	76.14	4944.2	5020.34	-15729.2
13	Thellar	8653.3	6699	98.82	3203.6	3302.42	-5350.9

14	Tiruvannamalai	18627.0	6700	111.78	3142	3253.78	-15373.2
15	Thurinjapuram	15643.6	6351	76.14	2795.4	2871.54	-12772.1
16	Vandavasi	11993.5	6921	98.82	1610.1	1708.92	-10284.6
17	Vembakkam	12242.1	7568	103.68	1690.4	1794.08	-10448.0
18	West Arni	10029.8	4055	159.94	844.5	1004.44	-9025.3
Total		**257646.8**	**108066.0**	**1856.9**	**40717.4**	**42574.3**	**-215072.5**
Source: CWRM- TN- Tiruvannamalai Plan, 2020-21							

3.7.5) Ground water Resources

The total ground water recharge in both monsoon and non-monsoon season is 116334 Ha m.

Table 3.33. Assessment of dynamic ground water resources of Tiruvannamalai district (2017-2020)

S no	Parameter	Quantity
1	No of Blocks	18
2	No of Firkas	52
3	No of GPs	860
4	Recharge from Rainfall during monsoon season in Ham	33058.30
5	Recharge from other sources during monsoon season in Ham	72485.18
6	Recharge from Rainfall during non-monsoon season in Ham	5819.94
7	Recharge from other sources during non-monsoon season in Ham	4970.43
8	Total Annual Ground Water Recharge in Ham	116333.86
9	Provision for Natural Discharge in Ham	11633.39
10	Net Annual Ground Water Availability in Ham	104700.47
Source: WASCA-TN, Ground Water Assessment Study, Prime Meridian, Jan 2021		

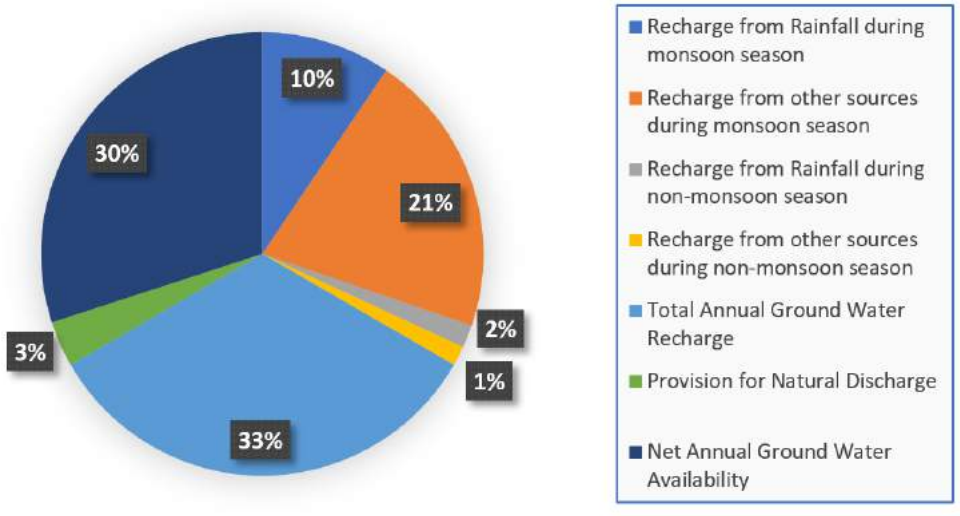


Fig 3.31. Assessment of dynamic ground water resources of Tiruvannamalai district (2017-2020)

Geology: Geologically, the area lying with in this district can be broadly classified into hard rock and sedimentary terrain.

a) Hard rocks: More than 95% of the area of this district is underlain by hard rock formations. These hard rock formations are predominantly occupied by gneissic rock. Charockites are prevalent in the western part, in and around Javadu hills, around central part of Tiruvannamalai block and as narrow limbs in parts of Cheyyar and Vandavasitaluks.

b) Sedimentary formations: Sedimentary formations include the transported materials by means of stream, river, wind etc., which are either loose or compact in nature. The common terminology used for such formations are alluvium which consists of sandstone, compact gravels, shales, etc., Alluvial or unconsolidated formation occur as thin and isolated patches along the river Cheyyar and also in southern portion of the river Palar. They generally consists of sand, gravel, gravelly soil, clay, etc., which are recent to sub recent (quarternary) in age.

b.1) Gondwana formations: These are semi-consolidated formations consisting of sandstone and shale.

Long term trend of water level: The long term fluctuations of water levels range from G.L. to 14.0m in many parts of the Tiruvannamalai District. The analysis reveals that the water level has gone down in the north, west and central parts of the Tiruvannamalai District. The seasonal fluctuation study reveals that due to necessity for development of ground water for different sectoral needs and due to failure of monsoons, the water level has gone down.

As per the latest categorization, out of 52 firkas, 37 fall in Over Exploited category, 7 fall in Critical and 8 fall in Semi Critical category.

In order to stop further deterioration of Ground water, 2 check dams and 76 recharge wells have been proposed to be constructed in the report.

3.7.6) Water budgeting- Soil Moisture management

The soil is an important medium to store the available water and the storage capacity vary with the type of soil especially its textural composition. In overall composite water budgeting estimation of stored water in the soil assumes greater significance in Tiruvannamalai because of it higher proportion of area under rainfed cultivation. The average annual volumetric soil moisture is taken for estimating the amount of water stored as soil moisture which accounts to 84.93 TMC (Table 3.36 and 3.37).

Table 3.34. Soil moisture analysis

Sl.No.	Month	Volumetric Soil Moisture (%)
1	Jul-18	31
2	Aug-18	42
3	Sep-18	30
4	Oct-18	25
5	Nov-18	34
6	Dec-18	20
7	Jan-19	16
8	Feb-19	16
9	Mar-19	4
10	Apr-19	14
11	May-19	15
12	Jun-19	32
Source: CWC- WRIS, and CWRM- TN- Tiruvannamalai Plan, 2020-21		

Table 3.35 Amount of water stored as soil moisture in different blocks

S.No	Block	Area influencing soil moisture Ha	Average soil moisture is 23.25 mm and the unit is M3	Amount of water stored as Soil moisture (TMC)
1	Anakavur	18136.41	41713743.00	4.17
2	Arni	17232.47	39634681.00	3.96
3	Chengam	25853.25	59462475.00	5.95
4	Chetpet	18027.28	41462744.00	4.15
5	Cheyyar	18375.62	42263926.00	4.23
6	Jawadhu hills	12984.05	29863315.00	2.99
7	Kalasapakkam	17490.5	40228150.00	4.02
8	Kipennathur	20277.71	46638733.00	4.66
9	Pernamallur	18342.96	42188808.00	4.22
10	Polur	21254	48884200.00	4.89
11	Pudhupalayam	15513	35679900.00	3.57
12	Thandarampet	33524	77105200.00	7.71
13	Thellar	23402	53824600.00	5.38
14	Thiruvannamalai	25205	57971500.00	5.80
15	Thurinjapuram	23439	53909700.00	5.39
16	Vandavasi	22338	51377400.00	5.14
17	Vembakkam	23984	55163200.00	5.52
18	West Arni	13887	31940100.00	3.19
Total		**369266.25**	**849312375.00**	**84.93**

Note: The average annual soil moisture percent of 23.25% is taken for analysis and all land area of the block except the area under non-agriculture is considered for arriving the total area influencing soil moisture content

Source: CWRM- TN- Tiruvannamalai Plan, 2020-21

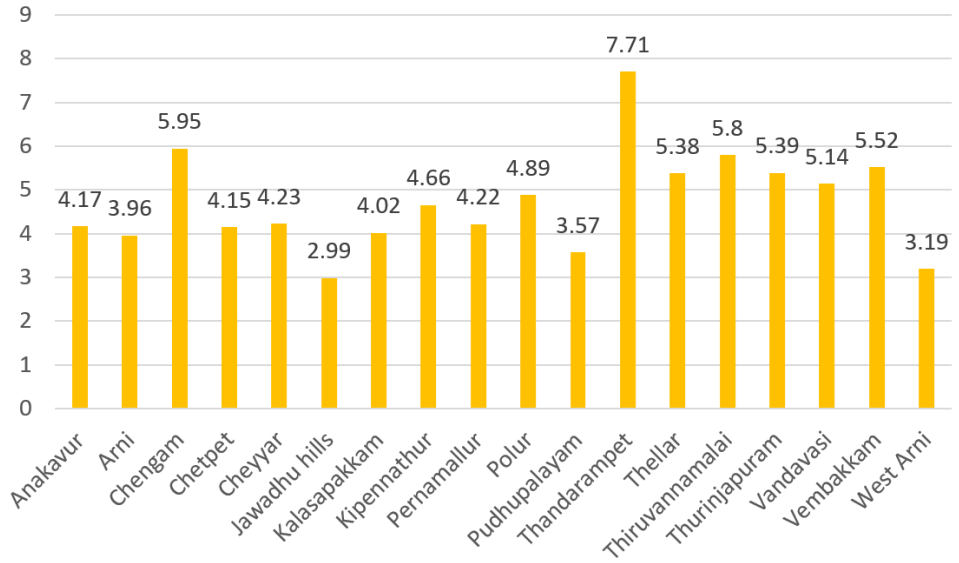


Fig 3.32.Amount of water stored as Soil moisture (TMC)

3.7.7) Water budgeting- Evapotranspiration losses and management

Evapotranspiration Analysis: The loss of water through evapotranspiration is important in the water budgeting. The annual total ET loss during 2018-19 was 805 mm with monthly average of 67.08 mm. The average percentage area influences the water loss through ET in the district was 44% and the total annual losses due to ET alone 160.65 MCM in the district (Table 3.38 and Fig 3.33.)

Table 3.36. Water loss through ET in Ha m across blocks

S.No	Block	Total Geographical area (Ha)	ET in mm	Water loss by ETo in Ha-m
1	Anakavur	26090	805	7371
2	Arni	20820	805	4878
3	Chengam	29419	805	9357
4	Chetpet	23437	805	9109
5	Cheyyar	24081	805	6904
6	Jawadhu hills	13796	805	5852
7	Kalasapakkam	22181	805	9427
8	Kipennathur	24217	805	9653
9	Pernamallur	24420	805	9015
10	Polur	26516	805	10598
11	Pudhupalayam	19726	805	6609
12	Thandarampet	39313	805	15456
13	Thellar	29063	805	10480
14	Thiruvannamalai	28453	805	11068
15	Thurinjapuram	29759	805	12827
16	Vandavasi	28890	805	10202
17	Vembakkam	31777	805	6432
18	West Arni	17586	805	5416

Source: CWRM- TN- Tiruvannamalai Plan, 2020-21

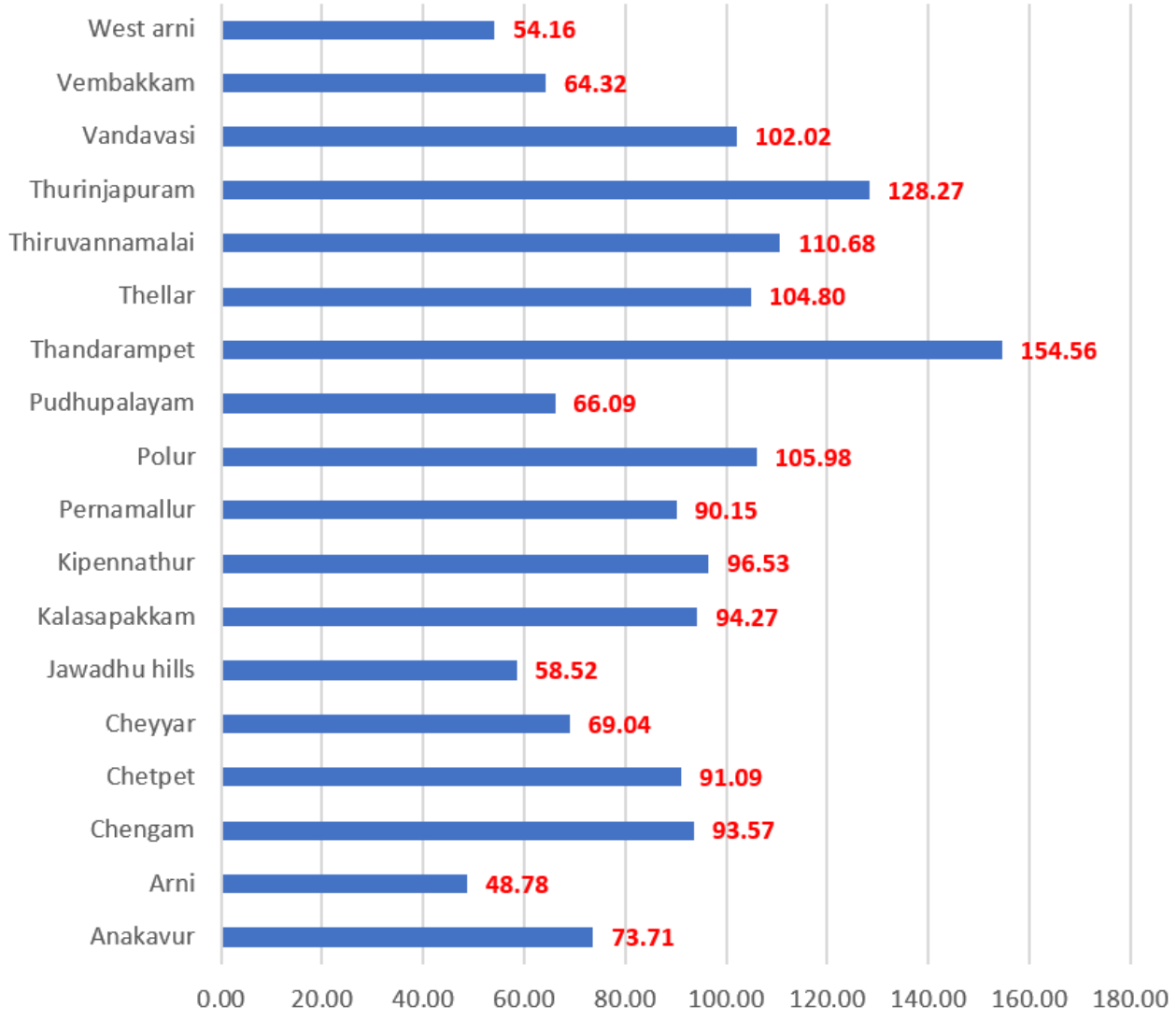
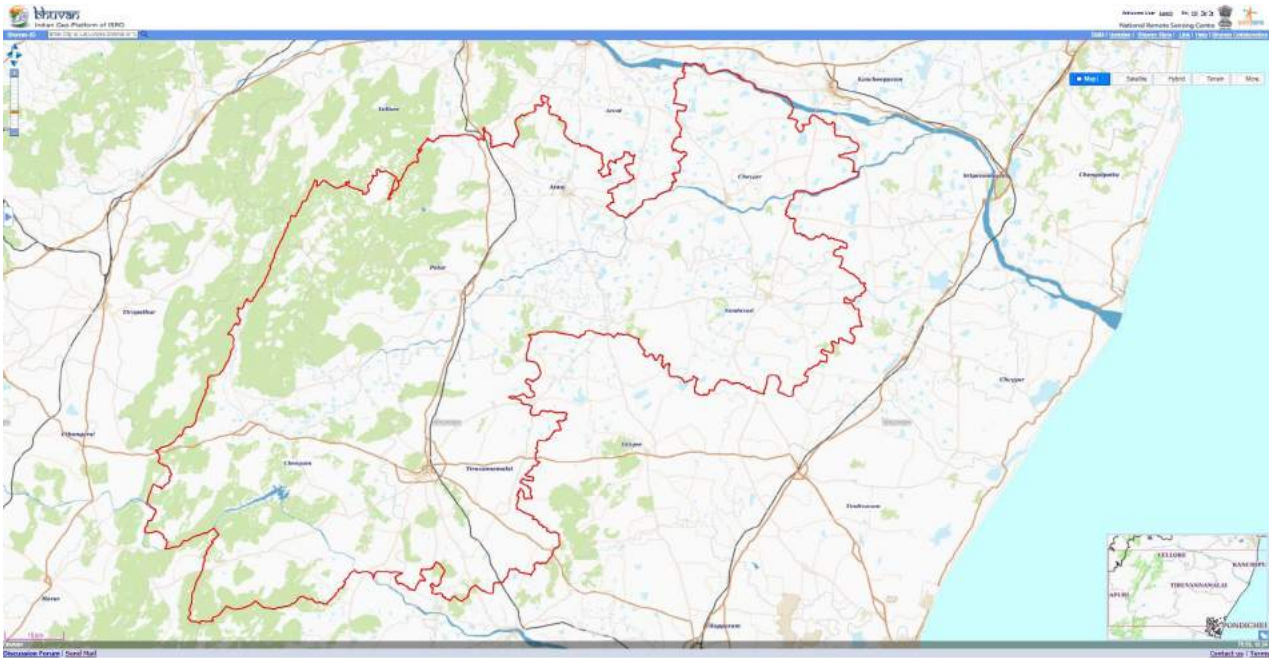


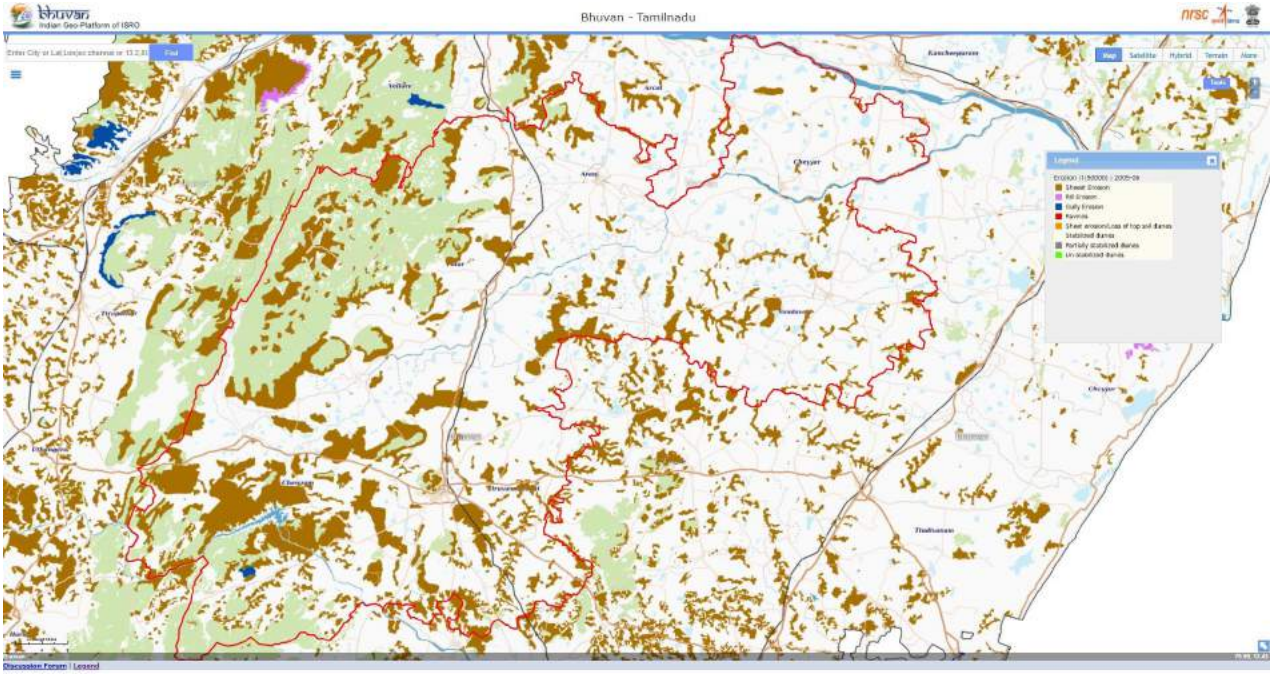
Fig 3.33. Estimaed losses by Evapo Transpiration in MCM

3.8) Thematic maps

Satellite view map - The map shows about the overall satellite view of the Tiruvannamalai district. The Satellite image provides the overview of the district; how the habitations and other land forms are distributed within the geographical area of the district

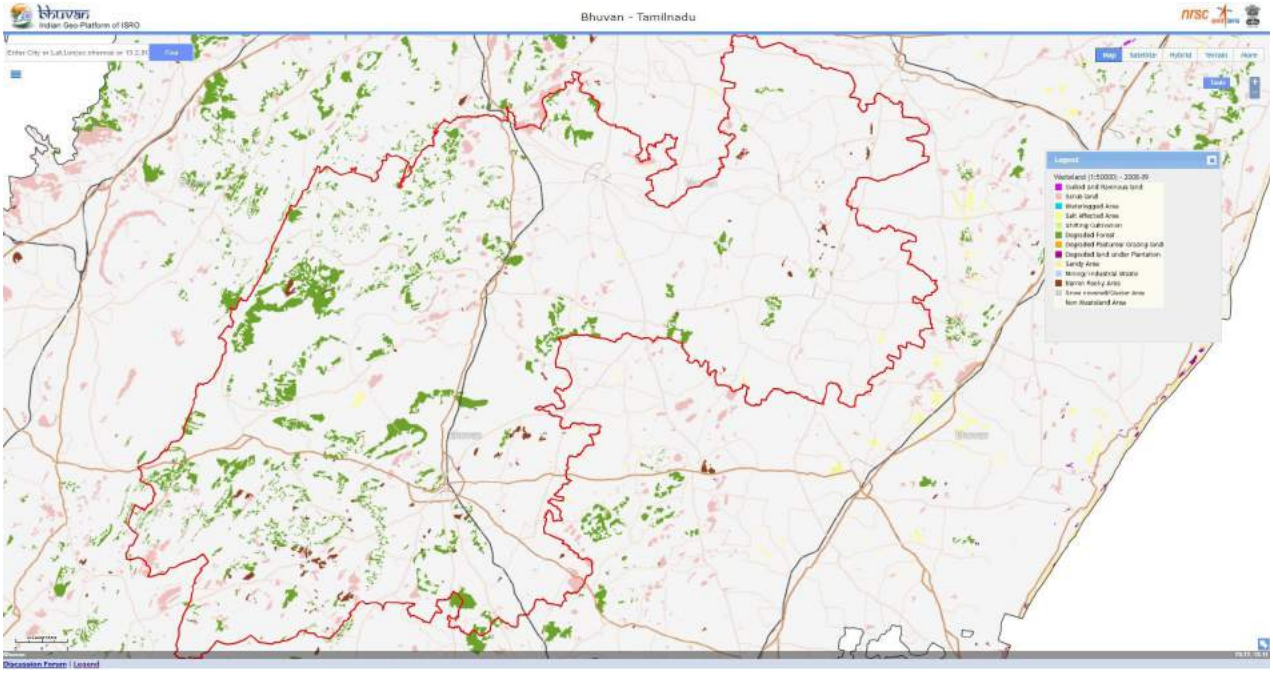
Location map - The map shows the location of the district which is present in the geographic area

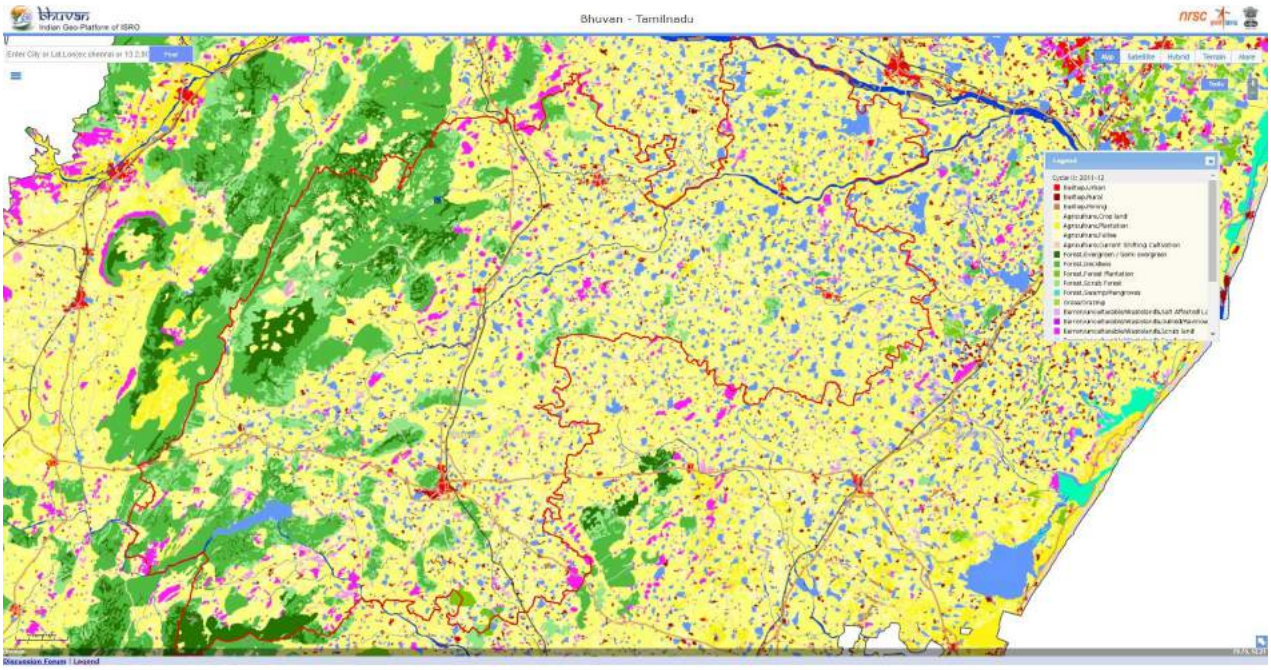




Soil erosion map - The erosion map shows the soil erosion capacity with respect to rainfall, soil physical properties, terrain slope, land cover of Tiruvannamalai district. The soil erosion map used for soil conservation and regional planning and watershed management. In Tiruvannamalai district, it is observed that sheet erosion is more predominant so the measures has been planned to arrest further erosion.

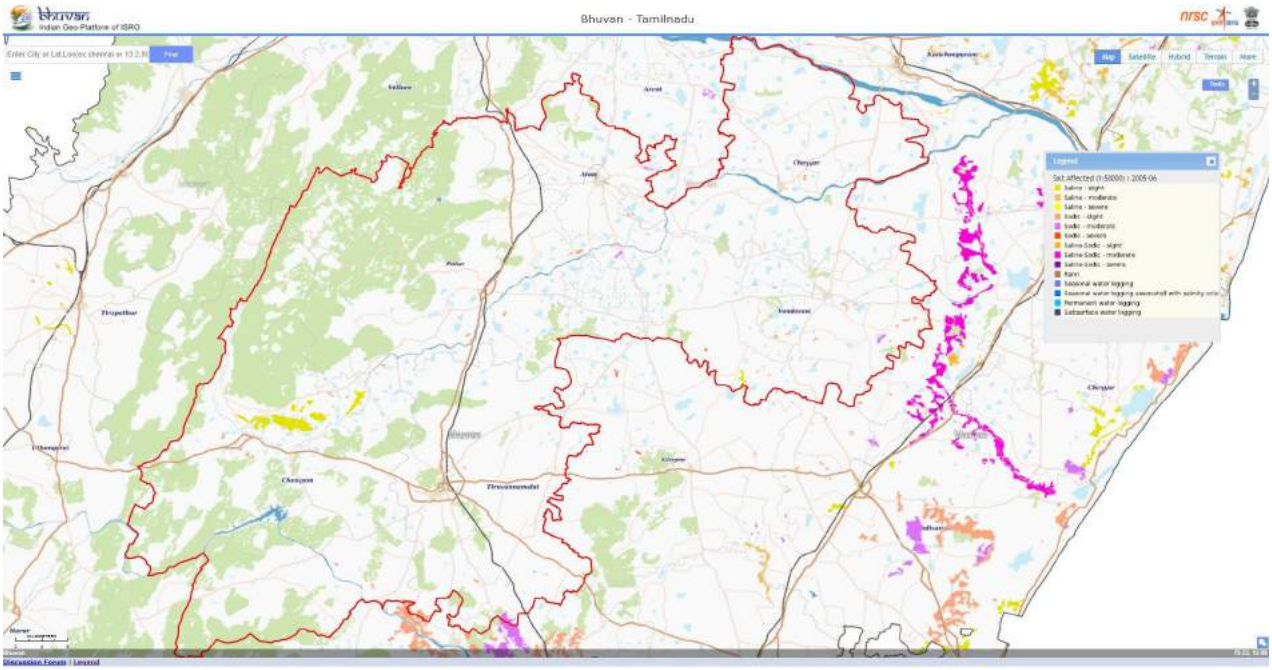
Wasteland map - The wasteland map illustrates the availability of the wasteland in Tiruvannamalai. It is noticed that there are patches are degraded forest in Thiruvanamali district. During planning the GPs, the plantation measures have been taken up in the identified degraded forest to convert into productive land

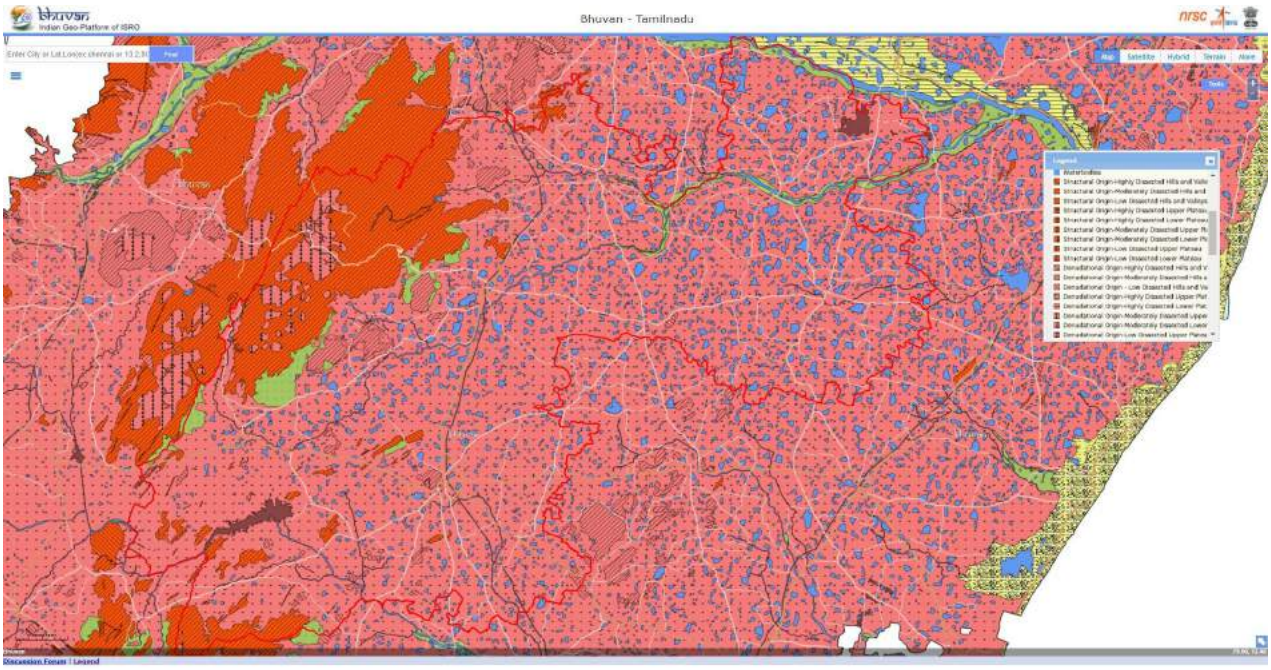




Land Use Land Cover map - Land Use Land Cover (LULC) map provides the information about the current landscape and the existing land use pattern. The map clearly shows that the Tiruvannamalai district is covered by the agricultural crop land and fallow lands. The map helps the decision makers and planners to concentrate on the fallow land development activities. During the planning of GPs, the more fallow land activities has been proposed in the Tiruvannamalai district

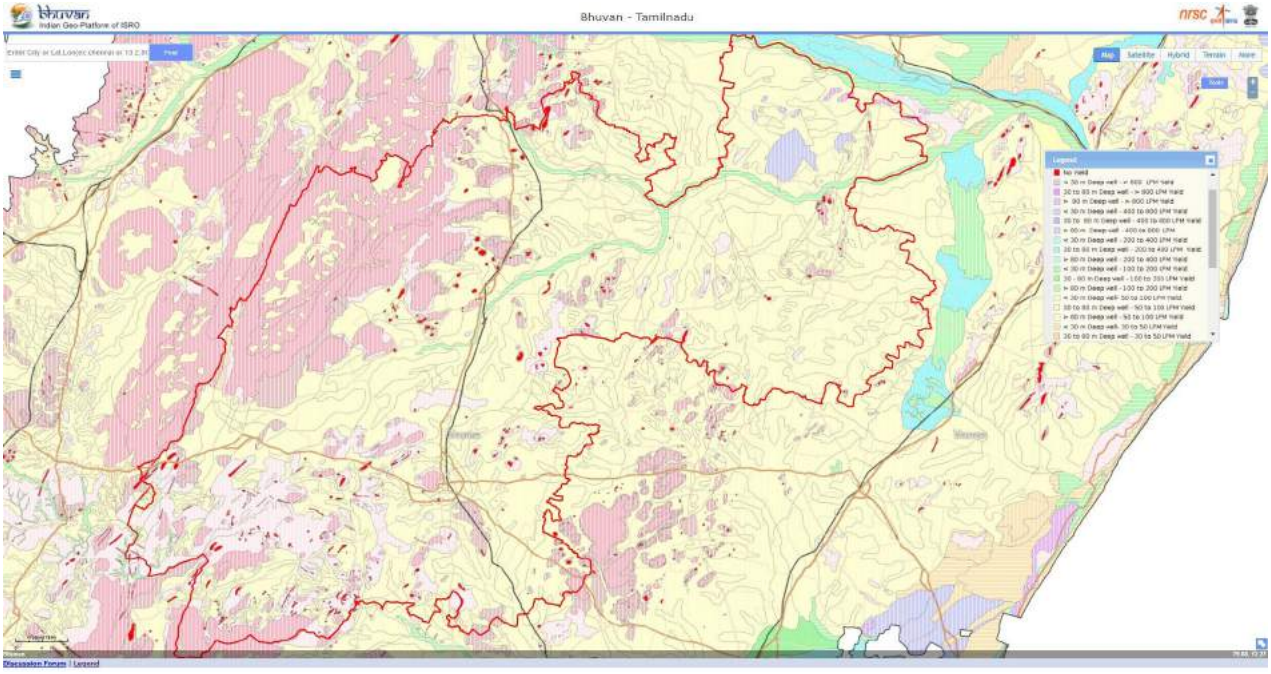
Salt affected area map - Salt affected areas are one of the most important degraded areas where soil productivity is reduced due to either salinisation or sodicity or both. In Thiruvanamali district, it is observed that the some parts of the land are slightly saline. While planning the GP, this area has been treated specially and given alternative cropping and other any other steps has been suggested to reduce the salinization.

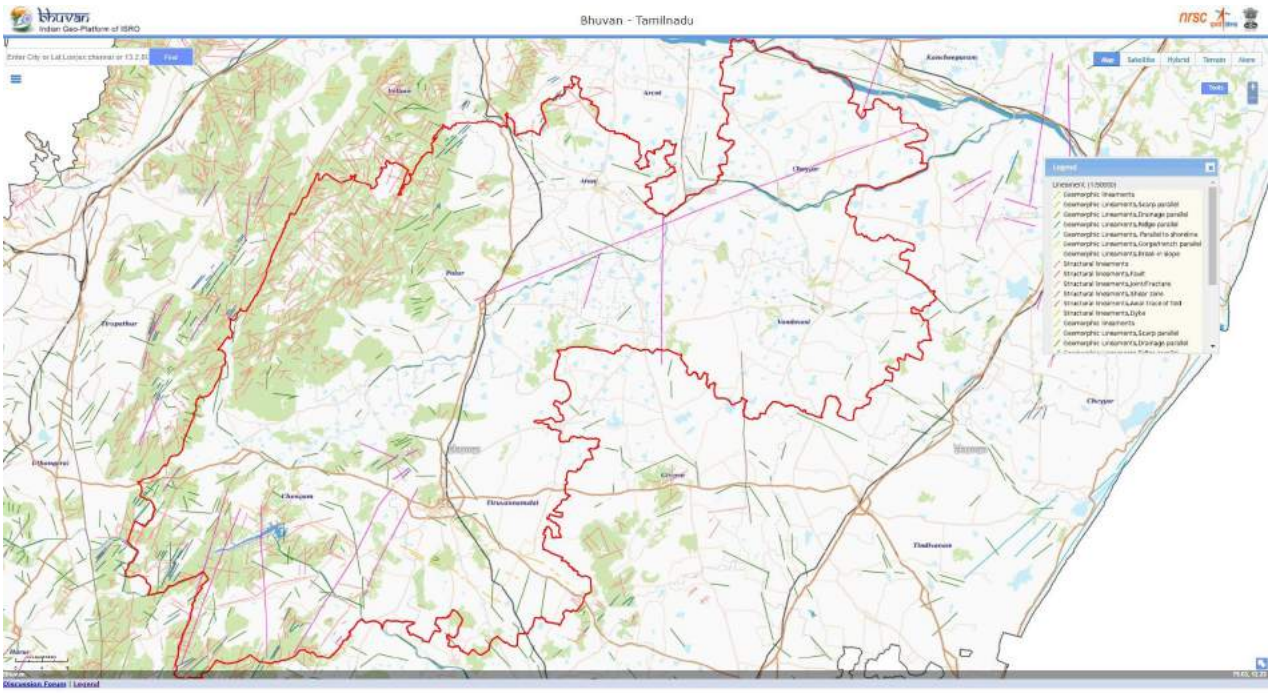




Geomorphology map - The Geomorphology map is the graphical inventories of a landscape depicting landforms and surface as well as subsurface materials. It determines the character of soil, vegetation, water percolation and land cover. The major part of the Thiruvanamali districts covers under the Denudation orgin – pediment- pediplain complex category. The geomorphic and geologic conditions is guided us to undertake appropriate work in particular location to reap maximum benefits.

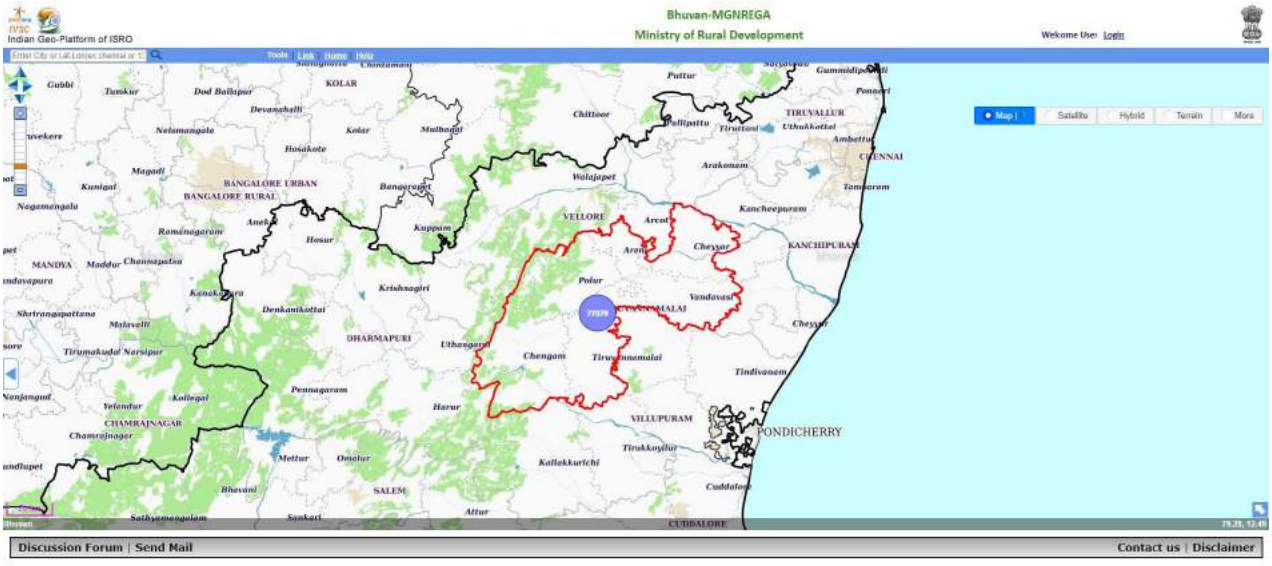
Ground water prospectus - The map provides the required information on geological parameters connected to ground water exploration and the probable ground water prospects and helps in identification of sites for planning recharge structures to address water scarcity in a more effective manner for Tiruvannamalai district.

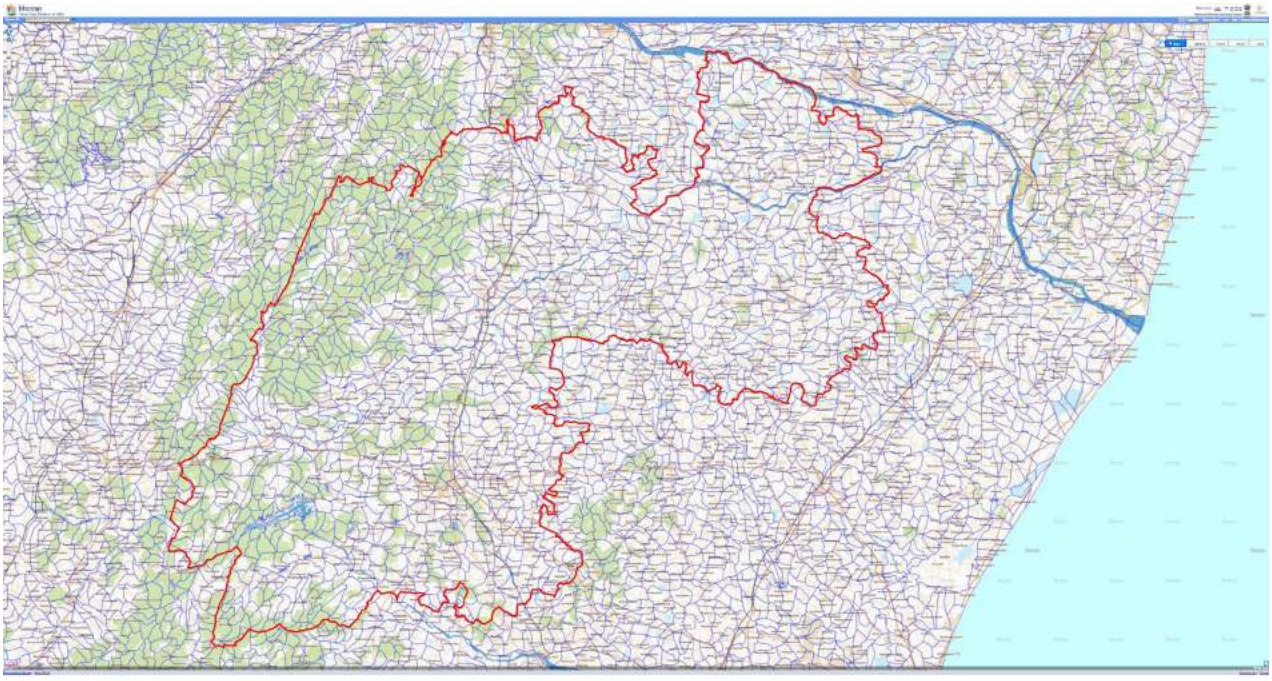




Lineament Map - A lineament map shows the linear feature in a landscape that is an expression of an underlying geological structure such as a fault, fracture, or joint of Tiruvannamalai district. . This map is very useful to decide the suitable water conservation, harvesting and recharge measures in the region.

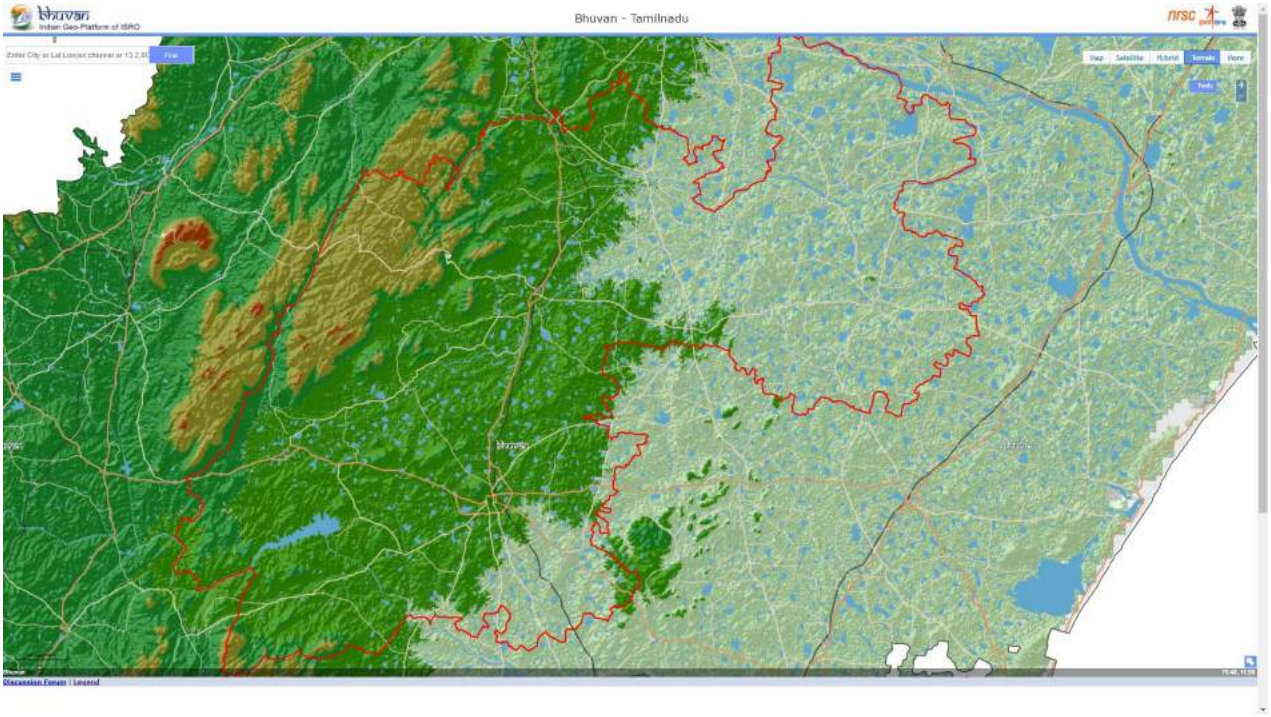
MGNERGA works map - This map shows the MGNERGA works carried out in the Tiruvannamalai district. This will be useful to understand the past works and to propose the future works to avoid duplication.





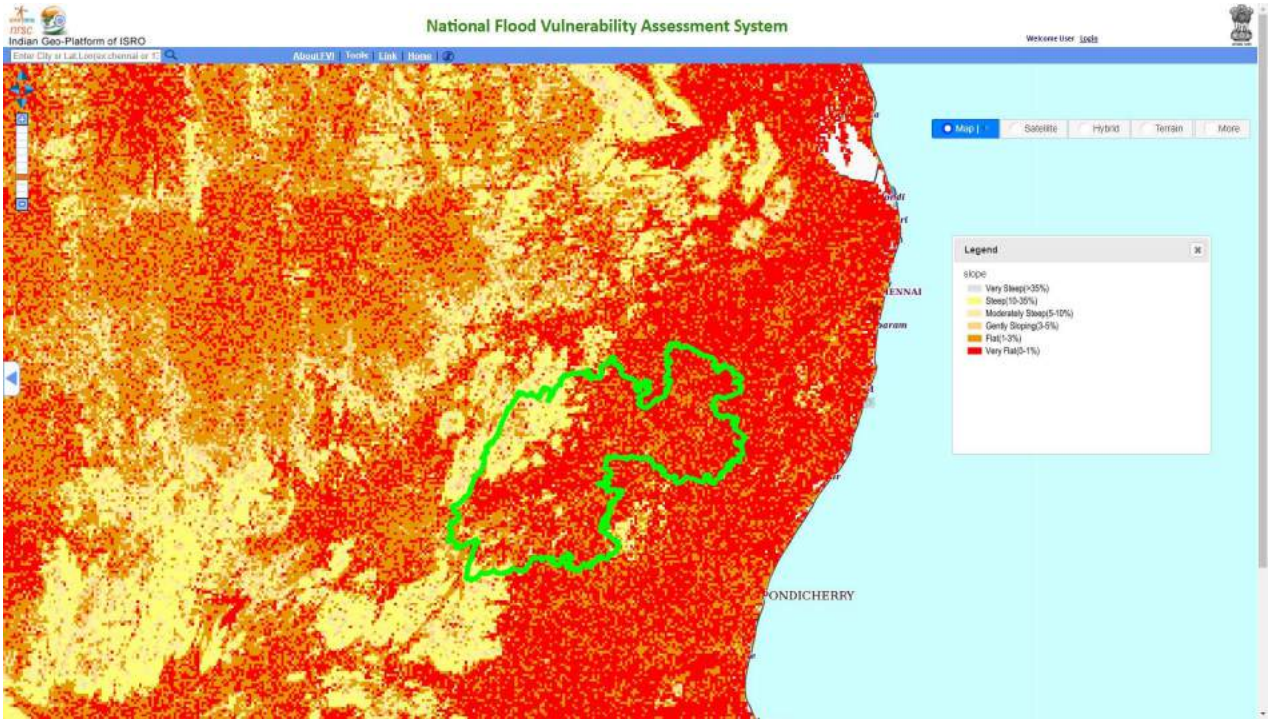
Watershed map - A watershed map is the area of land where all of the water that falls in it and drains off of it goes into the common outlet. This map is used for the interventions based on ridge to valley concept and sequencing the plan accordingly.

Drainage map - The drainage map shows the drainage order, pattern and destiny. Also, It shows the spread and extent of surface water bodies in the Tiruvannamalai district. This map is widely used to identify the suitable locations for check dams on the drainage, gabion structures and desilting the drains

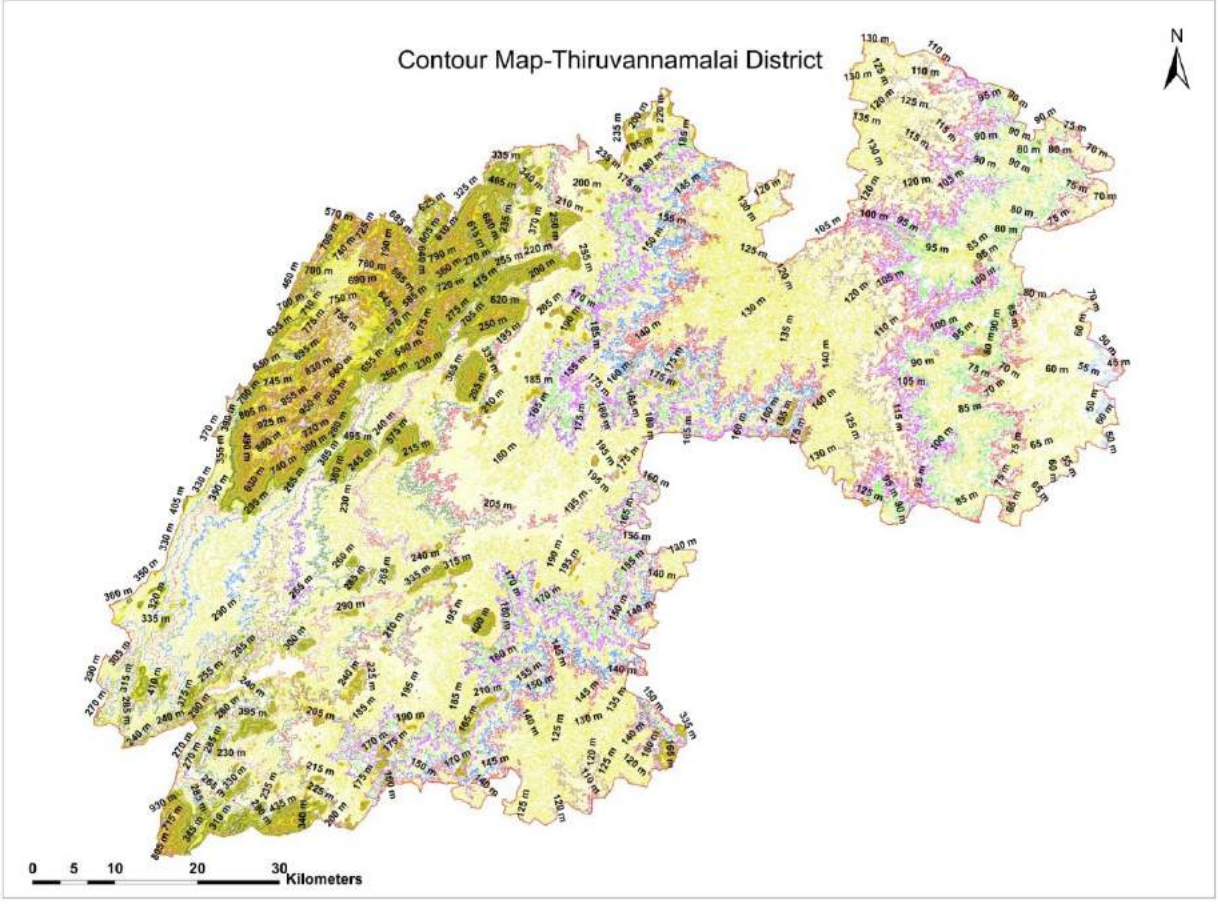


Terrain map - A terrain map shows an area of land divided into terrain map units defined by similar elevation, slope, landform. This map will be useful to understand the terrain to identify the water and soil conservation related activities in the Gps of Tiruvannamalai.

Slope map - Slope map illustrates the measure of steepness or the degree of inclination of a feature relative to the horizontal plane. Slope is typically expressed as a percentage, an angle, or a ratio. The average slope of a terrain feature is calculated from contour lines on a topo map or DEM . It is used for analysing the soil conservation measures and construction of the water recharge structures such as check dam, farm ponds etc.,



Contour map - A contour map is illustrated with contour lines which shows valleys and hills, and the steepness or gentleness of slopes. The map clearly shows gentle slope towards the coast. The contour map plays a vital role in planning and identifying the recharge structures, farm ponds and contruction of grey water drainage network etc.,



Chapter 4 : WASCA TN : Key Water Challenges in WASCA – Tiruvannamalai

The key water issues under each of the four key vulnerability themes namely socio-economic, climate, water and agriculture and allied sectors were analysed at the GP levels to identify the actions necessary for improved management of the water resources. The issues under land use categories- one to six (areas under forest, non-agricultural use, barren and uncultivable lands, permanent pastures and other grazing land area, land under miscellaneous tree crops, cultural waste lands) are related to public and common land resources. While the issues under productive land scape's are from land use categories six to ten (fallow land other than current fallow, current fallow, total unirrigated land and irrigated land). Besides, issues related to common rural infrastructures and services for drinking water access and grey water management (Table 4.1).

Table No: 4.1 Key water challenges in four different vulnerability area

Sl.No	Climate Vulnerability Area	key water challenges
1	Socio-economic	**1) SC and ST population:** 25.05% of the total Population belongs to SC and ST population who are socio economically vulnerable, mostly landless and with less assets **2) Marginal farmers proportion:** Among farmers, 81% of them are marginal farmers holding less than one Ha of land and hold only 47 % of the total land in the district. In addition, of the total holdings only 12% are from SC and 2% ST communities **3) Active job card holders:** Only 74.66% of the total job card holders are active **4) Drinking water demand:** Of the total drinking water demand 85% is met through ground water resources and remaining 15% is met by surface water sources. Increasing salinization of ground water is an area of concern in the district. **5) Grey water management:** 39.95 MCM grey water generation is estimated annually and reuse and recycle strategies are in need
2	Climate	6) There has been changes in the **maximum and minimum temperature as well as rainfall quantity** compared the annual normal (1970-2000) of the district **a) Rainfall:** The annual rainfall of the district is 1041mm, the estimated projections for the period is there will be an decrease in 5 and 4% rainfall in both the century (Mid and End) **b) Max. temp:** average maximum temperature range in the district is predicted to 2.1oC mid of the century. For End- century, this increase would be of oC. **c) Min temp:** average minimum temperature in the district is predicted to 2.4 oC mid of the century. For End- century, this increase would be of 3.7 oC.

3	Water resources (Hydrological)	**7) Watershed profile including the natural drainage lines:** The district has 1847 micro watersheds covering an area of 879431 Ha **8) Existing Water Recharge or Storage structures and canal networks** • Tank system details and canal network:3787 ponds and 1966 tanks with 767 Km length of field channels to distribute water to the agriculture fields - Needs marking the original area, deepening, desilting, bund strengthening, surplus weirs and bund plantation are the key issues. Most of the channels have issues related to marking the original area, removing the silts and deepening the flow area, strengthening the side bunds and lack of vegetation in the bund areas **9) Status of the ground water:** • There were no major issues in both chemical and biological contamination, however, increasing TDS content in six out of the eleven blocks that are located in the coastal area. The recent Ground Water assessment shows that out of 18 blocks, 9 blocks fall in OE category **10) Run-Off estimation** • total runoff is 108066 Ha m of which through treatment 52% of the run off can be harvested, But key issues are planning more activities in the common areas which is under the panchyat management needs attention since it falls under good and average catchments **11) Water Demand estimation** - Sources, Use, Demand for human use, agriculture, livestock etc from primary and secondary sources • The total demand for water including human, agriculture and livestock is 257647 Ha m • 88% is met through ground water while the balance proportion of 12% is met by surface water resources • Agriculture is the biggest user of water which is about 98%, only 1.4% for human and 0.6% for livestock

		12) Water budgeting **a) Surface runoff water** • The total demand is 257646.8 Ha m for human, livestock and agriculture. Through existing water storage measures 1856.7 Ha m TMC water is harvested from the runoff amount of 108066 Ha m TMC water available from runoff. But the total deficit in the district is 215072 Ha M • In total demand for water 88% is met through surface water while the balance proportion of 12% is met by ground water resources **b) Ground water** • Ground water recharge is the key areas of concern in the district and most of the traditional water storage structures used for irrigation in the past are now acting as ground water recharge structures **c) Soil moisture:** • The average annual volumetric soil moisture is taken for estimating the amount of water stored as soil moisture which accounts to 84.93 TMC, which is almost equal to the amount of surface runoff d) Evapotranspiration loss: • Annual total ET loss during 2018-19 was 805 mm. The average percentage area influences the water loss through ET in the district was 44% and the total annual losses due to ET alone 160654 Ha m in the district
4	Agriculture and Allied sectors	**13) Soil profile** • Soil type: Predominant soil type is clay occupying 65% of the total cultivated area of the district followed by red and loamy soil • Macro Nutrients: Nitrogen and Phosphorus are very low to low category in the total number of soil samples tested, while potassium is medium to high. Also, the content of the organic carbon also ranges between very low to low category. This indicates that the soil fertility is very poor and further intensive practices make soil more vulnerable to soil erosion and land becomes degraded over a period of time • Micro nutrients: Manganese, Zinc and Boron are deficient in more than 54 to 91% of the soils tested • Physical condition of the soil - pH value based:70% of the soils are moderately acidic to moderately alkaline in nature

		14) Land use profile • 27.05 % of the land is under public and degraded land • 72.90% of the land is under individual ownership • Of the individual ownership land, 30.7% is under fallow land other than current fallow and the fallow land • 42.18% of the total area is currently under cultivation. • Under public and degraded land, the district has negligible area under permanent pastures, however the district has considerable number of small ruminants which are normally open grazed
		15) Agriculture **3a) crops** • Cropping pattern: Paddy is the primary crop cultivated in 39% of the total area cultivated followed Sugarcane, vegetables • of the total water used for irrigation, 88% is through surface water resources followed by remaining 12% through ground water resources • The total water demand for agriculture is 244307 Ha M **3 b) Livestock resources** • The main livestock are goat, sheep, cow and poultry. • The total water demand for livestock in the district is 7647 Ha.m, of which 42% is through ground water and 58% through ground water.
		16) Irrigation Profile • Type of Irrigation: the predominant type of irrigation is controlled flooding. • Means of extraction: since surface water is used via canal network, gravity is the main type followed by lifting method using electric power from ground water resource • Source of water: ground water is the main source for agriculture through open and tube wells
Source: CWRM- TN- Tiruvannamalai Plan, 2020-21		

Chapter 5: WASCA TN: Key Water Actions in WASCA – Tiruvannamalai

The integrated scientific approach has been adopted to identify the suitable water actions for each of the key vulnerable areas to accelerate the resilience measures. The following table 5.1 indicates the key water actions under socio-economic, climate, water and agriculture and allied sectors. The detailed list of activities are given under the four main sub themes namely

a) Public and common land resources
b) Agriculture and allied sectors and
c) Rural infrastructures

Table No: 5.1 Key water actions proposed for the four different vulnerability areas

S. no	Climate Vulnerability Area	Key water actions
(1)	(2)	(9)
1	Socio-economic	**1) Ensuring socio-economic equity issues:** Asset Creation for SC and ST are given high Priority, including access to safe drinking water, land development, creating additional employment days, explore the possibility to bring skilled jobs especially for women Marginal farmers are targeted in the individual assets creation including plantation, farm ponds, compost pits etc
		2) Increasing the rate of active job cards: There is a need for increase the active job holders to the total job cards registered in the village which is one of the strategies to increase work participation rate in the rural areas, here focus can be given to individual assets creation which encourage men and women to access the employment opportunities. Also, by encouraging the skilled works, the un employed rural youth's participation can be motivated
		3) Access to drinking water: Actions to improve the access by roof rainwater harvesting measures at both community and individual houses, models like tanka, restoring the traditional water bodies with low cost, simple water treatment plants etc which further ensure their access to drinking water and also here convergence under Jal Jeevan Mission(JJM) helps to meet the gaps in the rural areas
		4) Grey water management: Soak pit concept to be used for Grey water management (Community, Individual); Also under take Nutri Gardens with Five Plants per House Hold, focus with SC,ST and other marginal category families under MGNREGS with Moringa; Coconut, Papaya, Agathi, Curry leaf plants provided, near border of house- soak pit. At community soak pit area; Moringa plantation, Neem Plantation and Grass cultivation can be taken up after the soak pit as natural filters, besides, community soakpits and improvement to existing drains are essential.

2	Climate	**Climate resilient action models** are being piloted considering the key climate risks in different sectors 1) Greening of Hillocks 2) Agroforestry & Integrated farming systems 3) Silvi-pasture development 4) Horticulture for fallow land and dry lands farmers 5) Nursery raising 6) Cascade Tanks 7) River Rejuvenation 8) Artificial Recharge structures 9) Water Use Efficiency 10) Invasive species reduction 11) Spring sheds 12) Bamboo cultivation in public lands 13) Borewell recharge structures – Recharge Shaft 14) Community Soak pits 15) Open Wells for Irrigation
3	Water resources (Hydrological)	**1) Watershed profile including the natural drainage lines:** Ridge to valley approach through water shed analysis at GP level is done to identify the potential areas of interventions
		2) Existing Water Recharge or Storage structures and canal networks: Restoration of storage structures activities includes deepening and desiliting, providing silt traps at inlets, bund strengthening and planting as well as weir repair and construction
		3) Status of the ground water: Artificial recharge structures both at common and individual lands, check dams, check walls, percolation tanks, sunken bunds, contour bunds, water absorption trenches, compartmental bunds etc
		4) Run-Off Management: The catchment profile based planning is proposed by assessing the type of land and its current and past use pattern
		5) Water Demand estimation: Sector wise water demand has been done - Human, livestock and agriculture sectors by understanding the area under cultivation by different crops and its water requirement as well as livestock population and its requirements were taken in to consideration
		6) Water budgeting: Estimated water budget is done for the Surface runoff water, ground water, soil moisture and evapotranspiration with the surface runoff water based village level water budgeting in CWRM approach
4	Agriculture and Allied sectors	**1) Soil profile:** Measures that improve soil fertility as well as conservation were proposed including composting, bund plantation with fast growing nitrogen fixing plants and mulching, Farm bund with trench cum bund to allow excess water flow out of the farmland, improve moisture conservation and have better drainage are few important illustrations

		2) Land use profile: Actions for each of the lands types - common and individual with a set of logics were applied to identify the potential areas for actions in each of the land use types. Through these measures 29% of the additional area has been proposed under WASCA with different soil and water conservation actions
		3) Agriculture: **3a) crops** • diversification of cropping system with low water requirement crops and cropping systems and • increase the water use efficiency within the field • crop intensification with inter/mixed crops and agro forestry etc
		3 b) Livestock resources: Forage needs are crucial for livestock as the district has limited scope for irrigation to raise grasses under irrigated conditions: hence focus is given to actions such as silvi pasture, agro-forestry with trees having forage value, azolla, promoting good rearing practices by ensuring infrastructures like sheds, troughs, composting units etc
		4) Irrigation Profile: Improve the conveyance efficiency by restoring the supply channels, promoting improved irrigation methods including micro irrigation, alternate wetting and drying in paddy etc.
Source: CWRM- TN- Tiruvannamalai Plan, 2020-21		

In line with the key water actions discussed in the table 5.1, the extend as well as number of the works identified and proposed to improve the water resources are given in Table 5.2 and Table 5.3. Here importance is given to the public and common land management on priority which has higher proportion of good catchment land.

Table 5.2. Summary of works identified

CWRM themes	No of works
1) Public and common land development	1,65,740
2) Agriculture and Allied sector development	3,11,855
3) Rural water management	70,354
Total	**5,47,948**
Source: CWRM- TN- Tiruvannamalai Plan, 2020-21	

Table 5.3. Detailed lists of works under the three sub categories

S.no	Name of the Work & Unit	No of Works Identified CWRM
Water Action 1: Improvement of Public & Common Lands Development		
1	Afforestation in Public/common lands	18771
2	Contour Continuous Bunds (CCB) for Afforestation area	46771
3	Composting	12331
4	Drainage Line Treatment (DLT)	13071

5	Silvi-pasture Development	2841
6	Linear Plantation	60
7	Avenue plantation	57
8	Block Plantation (Community)	8233
9	Restoration of water bodies	
10	a.Tanks	1966
11	b. Ooranis	0
12	c. Ponds	3787
13	Artificial Recharge Structure	26113
14	Canal Bund Plantation	23839
15	WC - Irrigation channels - Desilting	3949
16	WC- Irrigation channels - canal side plantation	3949
	Sub total	**165740**
Water Action 2:Agricultural and allied Sector development (Productivity Enhancement)		
1	Farm Bunding	14099
2	Micro Irrigation	1451
3	Construction of farm ponds	9482
4	Land development	22483
5	Nursery Development	2303
6	Cattle Shelters	36428
7	Goat Sheep Shelters	17649
8	Fodder development for cattle	27091
9	Azolla units	33669
10	Cattle Trough	30453
11	Poultry shed	26006
12	Dry land Horticulture/Agro-forestry	24892
13	Vermi compost	37889
14	Construction of open well	27960
	Sub total	**311855**
Water Actions 3: Rural Water Management		
1	Soak pits (Community)	16547
2	Soak pits (Individual)	49167
3	Roof rain Water Harvesting	4640
	Sub total	**70354**
	Total	**547948**

Block wise estimation of work, budget and person days in Tiruvannamalai district										
S.No	Block/Mandal	CWRM Water Action 1: Improvement of Public & Common Lands Development			CWRM Water Action 2: Agricultural and allied Sector development (Productivity Enhancement)			CWRM Water Action 3: Rural Infrastructure		
		No.of Works	Budget (INR in Lakhs)	Person days (number)	No.of Works	Budget (INR in Lakhs)	Person days (number)	No.of Works	Budget (INR in Lakhs)	Person days (number)
1	Anakavoor	12147	21726	8095587	28735	42784	16669759	3468	778	122657
2	Arni	18424	59832	22350867	14630	55484	18878012	2295	570	89713
3	Chengam	14763	36136	12268254	14932	31617	10349779	907	974	152265
4	Chetpet	7709	34434	11567839	16956	46185	16949718	2937	770	121370
5	Cheyyar	4870	18561	6012603	14546	47201	15491403	3941	4006	626981
6	Jawadhu	5808	14583	5600651	5985	16764	5953296	4900	2449	384100
7	Kalasapakkam	6811	28932	9543925	21383	70124	25097297	3527	3292	515122
8	Keelpennathur	5757	26735	8793689	26701	101910	39303986	2866	898	141235
9	Pernamallur	7966	46131	17503423	9211	23178	7024158	12614	2040	315033
10	Polur	19348	104790	38285677	33746	102988	39574315	4300	3629	568312
11	Pudupalayam	9061	32168	11351961	10123	22652	8530758	2159	510	80358
12	Thandrampet	7486	20577	7421230	5714	16565	6885742	1031	472	74090
13	Thellar	3427	16001	5473294	21565	52821	20015950	5494	1047	165078
14	Tiruvannamalai	9036	20732	6741462	14523	31247	10936147	1117	653	102262
15	Thuringipuram	3302	16666	6063046	12687	24890	13120920	5047	890	140364
16	Vandavasi	5504	20175	6792103	16111	53479	18583285	9555	1434	227574
17	Vembakkam	16291	29460	10376350	23717	46789	17258817	1546	657	103056
18	West Arni	8031	19208	6256625	20589	38758	10882054	2650	558	88034
Total		**165740**	**566847**	**200498584**	**311855**	**825435**	**301505398**	**70354**	**25628**	**4017604**
Source: CWRM- TN- Tiruvannamalai Plan, 2020-21										

5.2) Convergence Plans and Actions

The schemes of both government (state and central) and private sectors which were implemented focusing on integrated water resources management and climate adaptation on district level was reviewed to understand its intensity of works and reach, the details are given below in Table 5.4. There are 7 existing schemes and financing mechanisms apart from MGNEREGS, comprise approaches for an integrated, climate-adapted water resource management in rural areas.

Table 5.4 List of schemes and the details of the works

No.	Name of the schemes	About the programme details in the scheme/policy reference	Specific allocation to district
1	Kudimaramath: Tamil Nadu Water Resource Conservation and Augmentation Mission	The Government have given Orders in G.O (Ms) No.96, RD & PR Dept., Dated. 26.7.2019 for the implementation of Kudimaramathu – A participatory Programme for the Rejuvenation of 5,000 Minor Irrigation (MI) Tanks under the 142 control of Panchayat Unions and 25,000 Ponds / Kuttai and Ooranies of Village Panchayats at a cost of Rs.1250 Crore.	The details of allocation to the Tiruvannamalai district is restoration of 37 tanks and with an estimated amount of Rs 1607 Lakhs in 2019[1]
2	Tamil Nadu - Irrigated Agriculture Modernization and Water Bodies Restoration and Management (TN-IAMWRM)	Under Phase III total three sub basins[2] are covered which aims to increase the water use efficiency and productivity and the scheme is supported by World Bank and implemented through Govt of Tamil Nadu	Aliyar Sub basin- 2580 Ha[3] Pambanar- Veratar - 1213.54 Ha Thurinjalar - 4442.63 Ha
3	Rainwater Harvesting and Runoff Management Programme	It is a state plan scheme and the kind of works undertaken are percolation ponds, major, medium and minor check dams, farm ponds, rejuvenation of unused wells, village tanks/ooranies	Allocation details are not given and it is taken under convergence with watershed development programmes
4	Mission on Sustainable Dryland Agriculture	Rain water harvesting is adopted as an entry point activities and promoted water harvesting structures such as checkdams, village ponds, community ponds and deepening of Ooranies	Rs 5 lakh per cluster was adopted and for the 48 cluster the total budget for the work in this district was Rs 2.40 Cr.
5	Tamil Nadu Watershed Development Agency (TAWDEVA)	Pradhan Mantri Krishi Sinchayee Yojana (Integrated Watershed Management Programme	9152 ha was covered under micro irrigation during 2018-19[4]

[1] http://www.wrd.tn.gov.in/Kudimaramath_2019-20_list_of_works.pdf

[2] https://www.tniamwarmtnau.org/sub-basins/phase-3

[3] http://www.iamwarm.gov.in/PDF/Project/DPR/PHASE-II/Aliyar.pdf

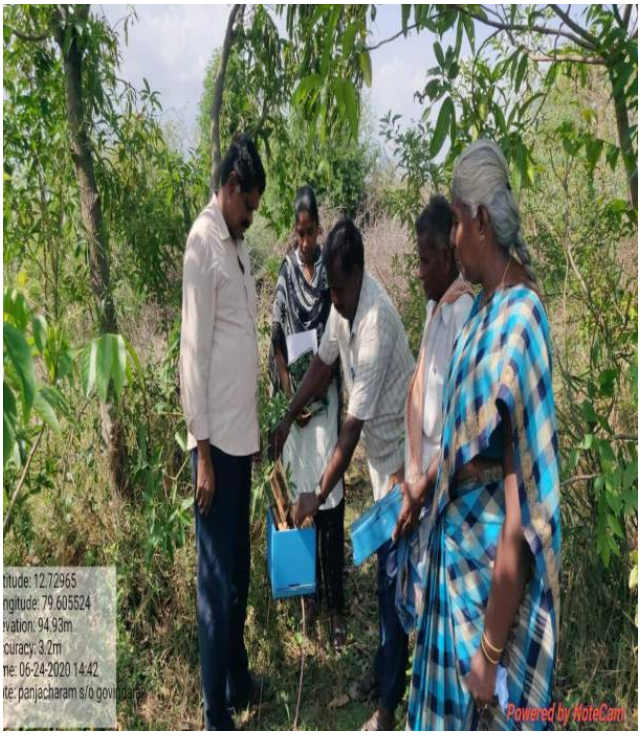
[4] http://agricoop.nic.in/sites/default/files/PMKSYAchivement2018-19.pdf

6	Jal Shakthi Abiyan	Importance was given to the water augmentation initiatives, specifically most of the blocks are categorized as Over exploited and critical by CGWB	A mission mode water conservation campaign was organised to ease water shortage in the district. Under this water banks, auto switch off motors for the over head tanks, mulching, pot irrigation, micro irrigation, village based water budget and IEC activities to raise awareness among general public was carried out[5].
7	Jal Jeevan Mission	The scheme is started from 2019-2020 - focus is given on drinking water	18.2% HHs has tap connection in the district
Source: WASCA Baseline report Tiruvannamalai, 2020-21			

Besides, other central schemes such as National Food Security Mission (NFSM), National Horticulture Mission (NHM) and state specific fallow land development scheme activities have been focusing on agriculture and horticulture, provisions for constructing and maintaining farm ponds, dug wells and tanks exist to ensure sustainable water supply for agriculture. Also, under PMKSY- Har Khet Ko Pani (HKKP) water bodies had been included under Repair, Renovation and Restoration framework and completed of water bodies in 2017[6].

Apart from this, in agriculture sector under state schemes several soil and water conservation activities have under taken and the details are given below:

1) Promotion of Integrated Farming systems under National Agriculture Development project during 2020-21. The activity has been implemented in West Arni block and promoted 100 units @ Rs 60680 per farm. Since paddy is the primary crop the integration model has been designed as Paddy- Dairy- Goat-Poultry - horticulture-apiary-agro-forestry.



[5] http://sujal-swachhsangraha.gov.in/node/3106

[6] https://sureshe.files.wordpress.com/2018/01/au4298.pdf

Table 5.5 Details of the scheme on Integrated Farming Systems					
Sl.NO	**Details**	**Physical Target**	**Physical Achievement**	**Financial Target in Lakhs**	**Financial Achievement-Lakhs**
1	Crop Demonstration undertaken so far	100	100	7.50	7.50
2	Kitchen Garden Cultivation	100	95	1.00	0.95
3	Milch Cow (Nos.)	100	55	15.00	8.25
4	Goat (Nos.)	1000	480	15.00	7.20
5	Backyard Poultry (Nos)	1000	600	3.00	1.80
6	Vermi compost unit (No.)	100	100	12.5	12.50
7	Horticulture Fruit Plant	100	100	1.30	1.30
8	Apiary Units (Nos.)	200	200	3.20	3.20
9	Agro Forestry, Fodder Trees and Slips (Nos.)	100	100	1.50	1.50
10	Livestock Shelter	100	100	0	0
11	Compost Pits	100	100	0	0
12	Farmers Training	3	3	0.30	0.30
13	Officials Training	1	1	0.08	0.09
14	Exposure Visit	2	2	0.30	0.30
Total				**60.68**	**44.89**
Source: Dept of Agriculture, Tiruvannamalai, 2020-21					

2) Fallow land development (Ha) - Dept of Agriculture

Under this scheme 314 ha of fallow land covering all the blocks have been restored under cultivation with crops such as millets, groundnut, pulses. Technical and financial support has been extended to restore the fallow land with due importance to soil health management and low water requiring crops.

Table 5.6 a. Details of the Fallow Land development scheme						
S No.	**Name of the block**	**Millets**	**Ground nut**	**Pulses**	**Total area under fallow land restored**	**Total Amount Rs in Lakhs**
1	Tiruvannamalai	20	0	0	20	2
2	Thurinjapuram	10	10		20	2.8
3	Kilpennathur	10	10	0	20	2.8
4	Chengam	0	0	15	15	1.388
5	Thandrampattu	10	0	10	20	1.925
6	Pudupalayam	0	0	15	15	1.388
7	Polur	0	10	24	34	4.02
8	Kalasapakkam	0	10	0	10	1.8
9	Chetpet	0	10	10	20	2.725
10	Arni	0	0	20	20	1.85
11	West Arni	0	10	10	20	2.725
12	Vandavasi	0	0	10	10	0.925
13	Thellar	0	0	30	30	2.775
14	Pernamallur	0	0	20	20	1.85
15	Cheyyar	0	0	20	20	1.85
16	Anakkavur	0	0	10	10	0.925
17	Vembakkam	0	0	10	10	0.925
	TOTAL	**50**	**60**	**204**	**314**	**34.671**
Source: Dept of Agriculture, Tiruvannamalai, 2020-21						

3) Farm ponds

The construction of farm pond has been promoted to facilitate the access to life saving irrigation in the dry land areas. 61 farm ponds were established in 13 blocks covering 43 GPs by the Dept of Agriculture Engineering. Importance was given to the promotion of pulses under this scheme.

Table 5.6 b. Details of the farm ponds scheme					
S No	**Name of the block**	**No of Gram panchayats**	**No of farm ponds**	**No of farmers benefitted**	**Crops**
1	Cheyyar	3	3	3	Groundnut & Pulses
2	Anakavoor	0	0	0	
3	Vembakkam	5	6	6	Groundnut & Pulses
4	Vandavasi	3	5	5	Groundnut & Pulses
5	Thellar	0	0	0	
6	Peranamallur	3	3	3	Groundnut & Pulses
7	Arni	6	9	9	Groundnut & Pulses
8	West Arni	4	4	4	Groundnut & Pulses
9	Chetpet	2	2	2	Groundnut & Pulses
10	Thiruvannamali	0	0	0	
11	Kilpenathur	1	1	1	Groundnut & Pulses
12	Thurinjapuram	3	3	3	Groundnut & Pulses
13	Polur	3	3	3	Groundnut & Pulses
14	Kalasapkkam	2	2	2	Groundnut & Pulses
15	Jawadhu Hills	0	0	0	
16	Thamdrampet	4	10	10	Groundnut & Pulses
17	Pudhupalayam	4	10	10	Groundnut & Pulses
18	Chengam	0	0	0	
	TOTAL	**43**	**61**	**61**	
Source: Dept of Agriculture, Tiruvannamalai, 2020-21					

4) Micro irrigation under PMKSY scheme by Dept of Horticulture

The area covered in this scheme is 2555 ha out of the planned target of 7200 ha. 2808 small farmers have benefitted under this scheme by installing drip irrigation systems to efficiently use the water resources.

Table 5.7. Micro irrigation scheme							
S No	Name of the block	Phy (Ha)	Fin (Rs. Lakhs)	GPs covered	No.of Beneficiaries	Area Covered (Ha)	Amount (Rs. Lakhs)
1	Anakkavoor	340	238.00	55	80	79.43	15.60
2	Arni	336	235.20	38	63	50.98	9.09
3	Chengam	490	343.00	44	227	249.77	75.44
4	Chetpet	330	231.00	49	74	66.11	15.15
5	Cheyyar	390	273.00	53	101	79.11	17.33
6	Jamuna Marathur	425	297.50	11	105	80.70	17.78
7	Kalasapakkam	360	252.00	45	148	135.38	22.22
8	Kilpennathur	476	333.20	45	235	203.07	57.21
9	Peranamallur	325	227.50	57	135	127.56	19.10
10	Polur	375	262.50	40	245	205.71	39.12
11	Pudupalayam	412	288.40	37	113	129.31	39.05
12	Thandrampattu	500	350.00	47	288	265.33	122.60
13	Thellar	379	265.30	61	57	48.35	11.31
14	Thurinjapuram	456	319.20	47	258	217.12	73.03
15	Tiruvannamalai	486	340.20	69	215	175.88	36.44
16	Vandavasi	395	276.50	61	147	161.96	30.46
17	Vembakkam	350	245.00	63	254	230.04	33.37
18	West Arni	375	262.50	37	63	49.16	13.49
	TOTAL	**7200**	**5040.00**	**859**	**2808**	**2554.97**	**647.79**
Source: Dept of Agriculture Engineering, 2020-21							

5) Promotion of horticulture crops - crop diversification strategy - Dept of Horticulture

Here high value vegetable cultivation has been promoted under open field as well as protected cultivation with the use of drip irrigation.132 small farmers benefitted under open field and 864. under protected area cultivation

Besides, the above mentioned schemes, it is proposed to forge new partnerships and strengthen the existing partnerships with the key water actions identified under the four different climate resilient themes in the CWRM plans.

Table 5.8. Convergence with line departments

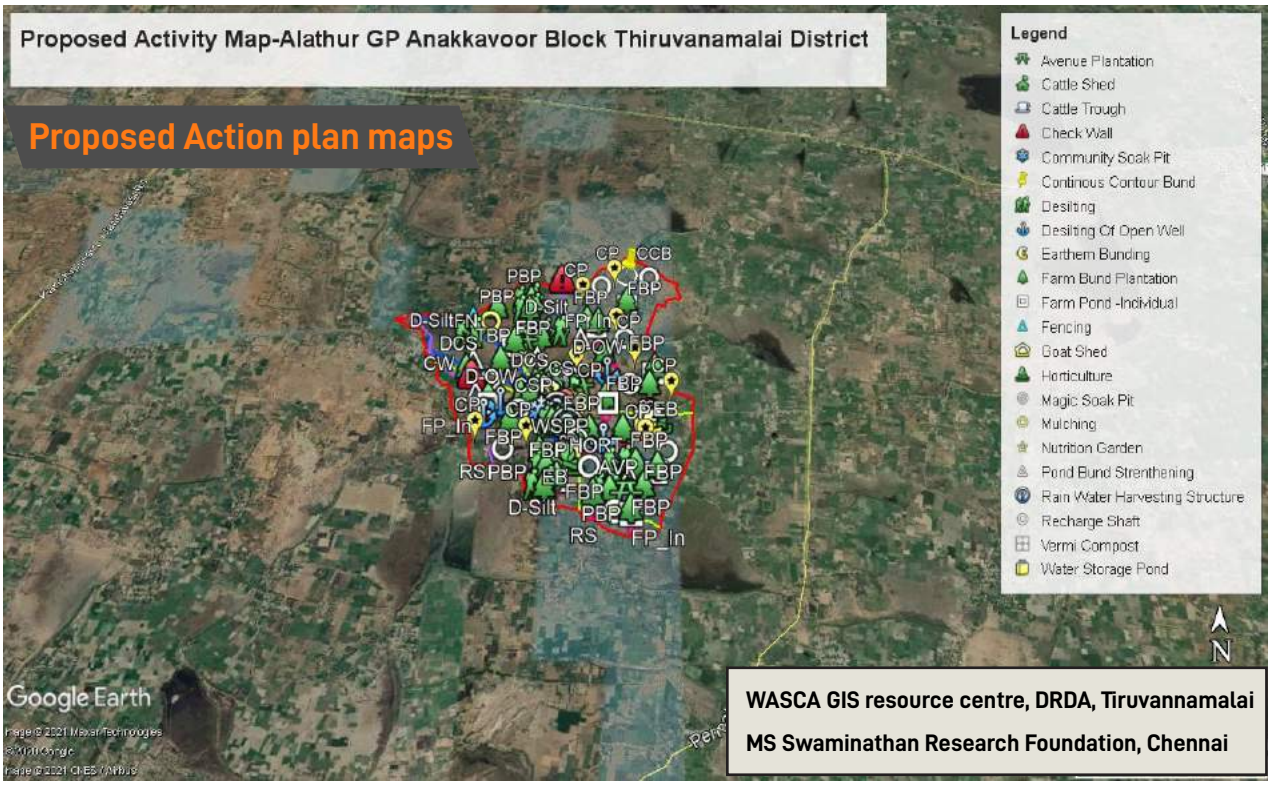
Sl.No	Area of Convergence	Name of the Department
1	Ground water development	Central Ground Water Board(CGWB), NABARD, Name other Line departments,
2	Agro Forestry	NABARD, State planning commission
3	Nursery raising	Dept of forestry
4	Fallow Land Development	State planning commission, DRD
5	Dry Land Farming and Horticulture	Dept of Horticulture
6	Silvi-pasture and pastureland development	Dept of Animal Husbandry
7	Involvement of SHGs in maintenance, management of community block plantations	Dept of Rural Development
8	Restoration of Cascade tanks	Water Resources Organization, Gram Panchayats, FPO/ Water users associations, DRD
9	River Rejuvenation (Name of the river)	WRO, CGWB and Dept of Agriculture Engineering
10	Greening of hillocks	Forest Dept and NABARD, TVS- CSR

Private sector schemes:

There are two NGOs and three private sector institutions under the Corporate Social Responsibility programme had partnered to implement the watershed schemes along with NABARD.

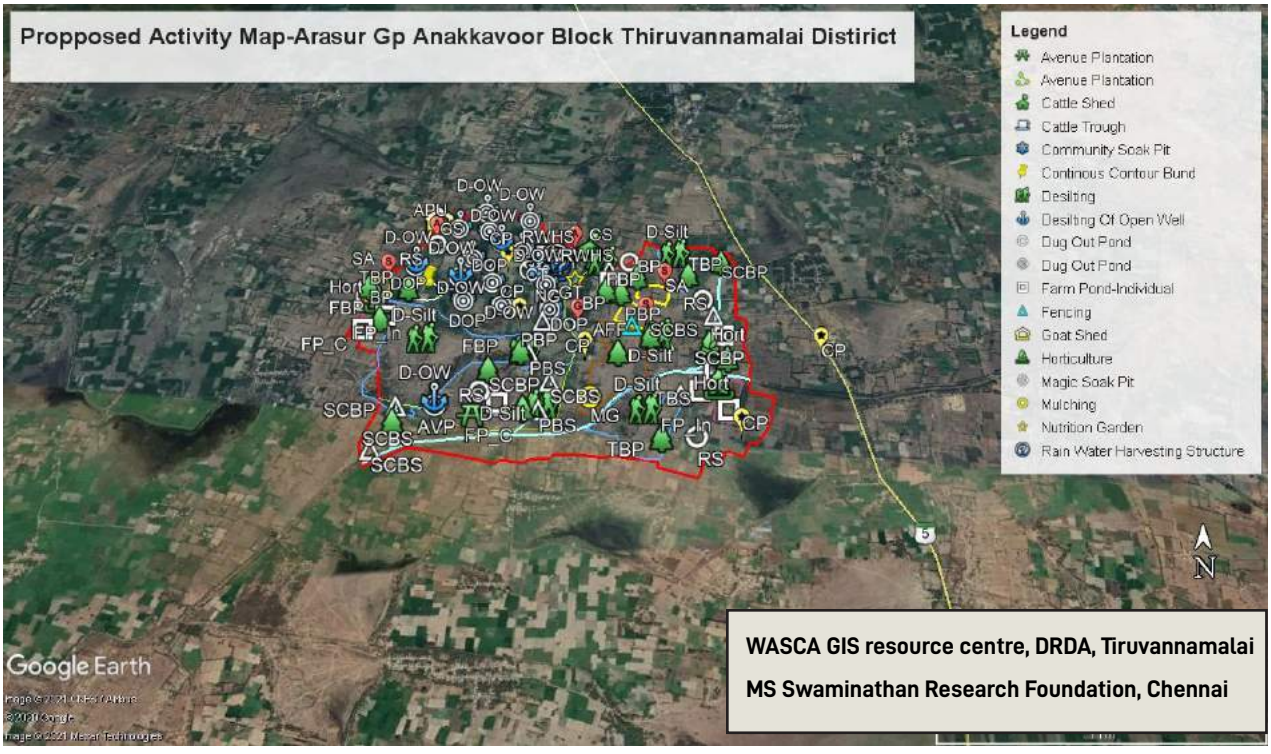
5.3) Action points - KMZ layers of four GPs per block

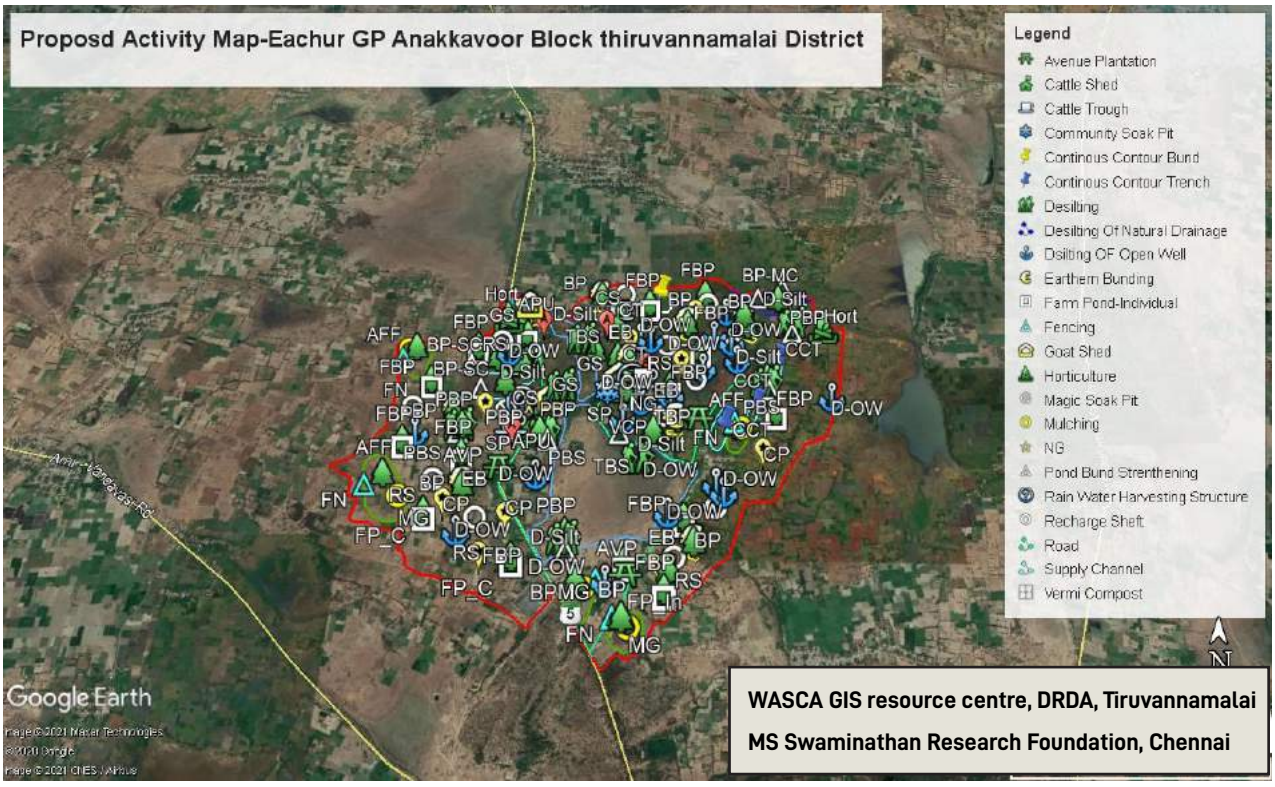
The key water action plans are geo-coded following the MORD guidelines to identify the location and follow up the actions, four GPs per block is given here:



Alathurai Gram Panchayat – Anakkavoor block

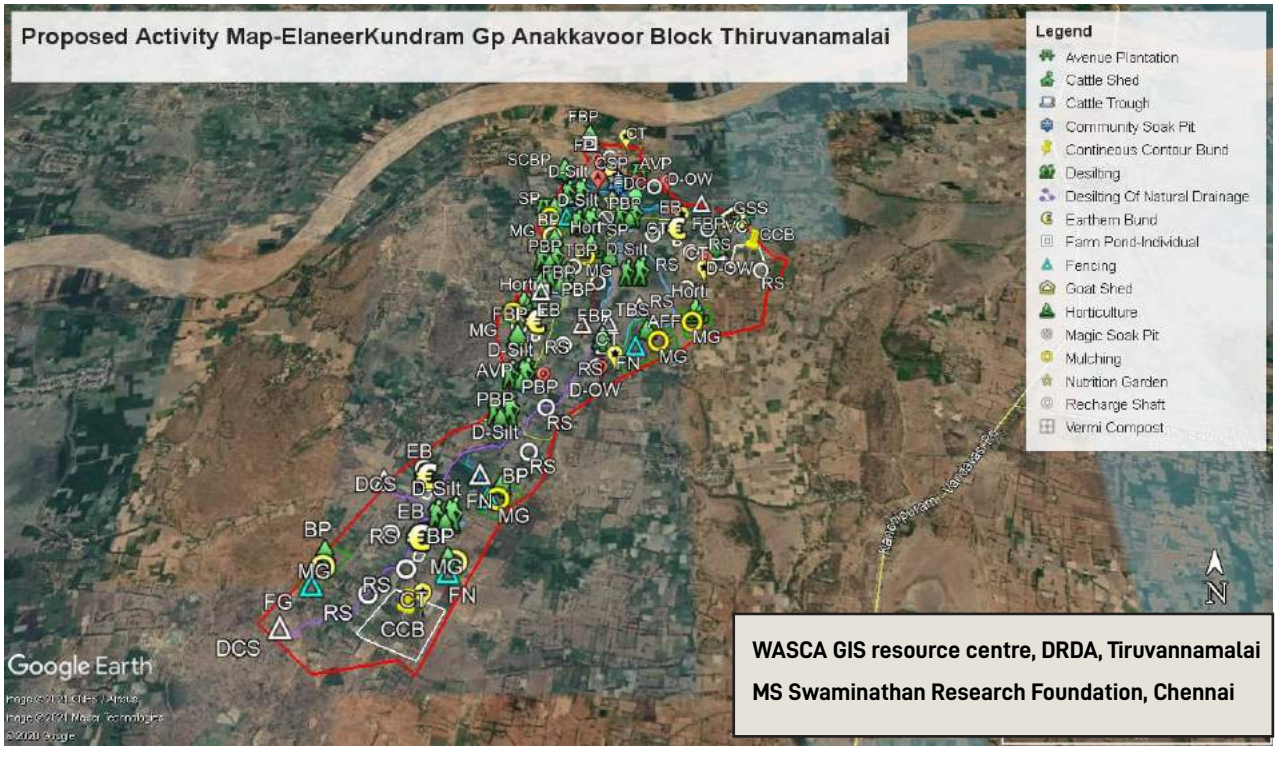
Arasur Gram Panchayat – Anakkavoor block

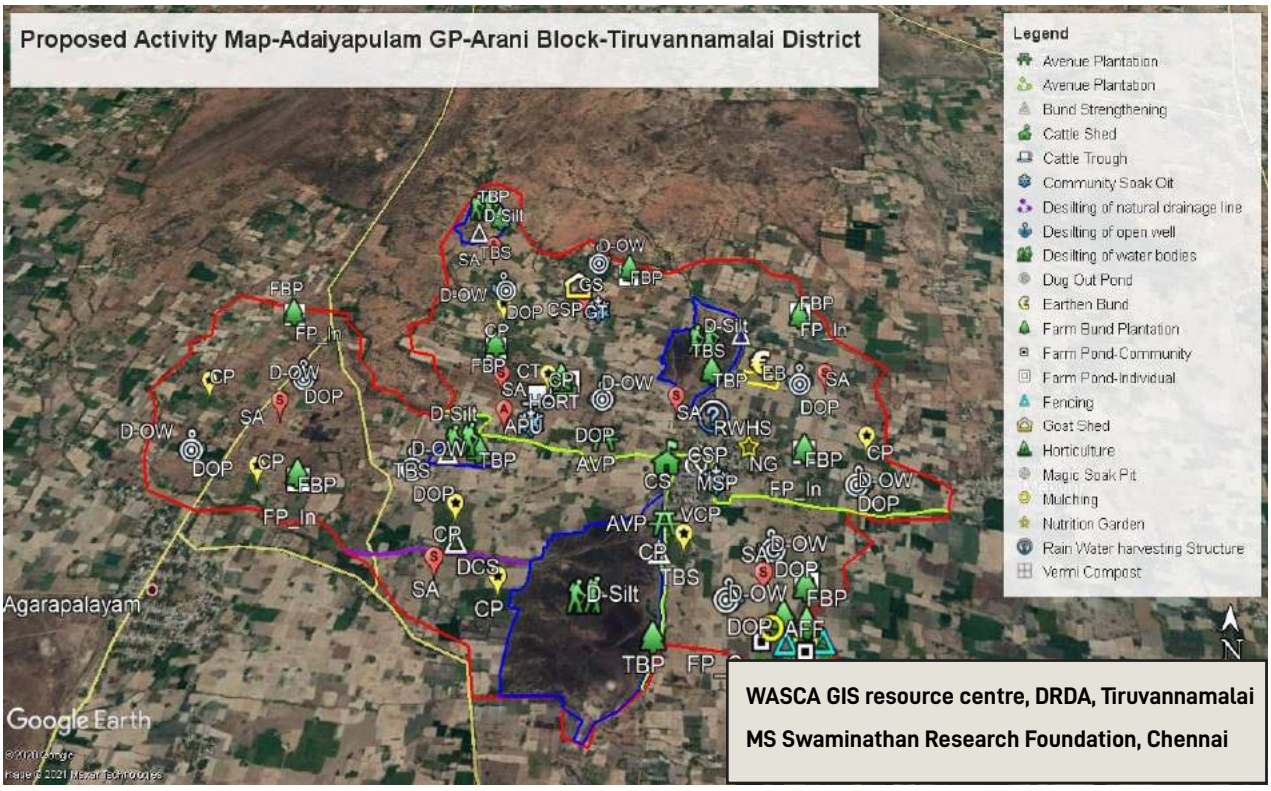




Eachur Gram Panchayat – Anakkavoor block

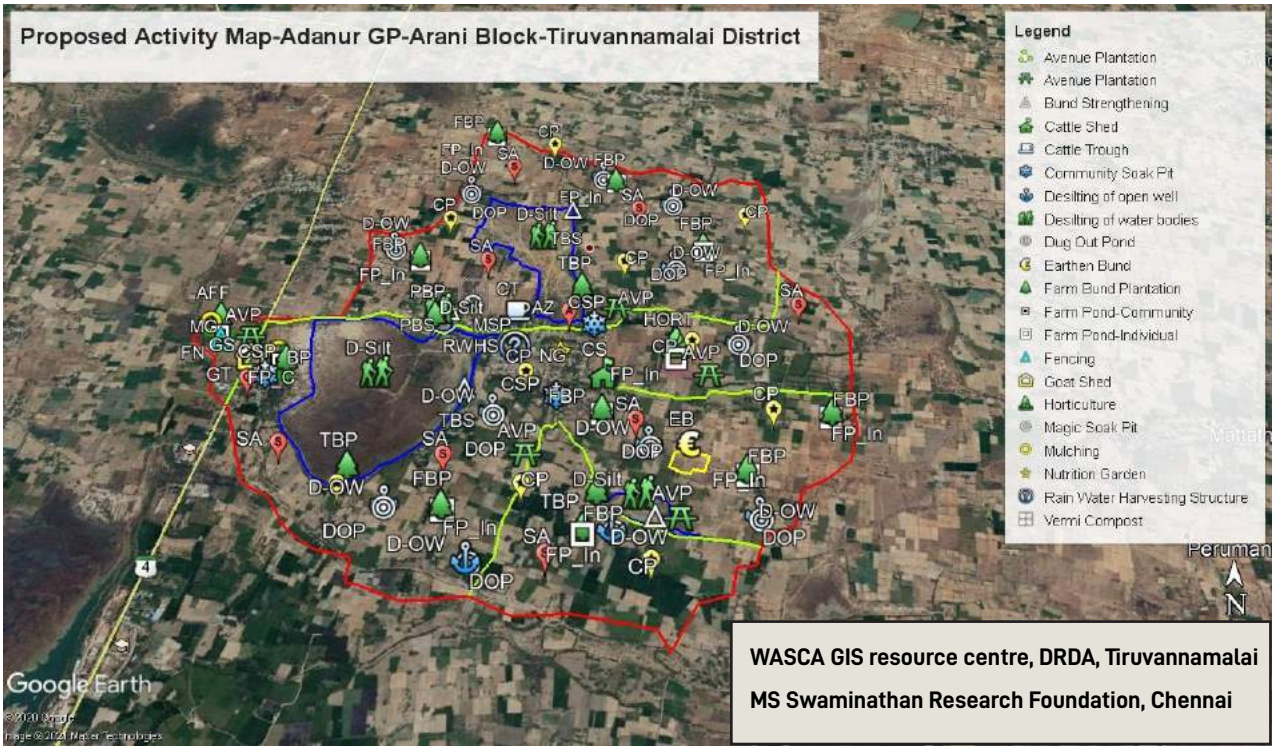
Elaneerkundram Gram Panchayat – Anakkavoor block

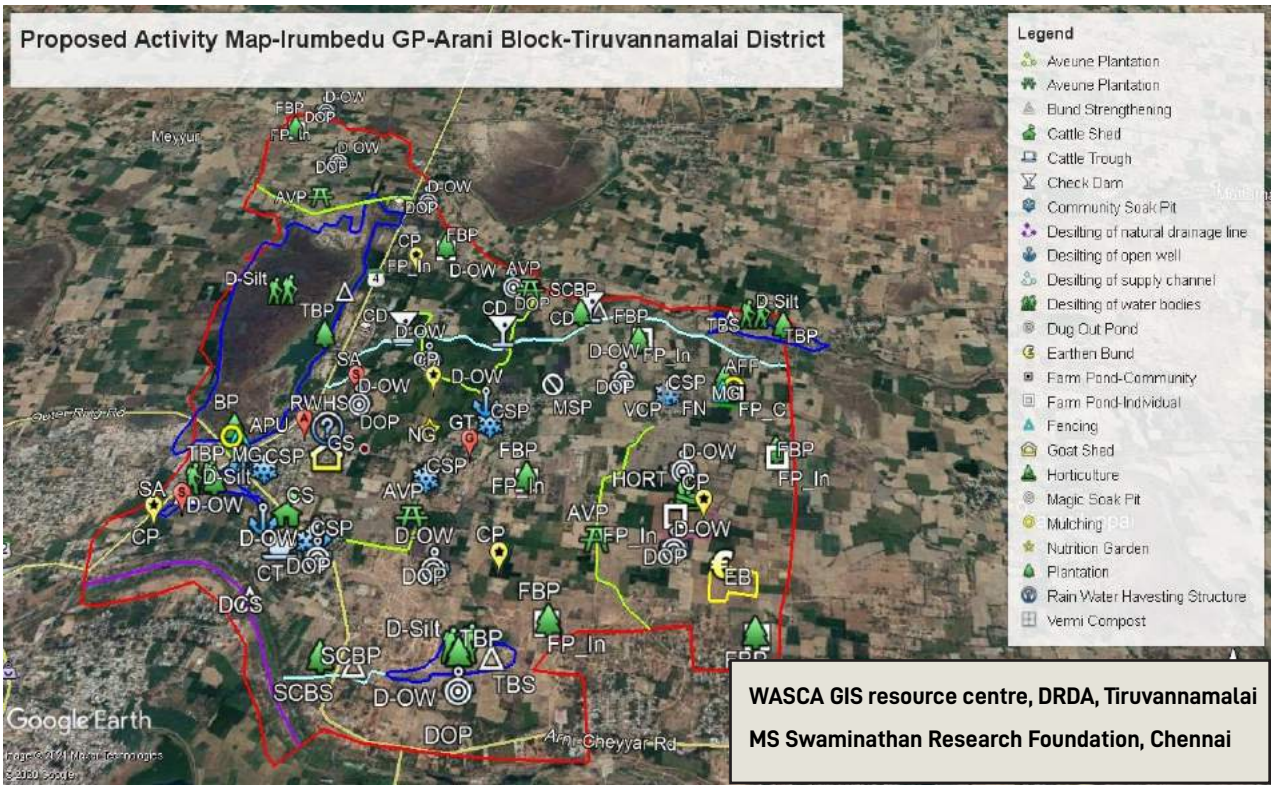




Adaiyapulam Gram Panchayat – Arani block

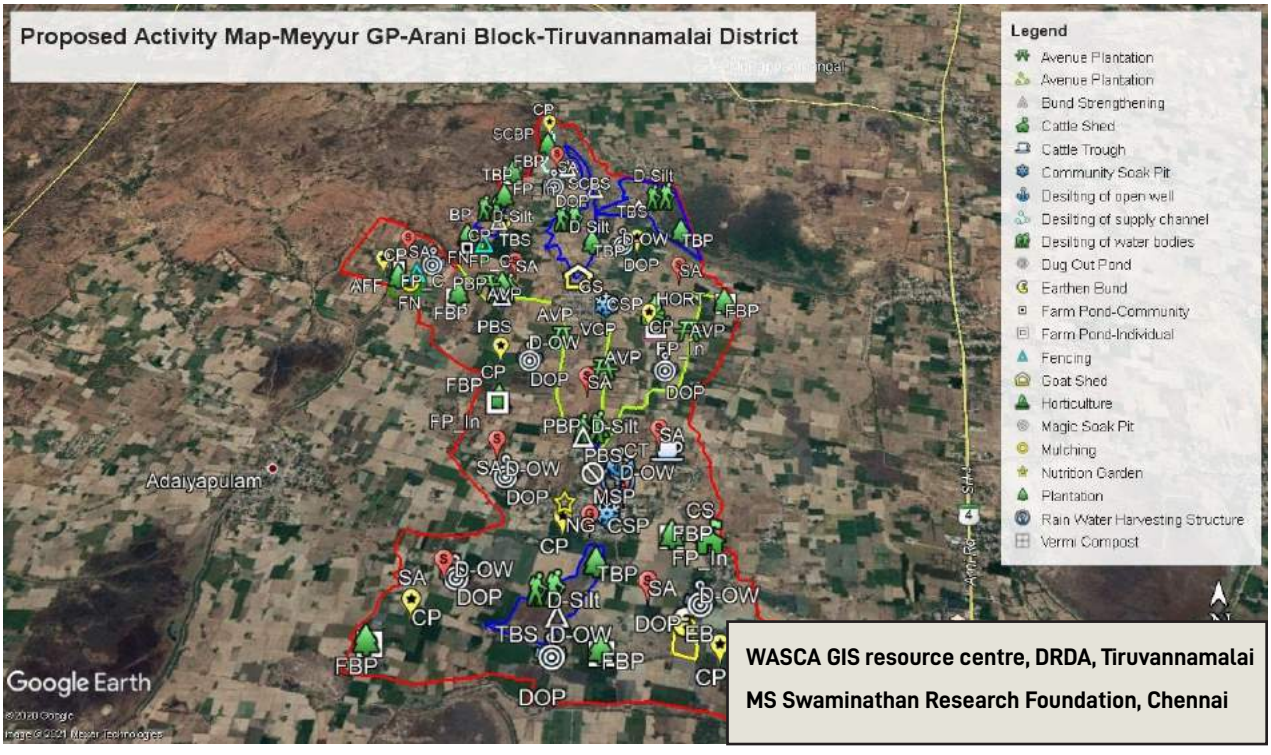
Adanur Gram Panchayat – Arani block

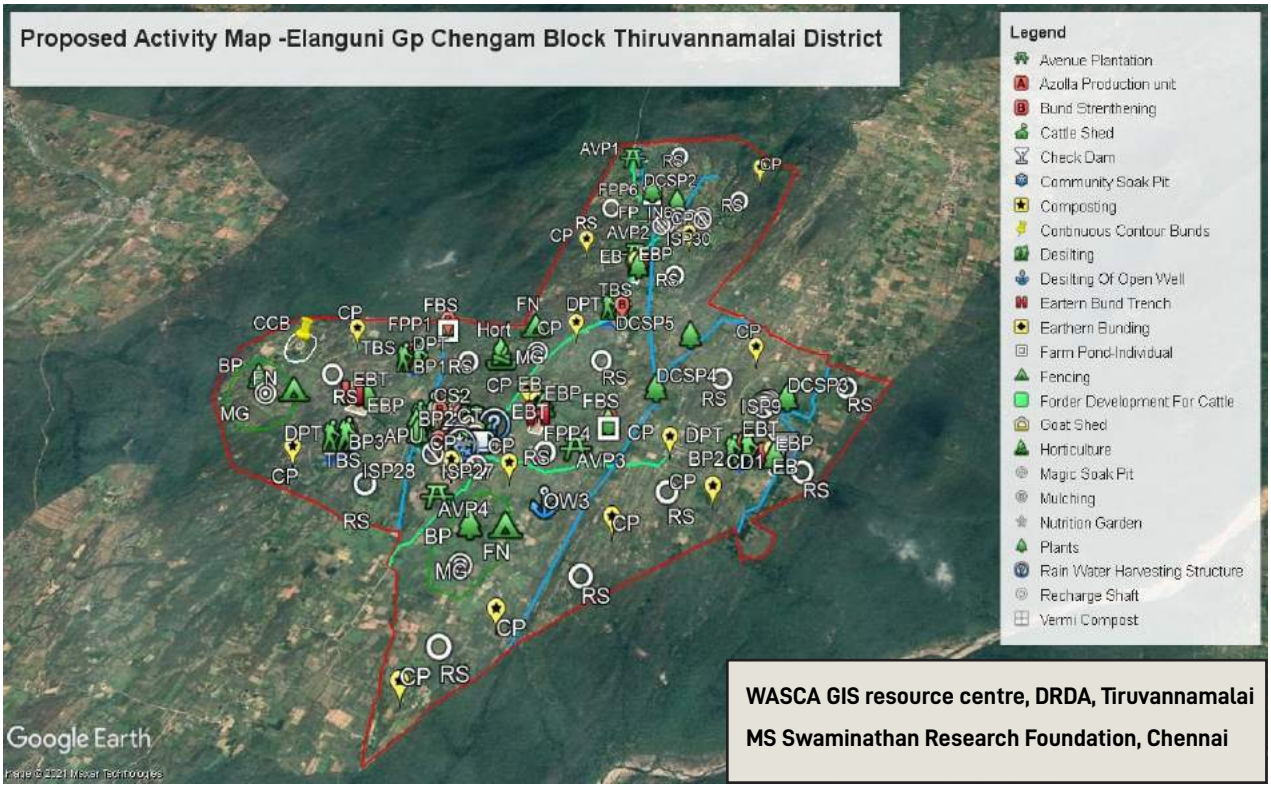




Irumbedu Gram Panchayat – Arani block

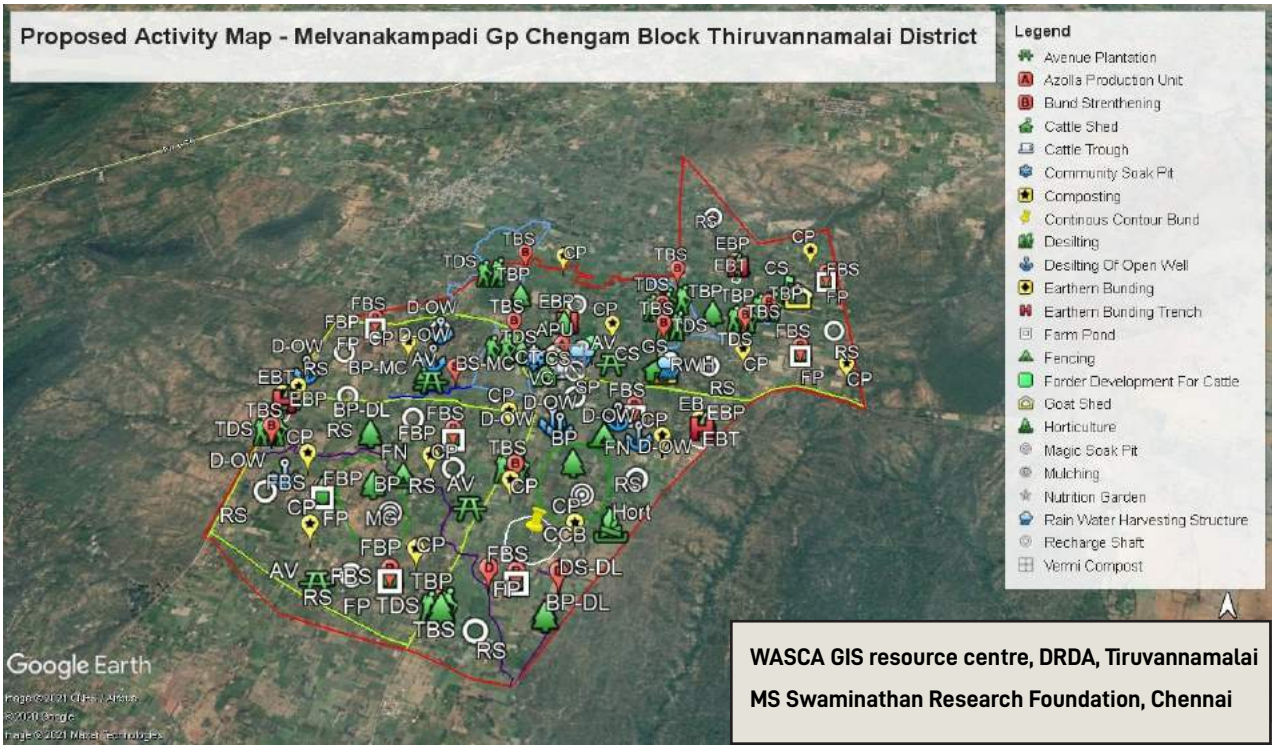
Meyyur Gram Panchayat – Arani block

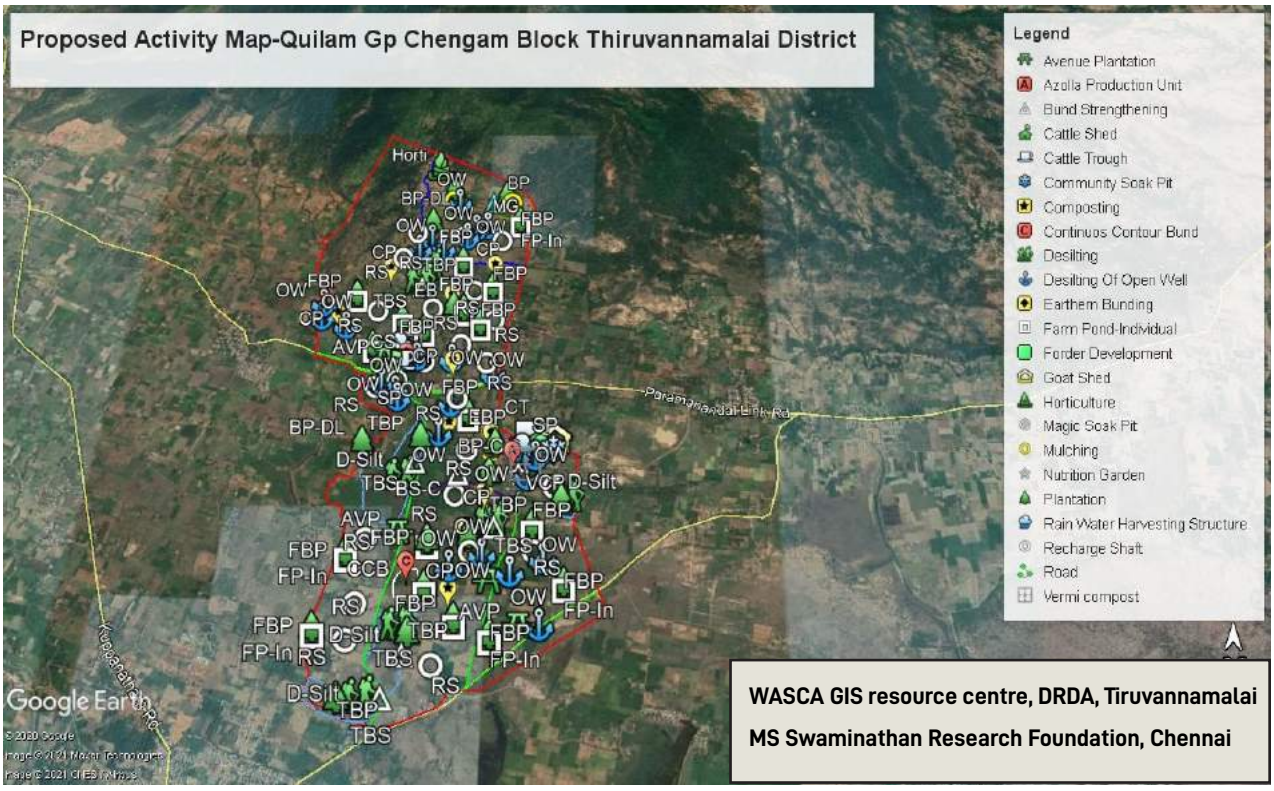




Elanguni Gram Panchayat – Chengam block

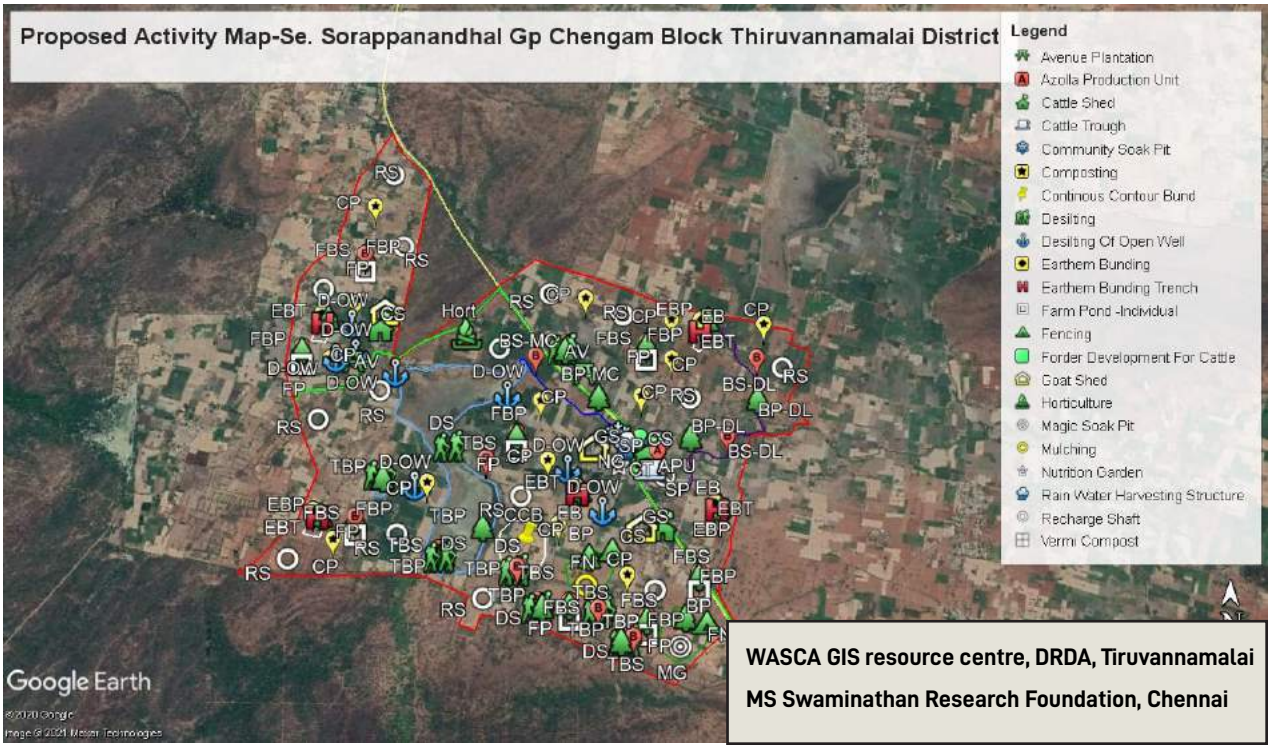
Melvanakampadi Gram Panchayat – Chengam block

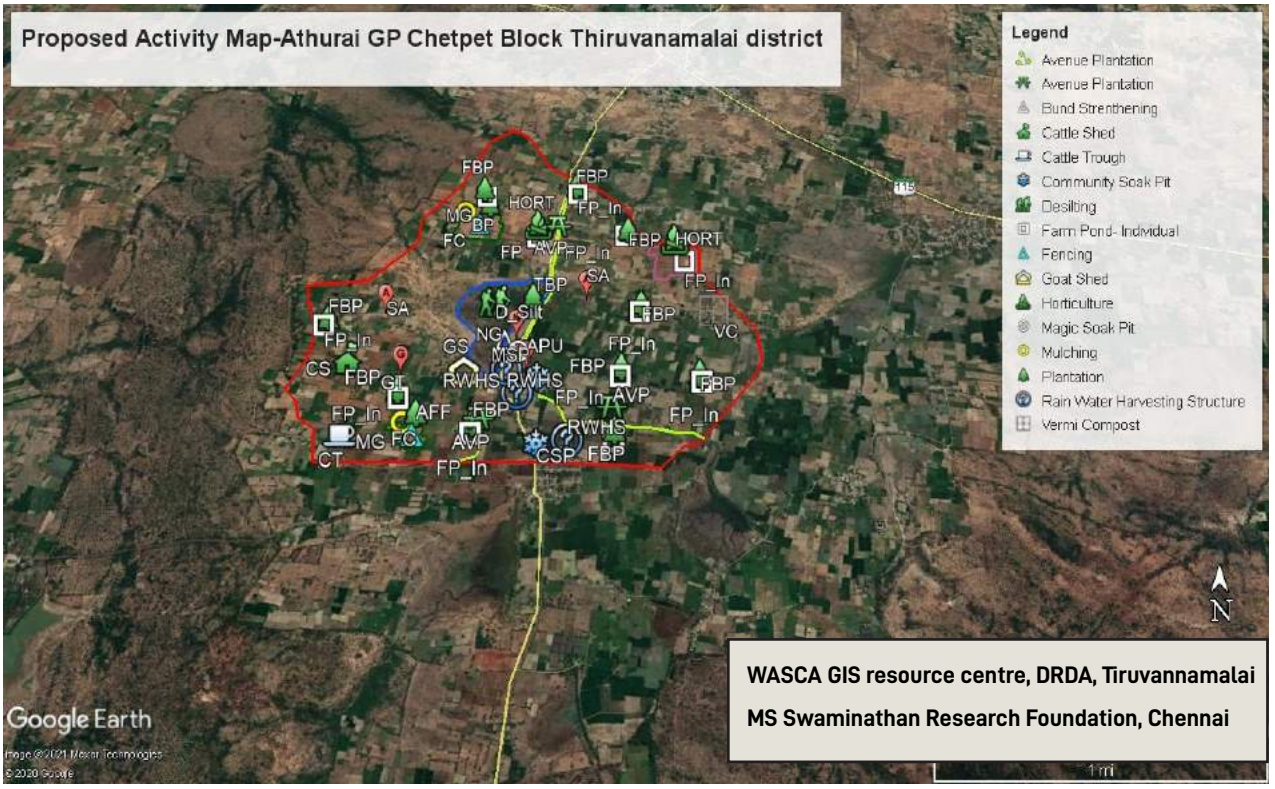




Quilam Gram Panchayat – Chengam block

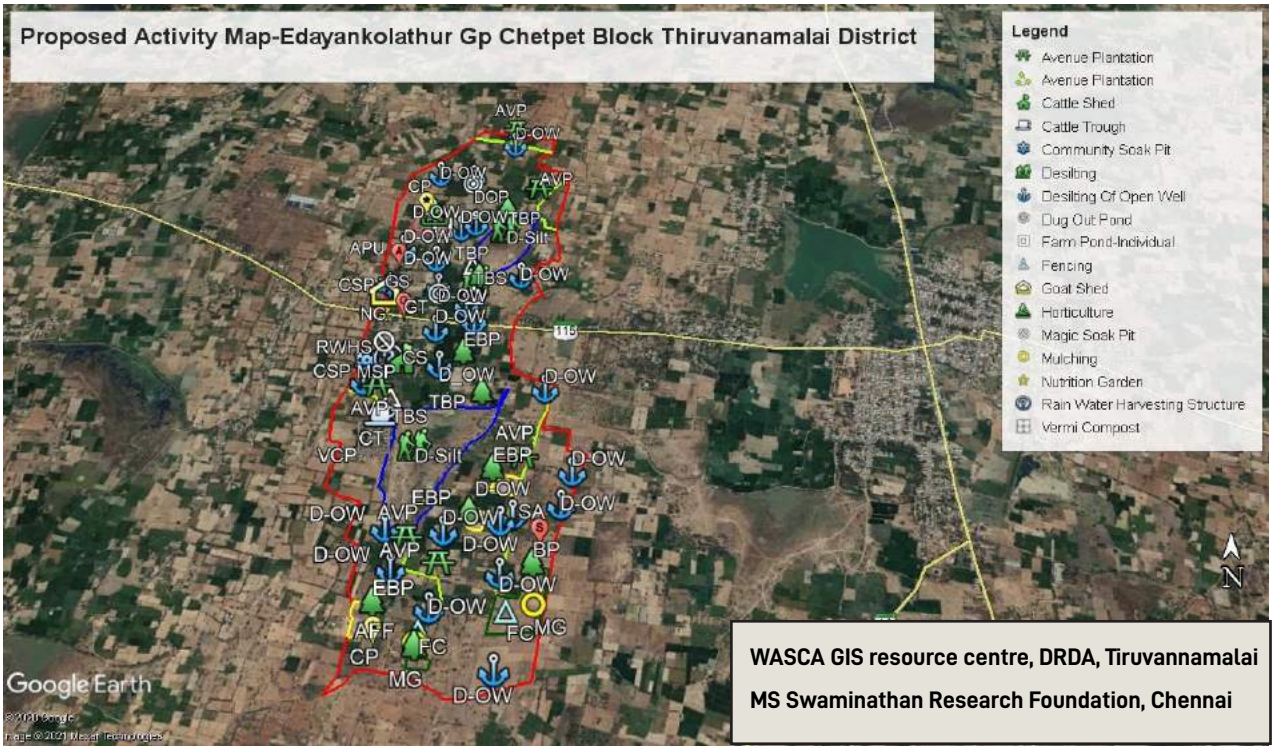
Se. Sorappanandhal Gram Panchayat – Chengam block

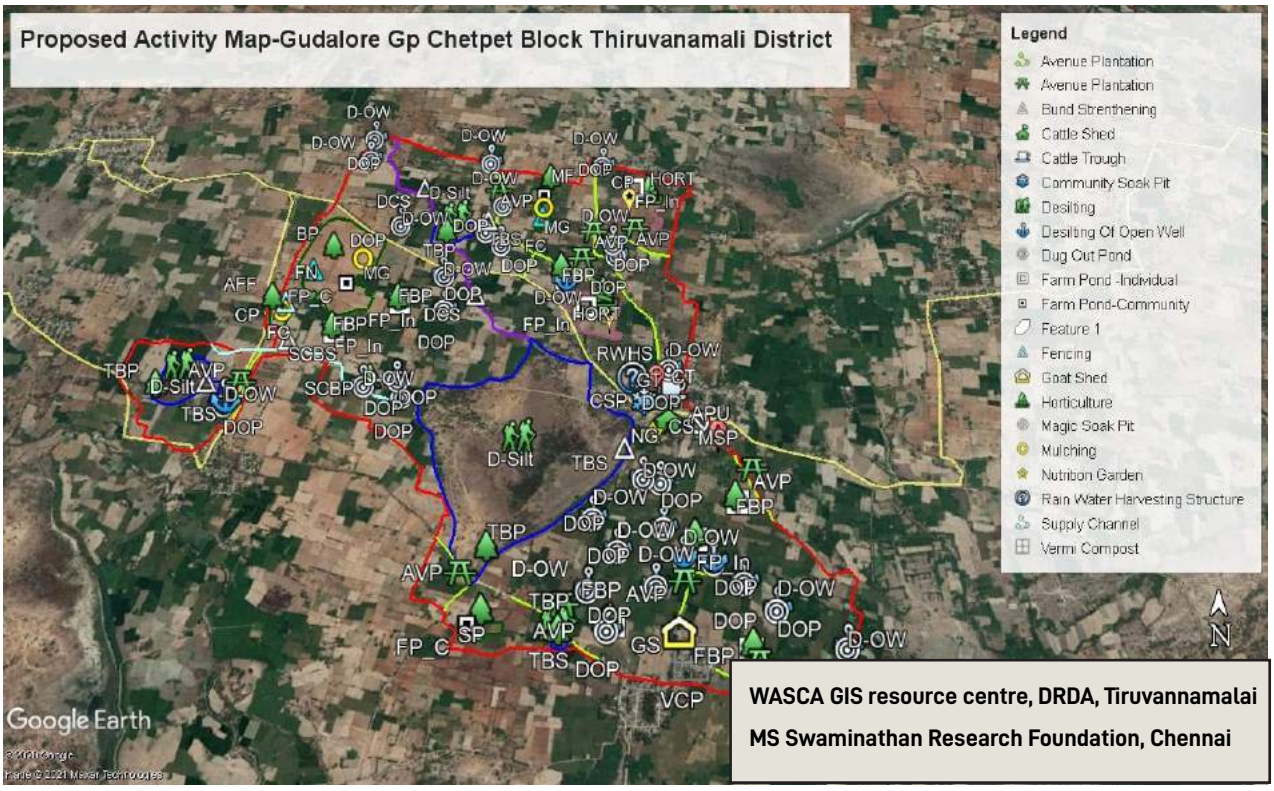




Athurai Gram Panchayat – Chetpet block

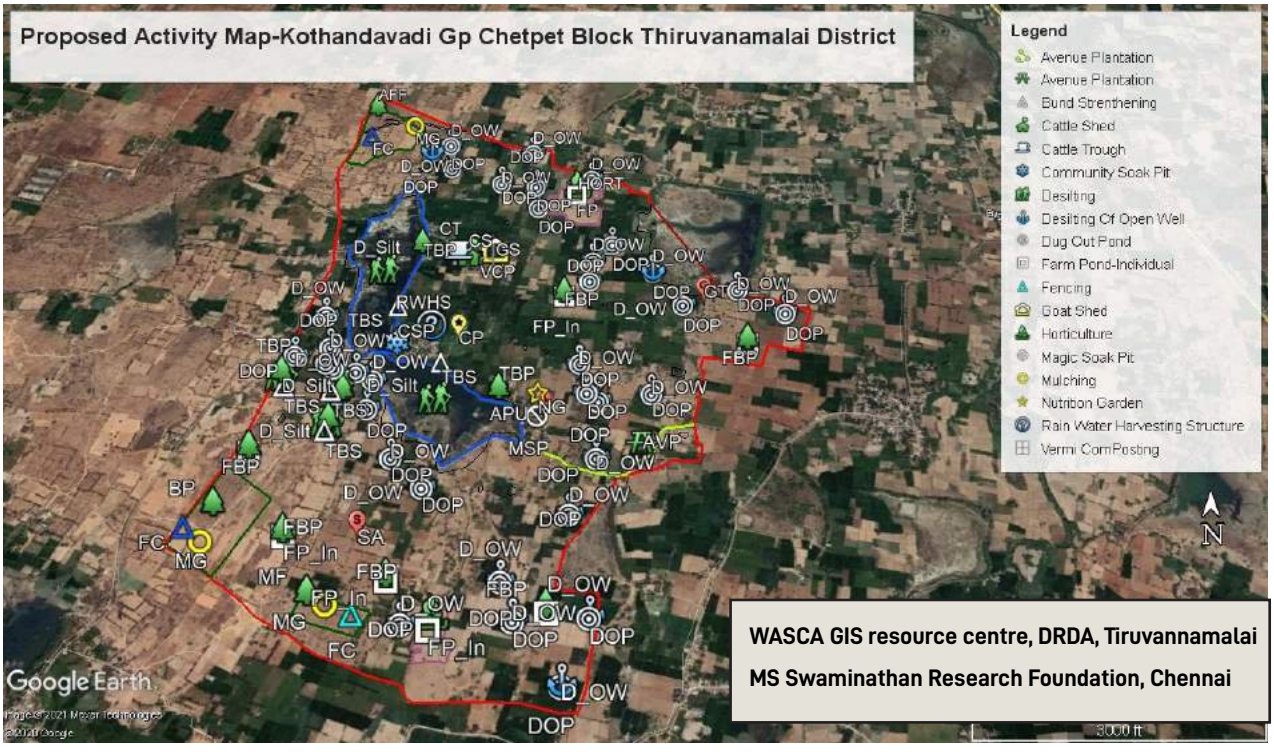
Edayankolathur Gram Panchayat – Chetpet block

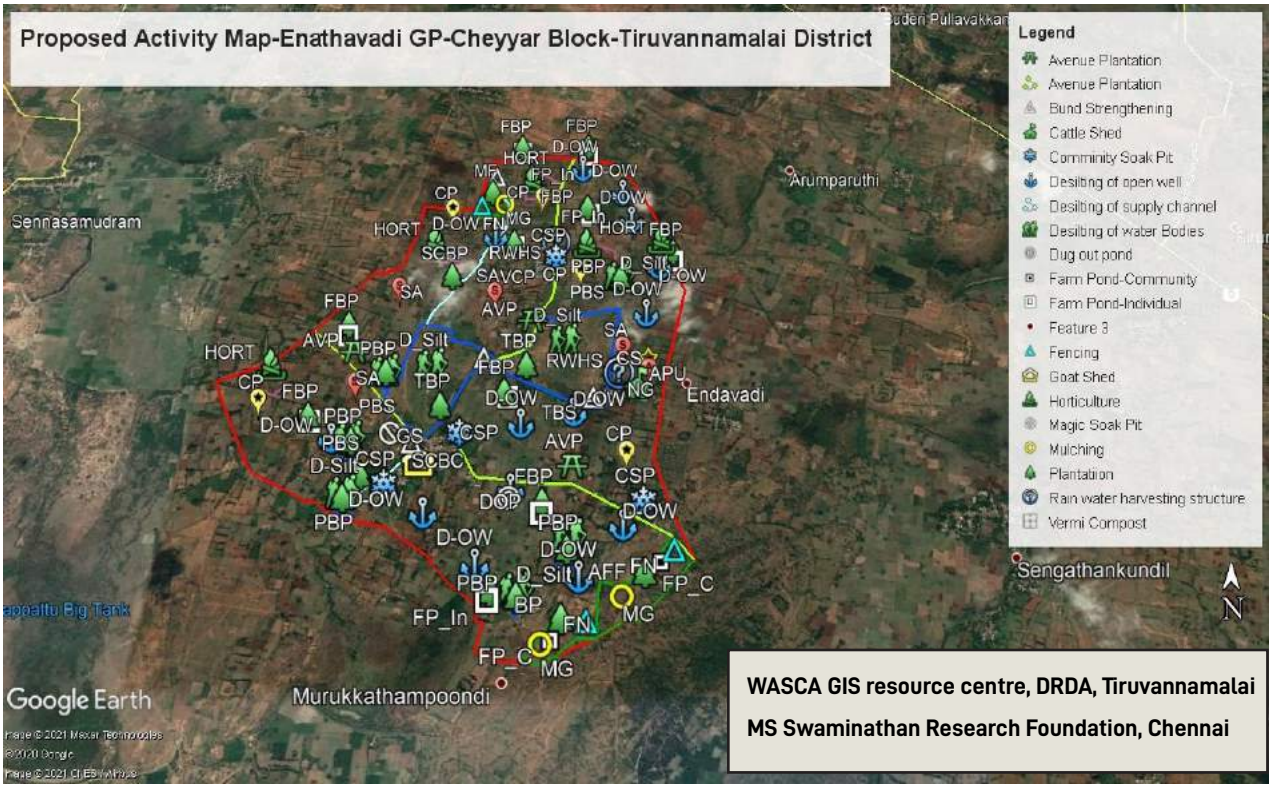




Gudalore Gram Panchayat – Chetpet block

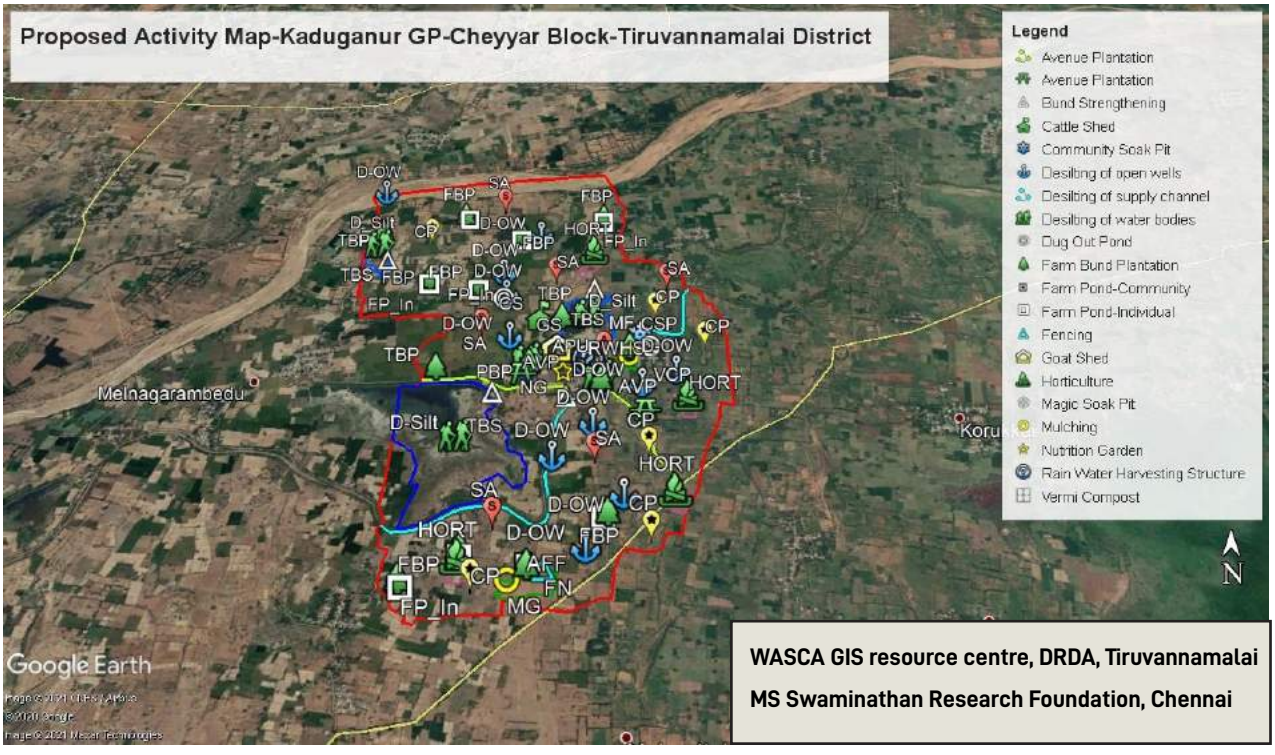
Kothandavadi Gram Panchayat – Chetpet block

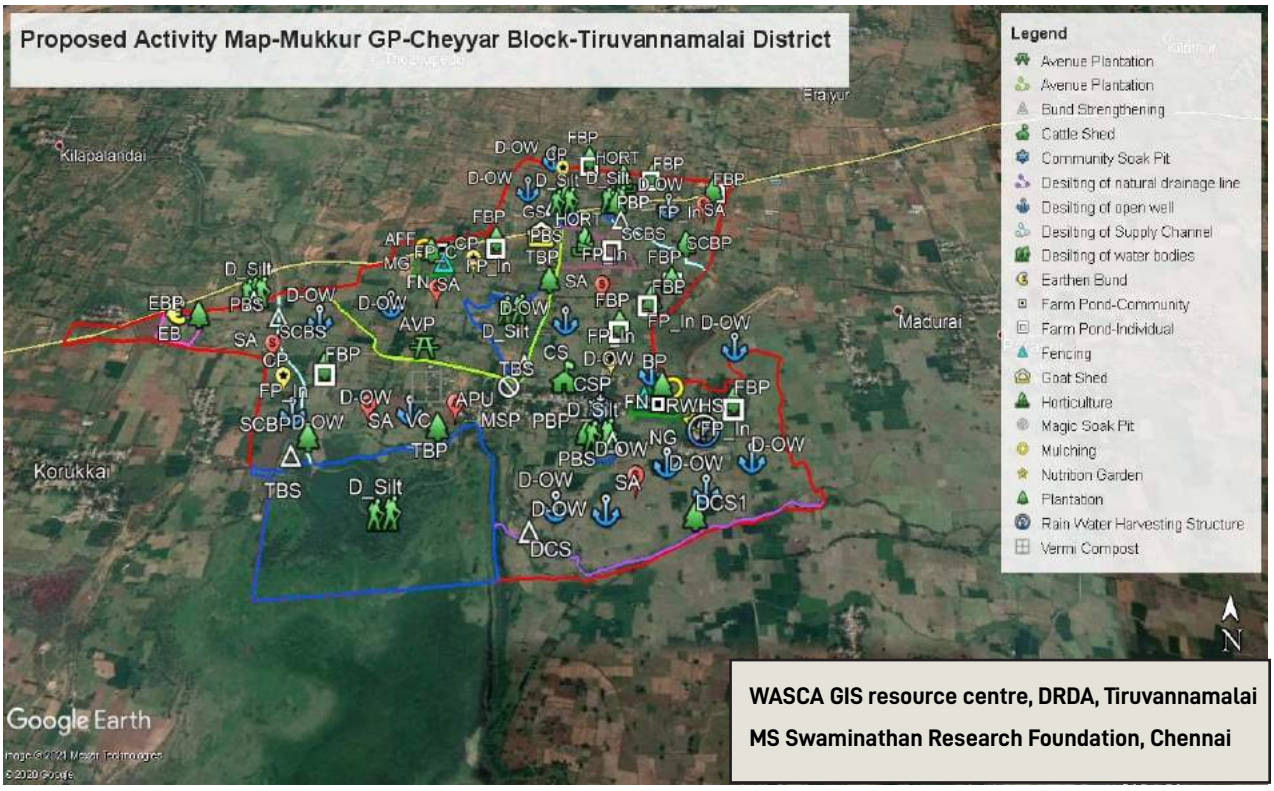




Enathavadi Gram Panchayat – Cheyyar block

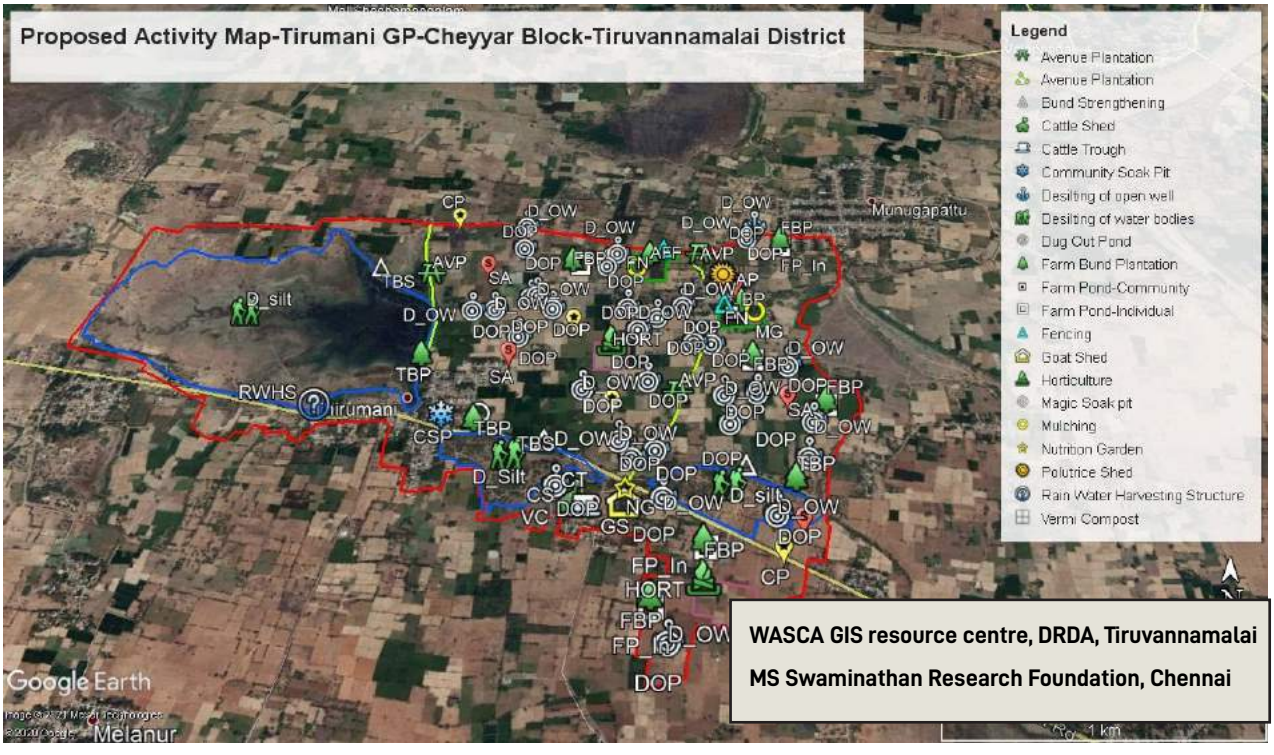
Kaduganur Gram Panchayat – Cheyyar block

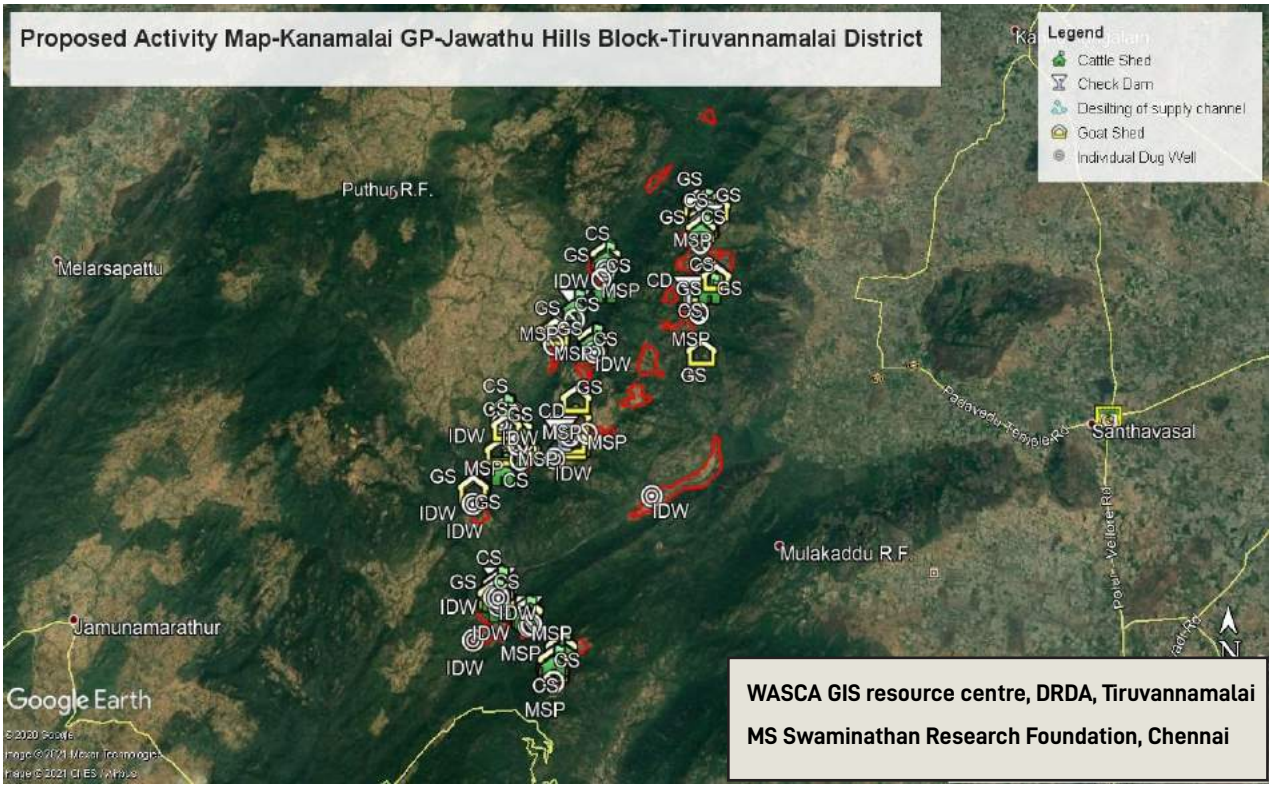




Mukkur Gram Panchayat – Cheyyar block

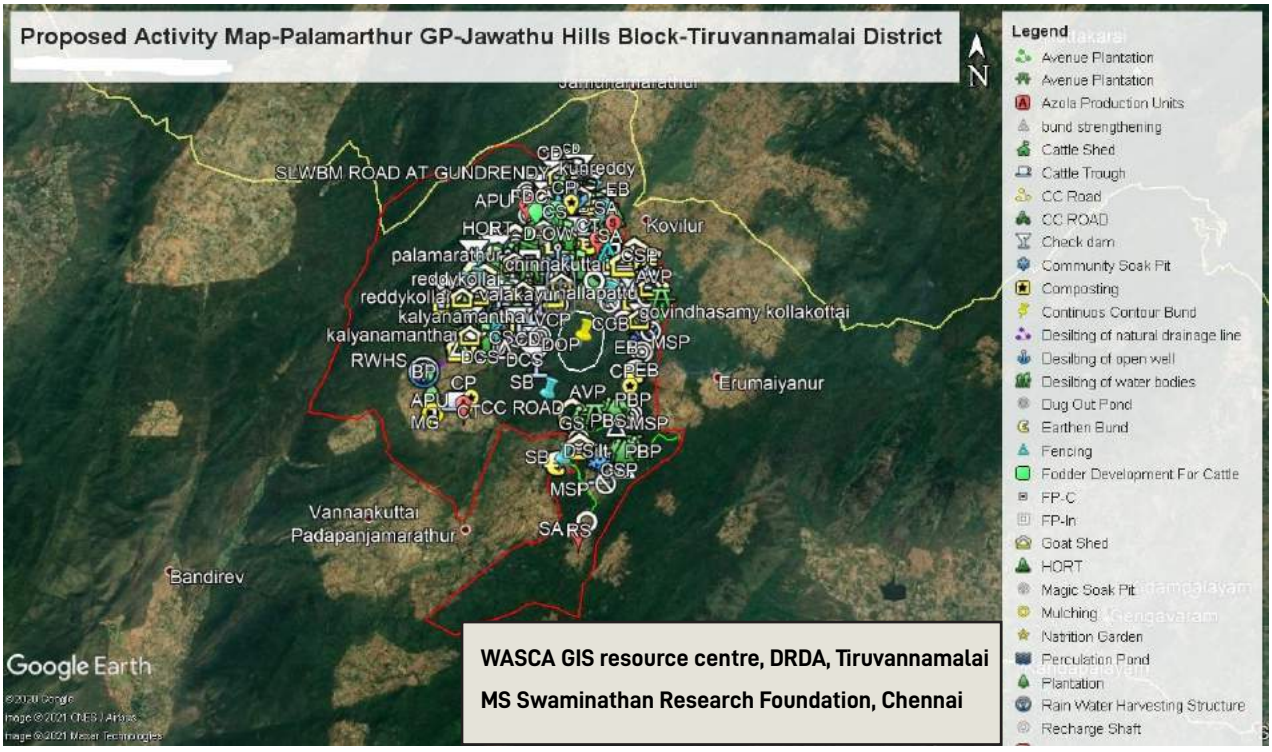
Tirumani Gram Panchayat – Cheyyar block

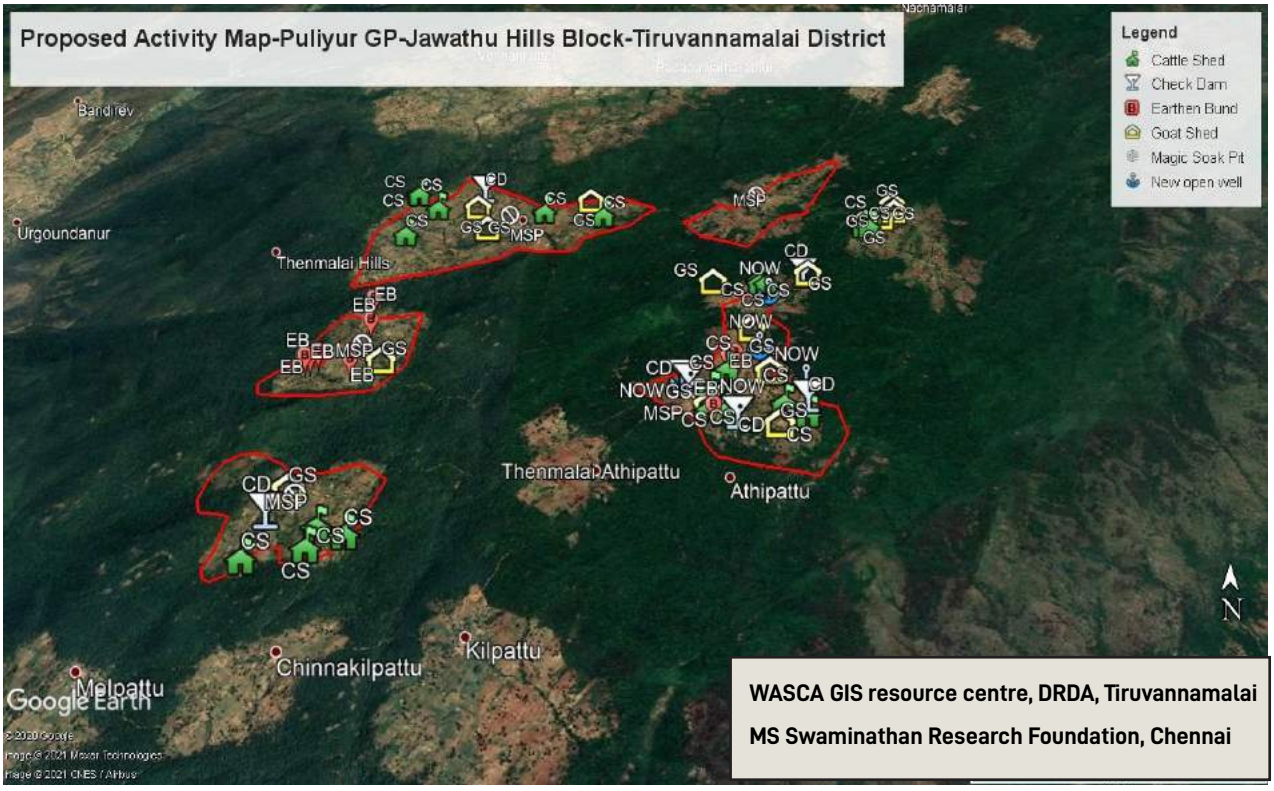




Kanamalai Gram Panchayat – Jawathu Hills block

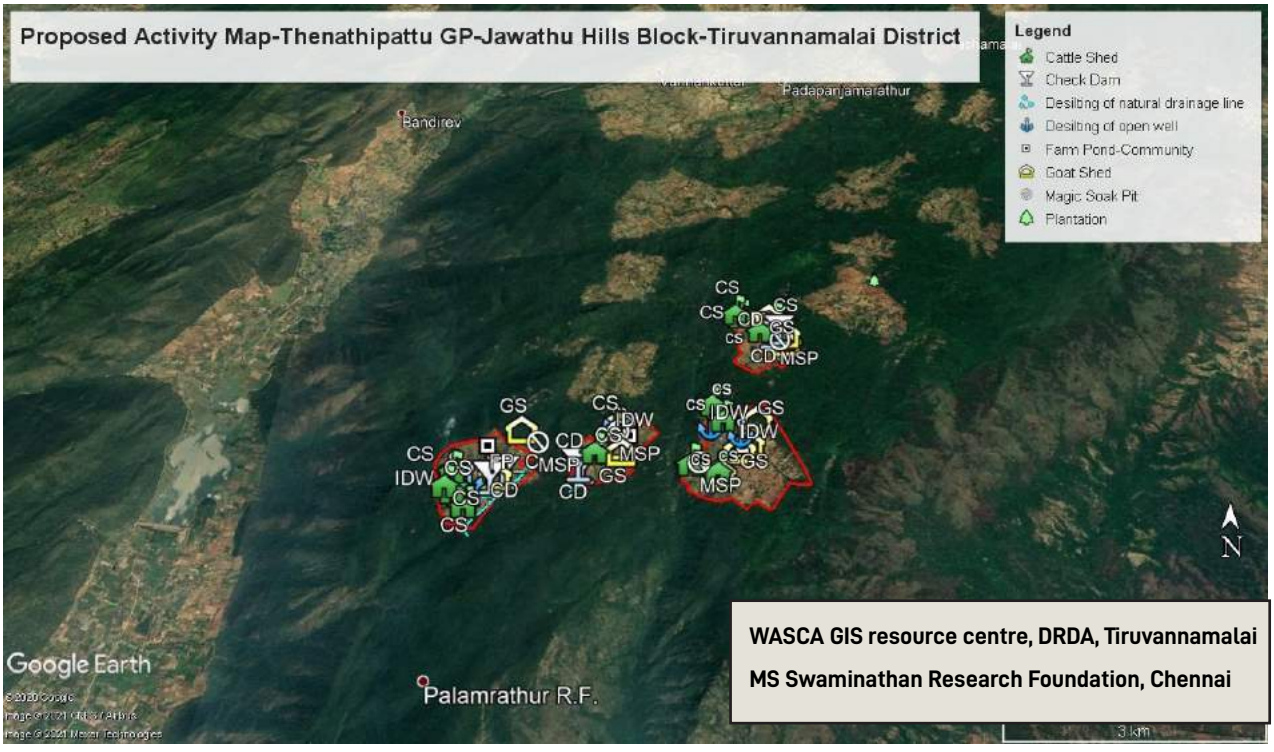
Palamarthur Gram Panchayat – Jawathu Hills block

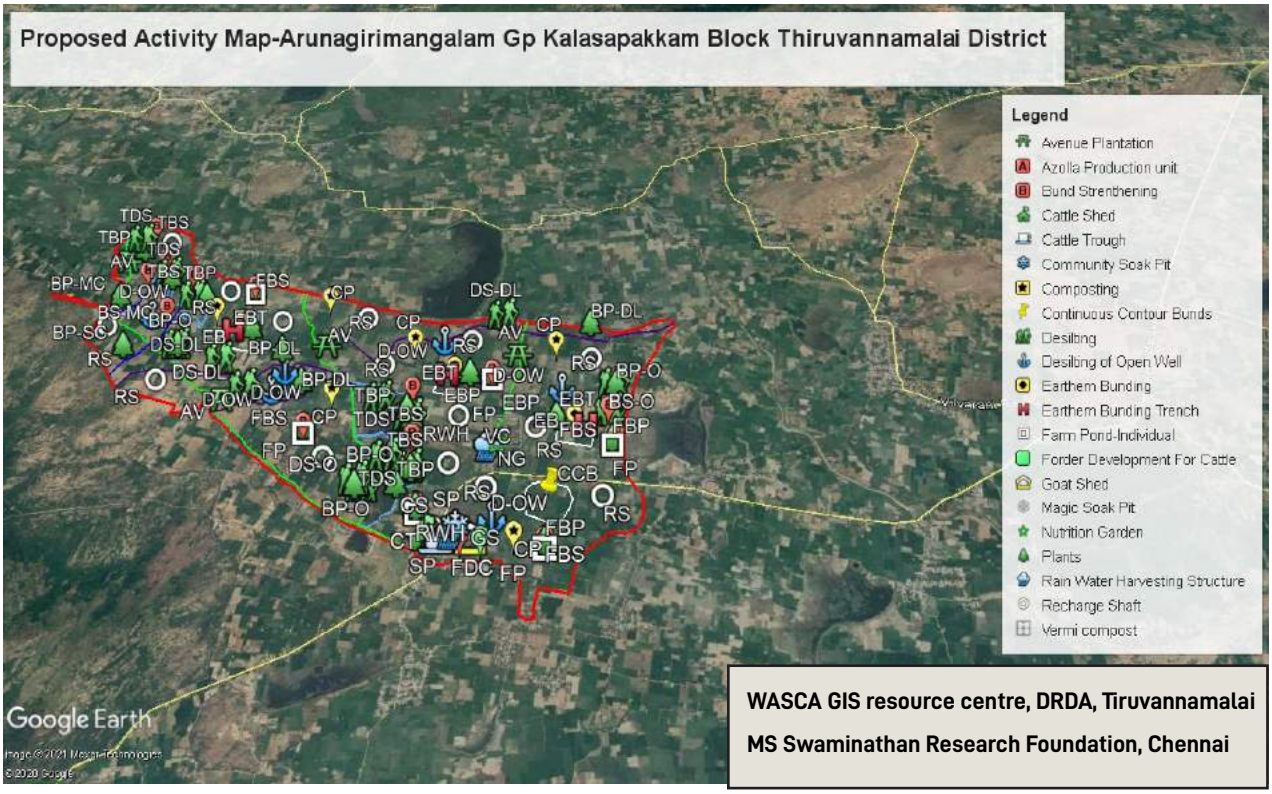




Puliyur Gram Panchayat – Jawathu Hills block

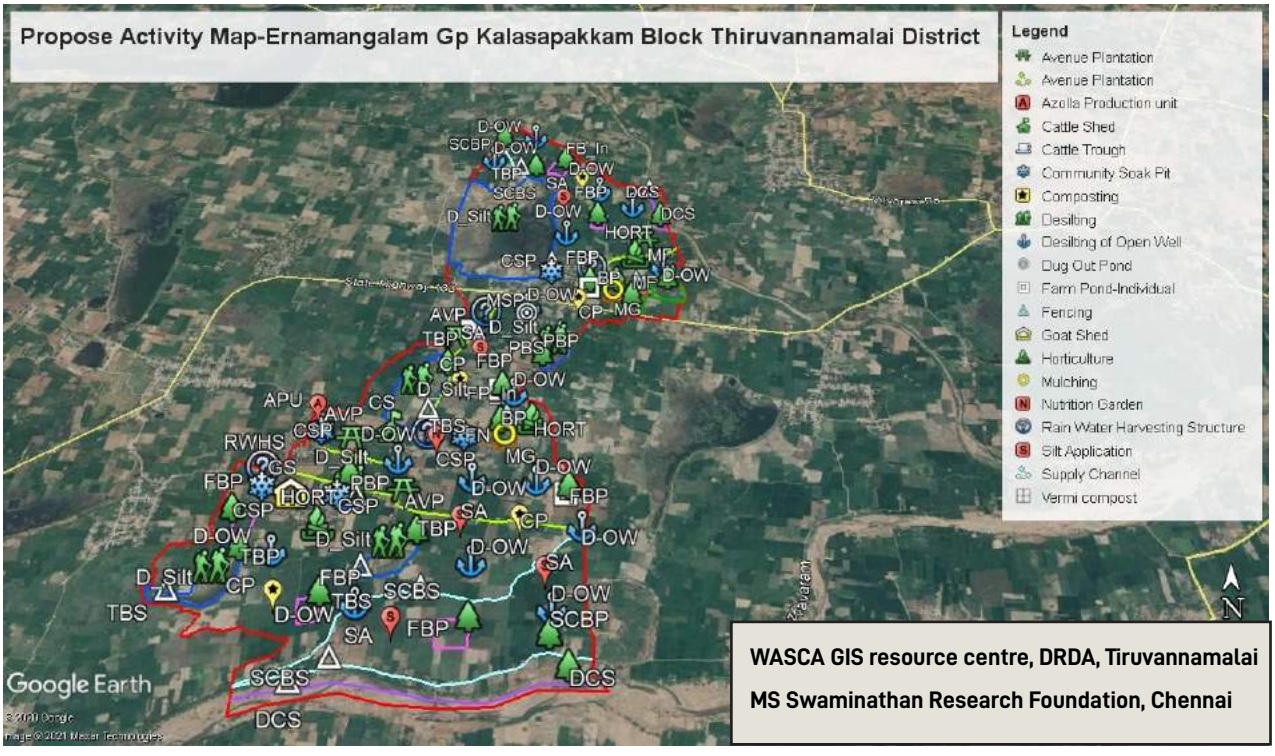
Thenathipattu Gram Panchayat – Jawathu Hills block

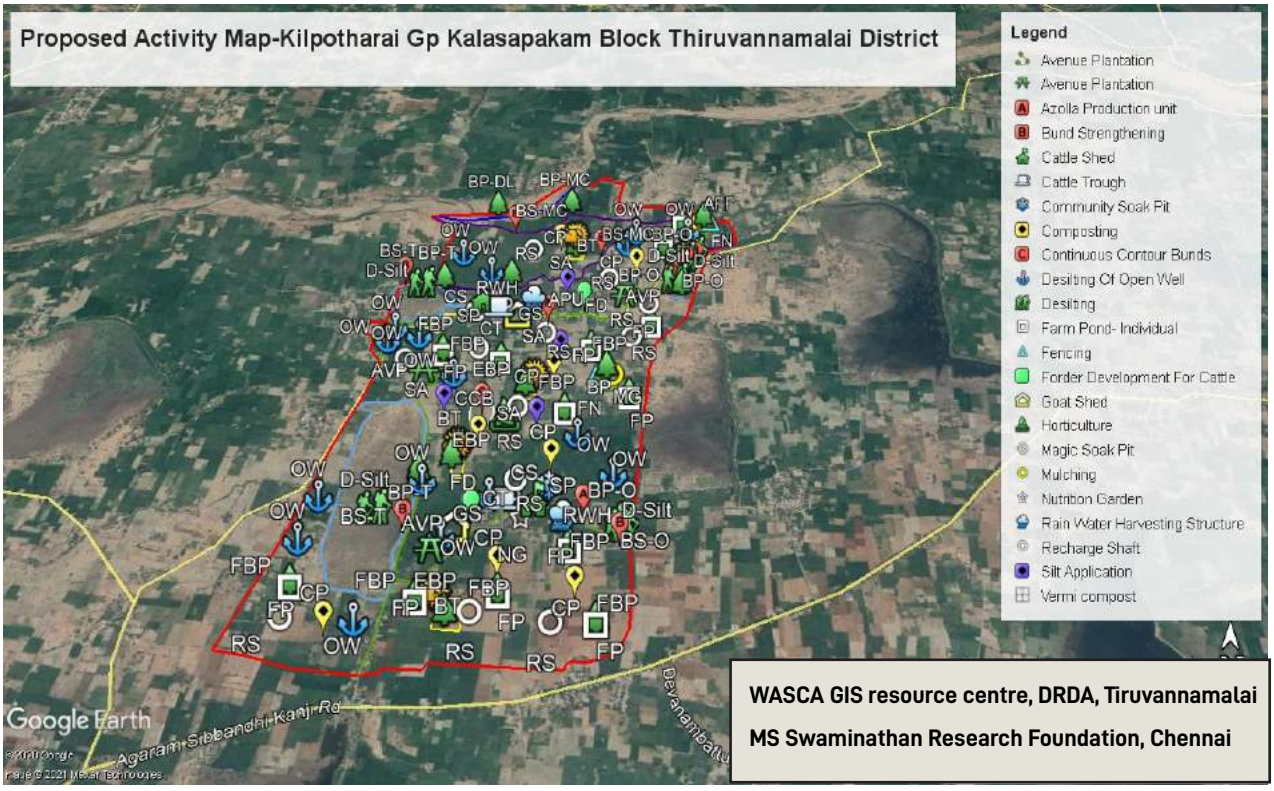




Arunagirimangalam Gram Panchayat – Kalasapakkam block

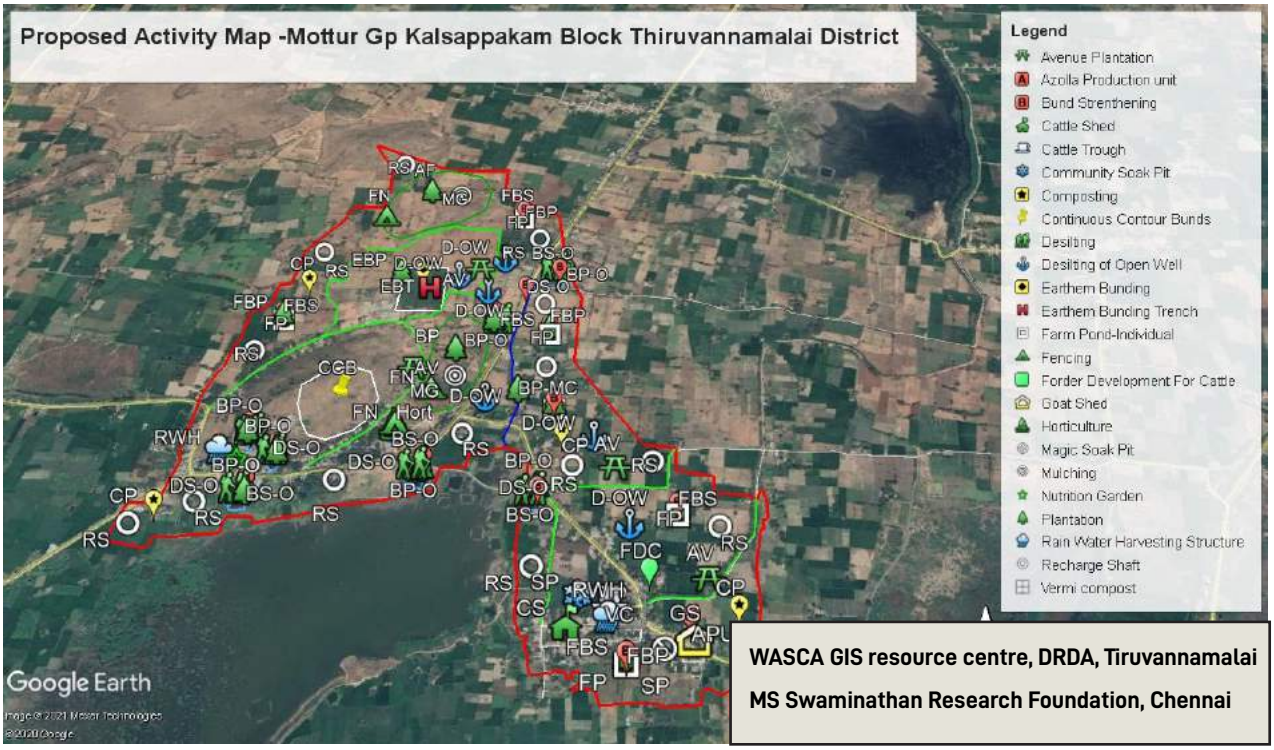
Ernamangalam Gram Panchayat – Kalasapakkam block

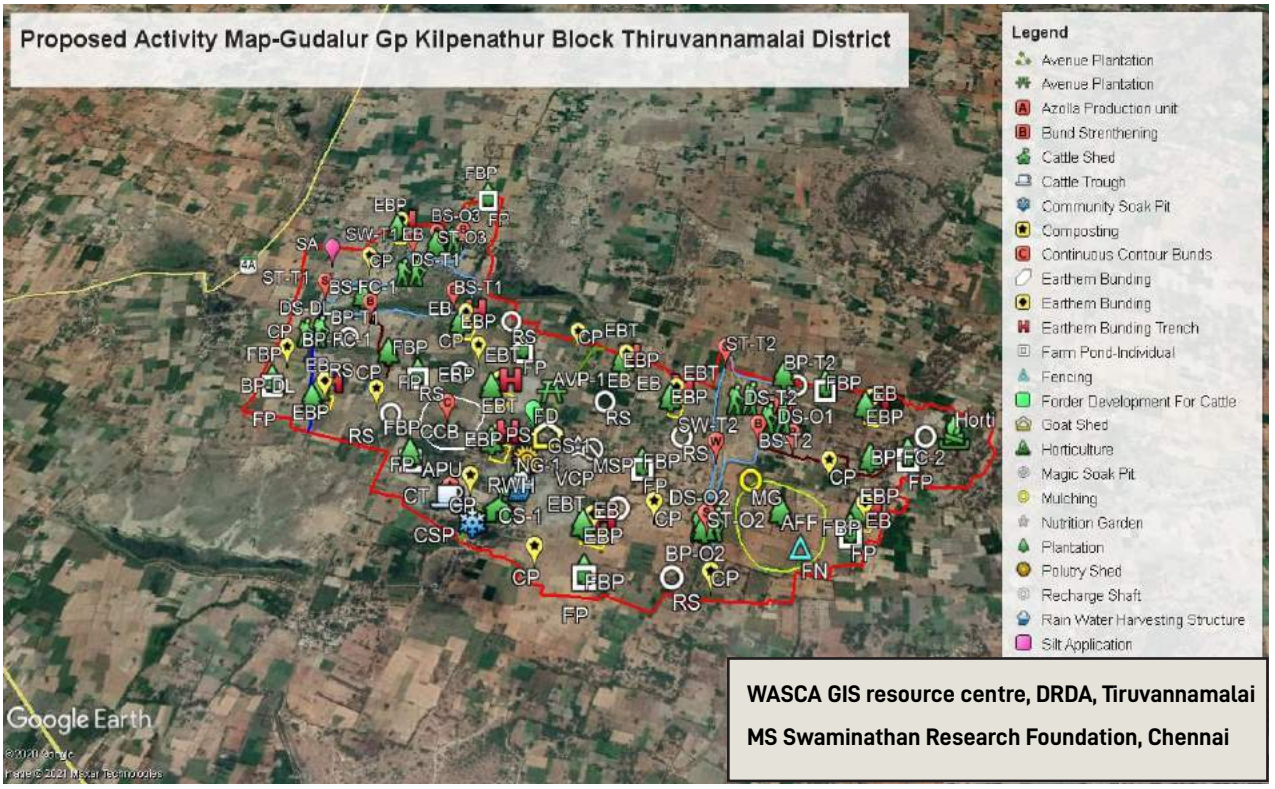




Kilpothari Gram Panchayat – Kalasapakkam block

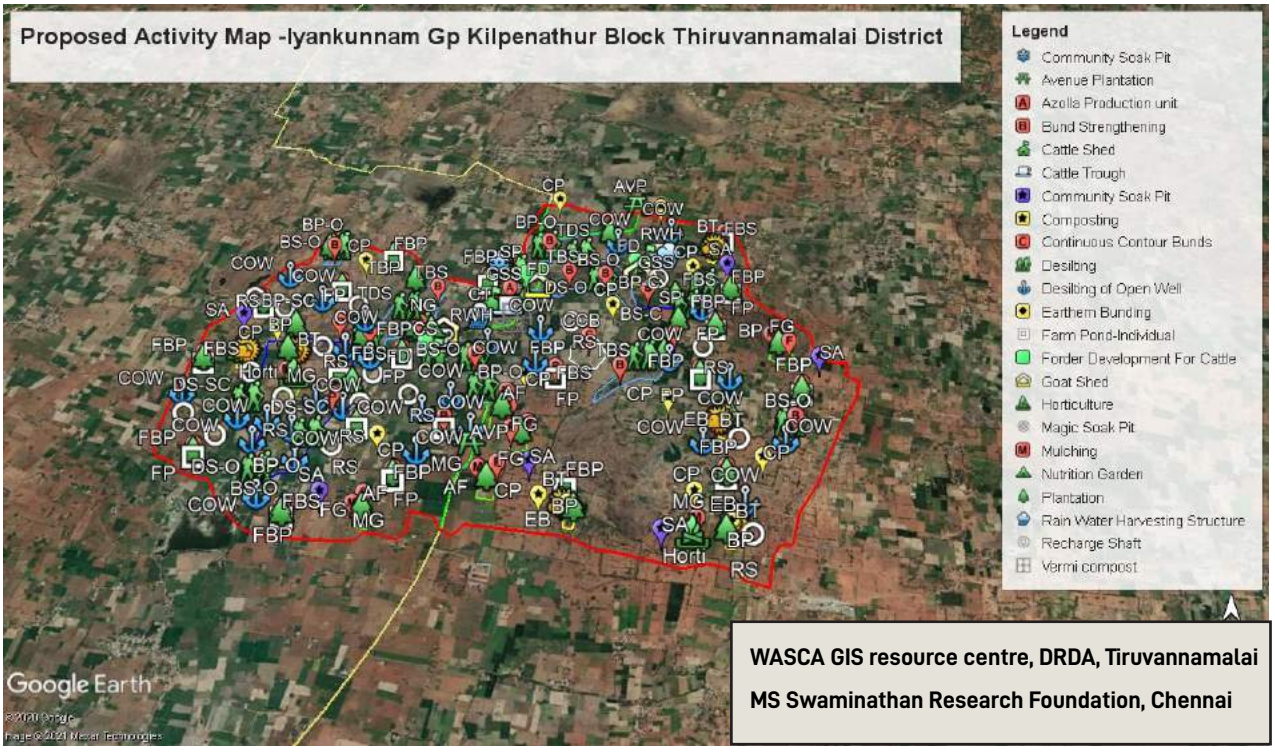
Mottur Gram Panchayat – Kalasapakkam block

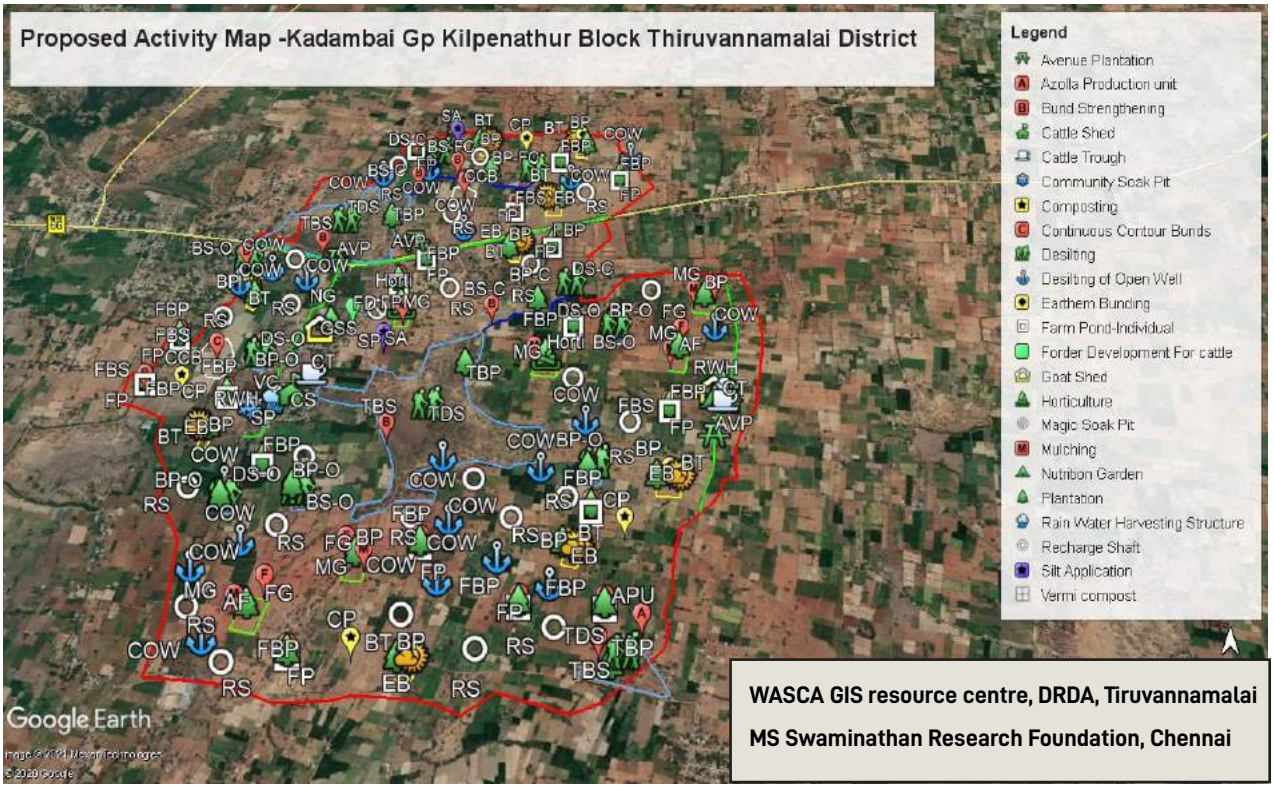




Gudalur Gram Panchayat – Kilpenathur block

Iyankunnam Gram Panchayat – Kilpenathur block





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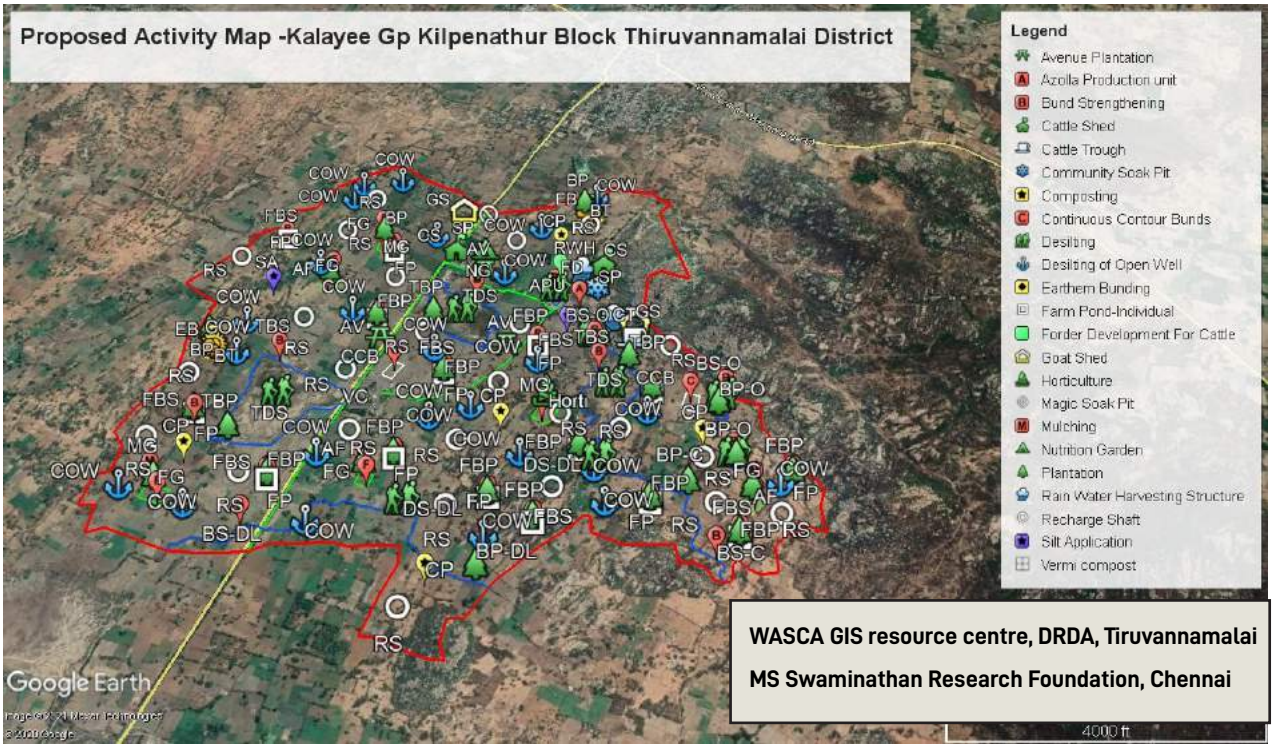
Kadambai Gram Panchayat – Kilpenathur block

Kalayee Gram Panchayat – Kilpenathur block



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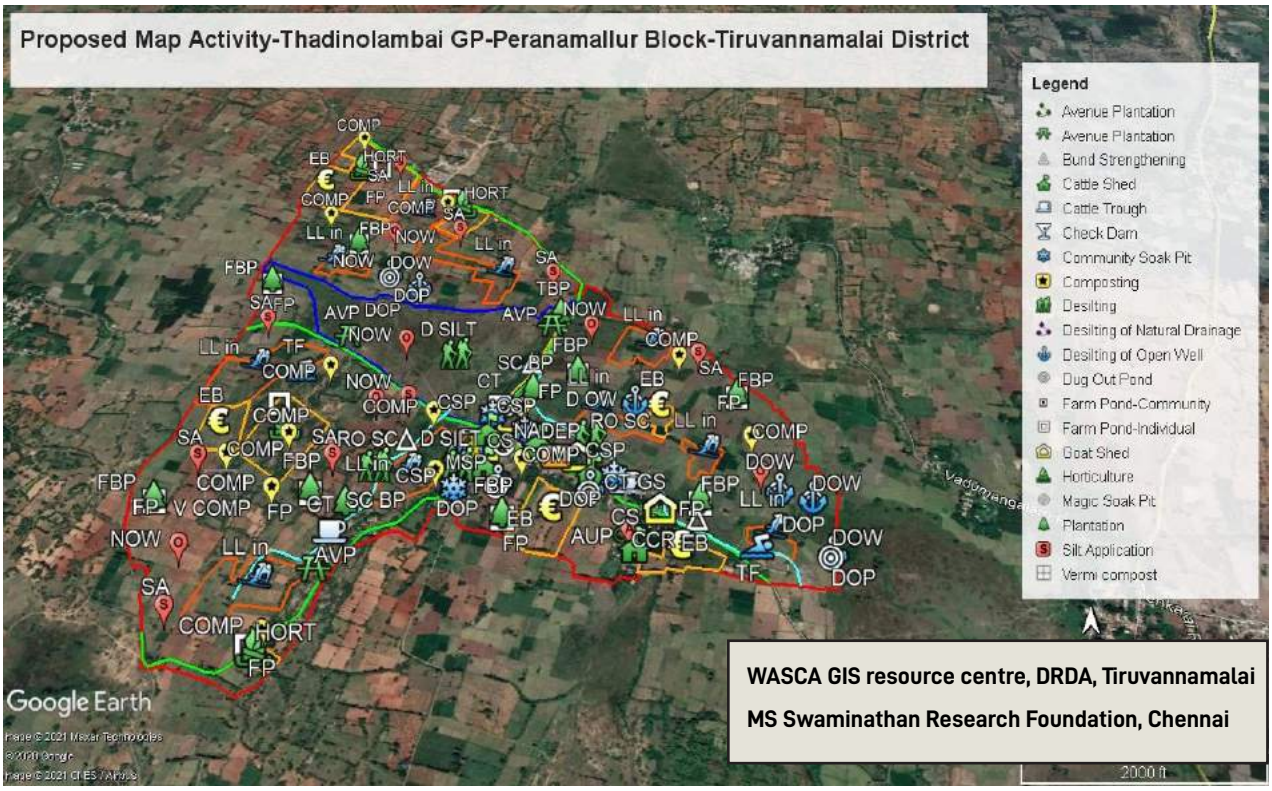
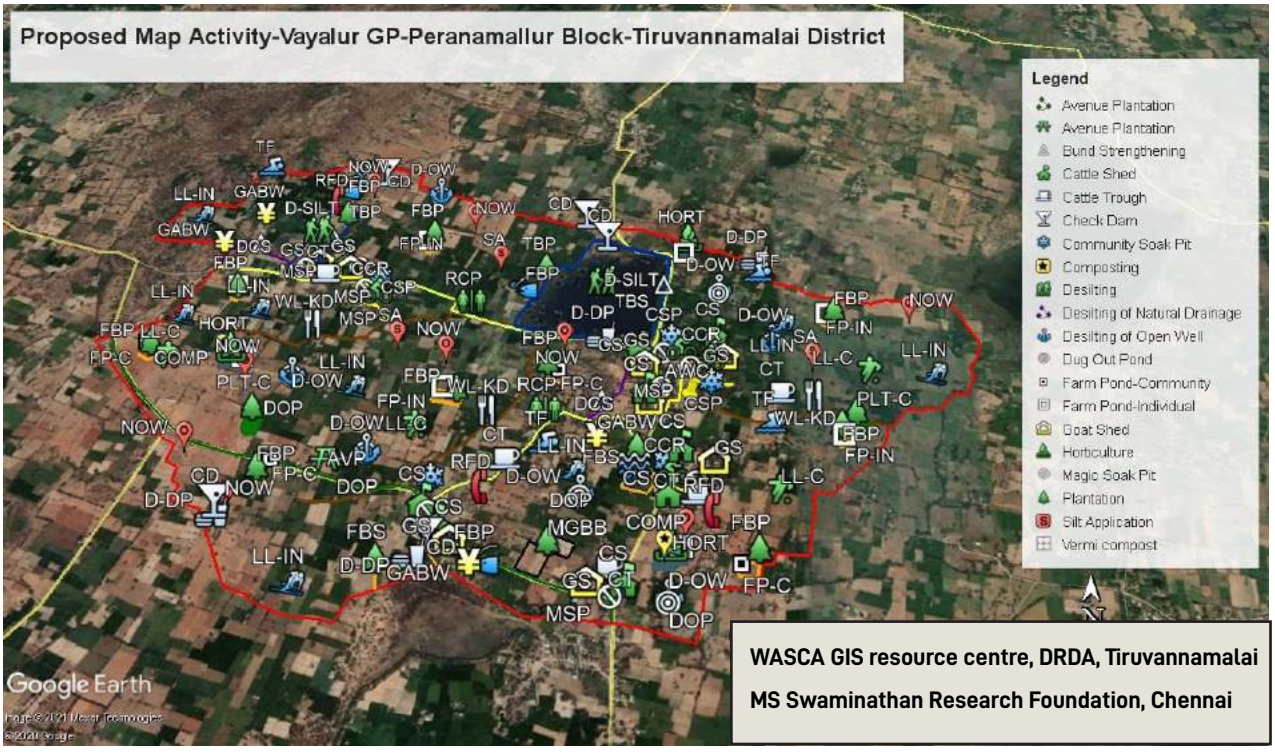
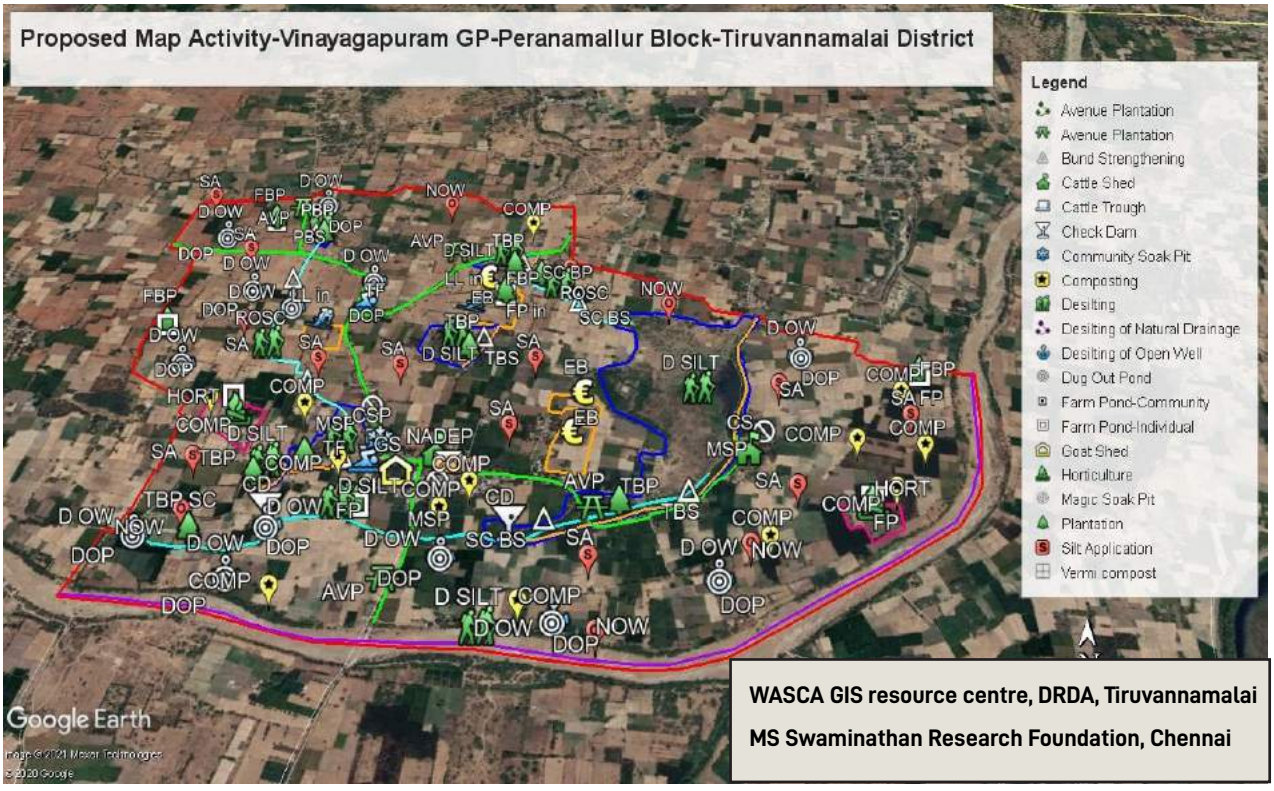


Thadinolambai Gram Panchayat – Pernamallur block

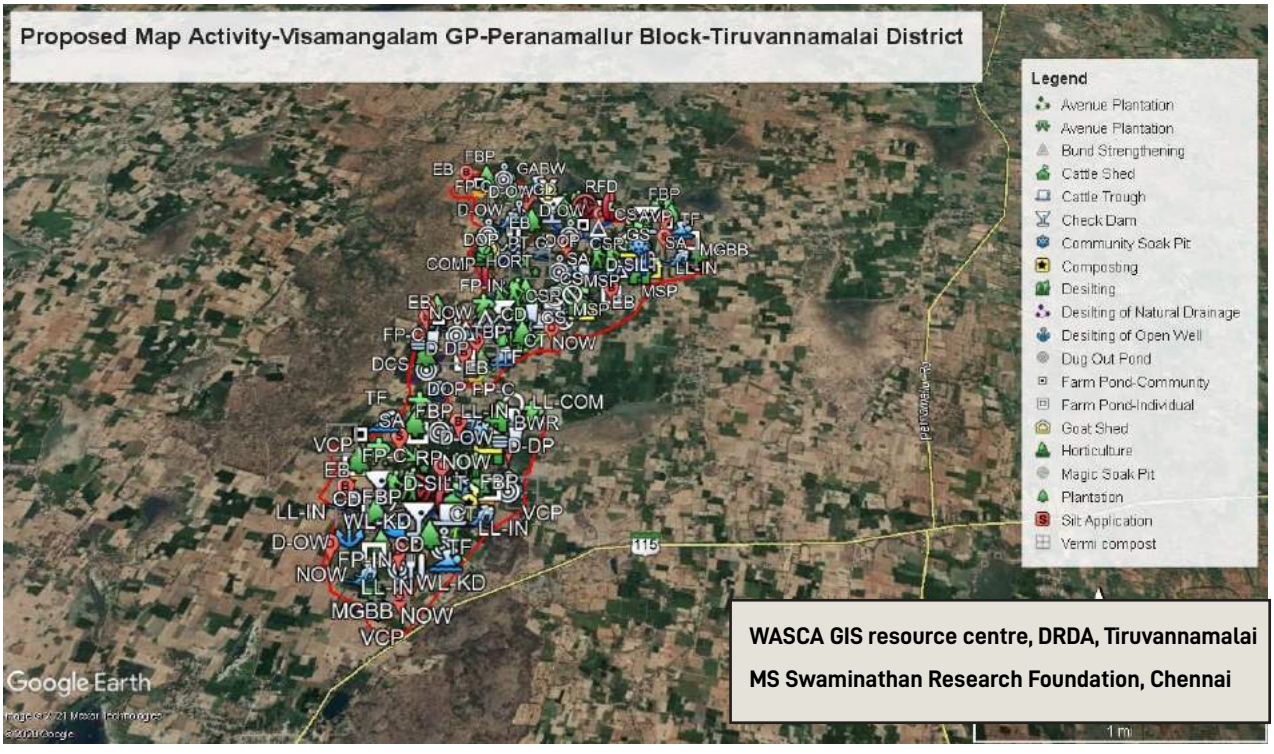
Vayalur Gram Panchayat – Pernamallur block

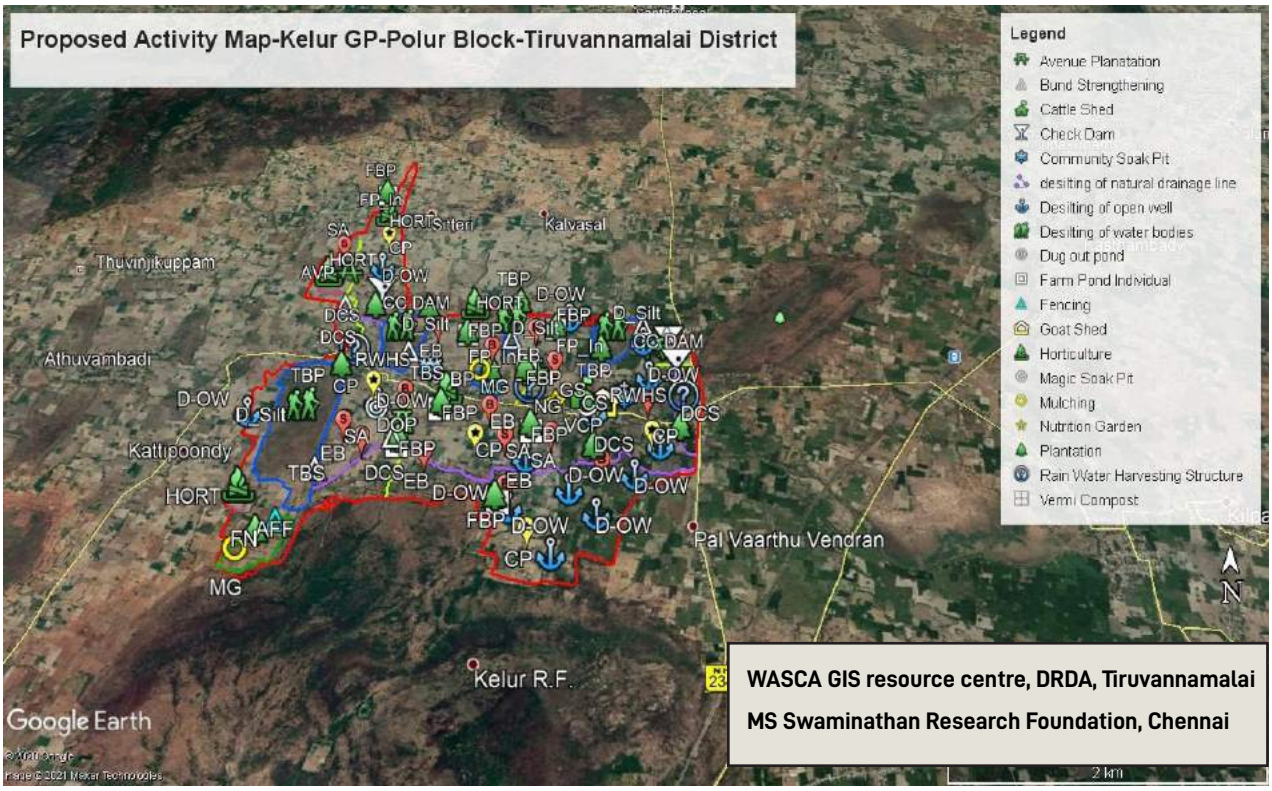




Vinayagapuram Gram Panchayat – Pernamallur block

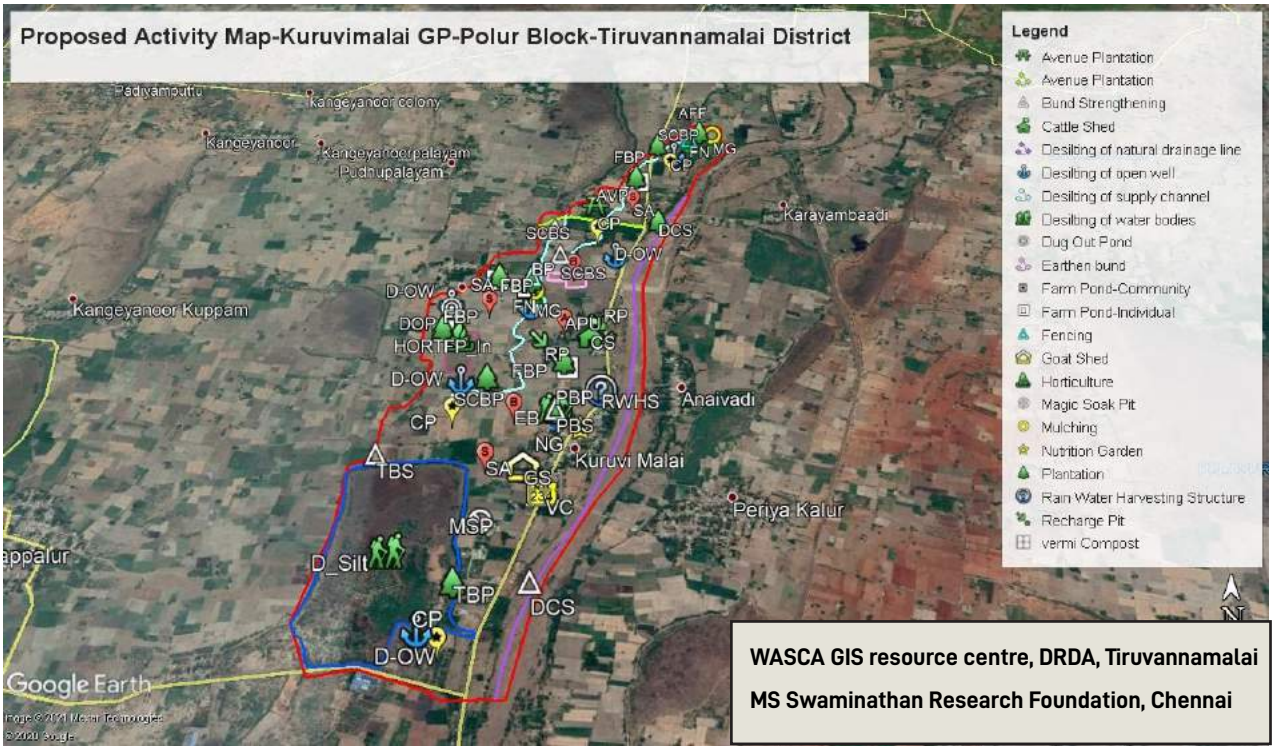
Visamangalam Gram Panchayat – Pernamallur block

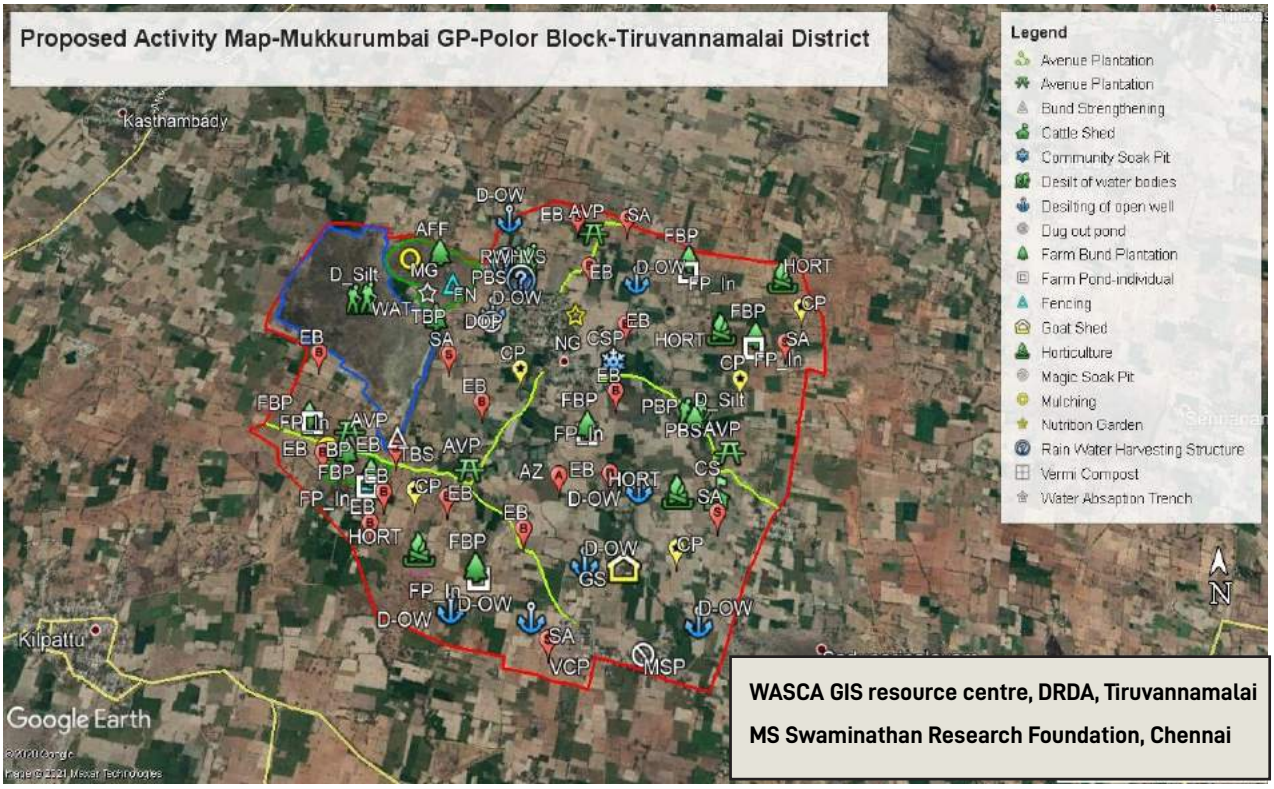




Kelur Gram Panchayat – Polur block

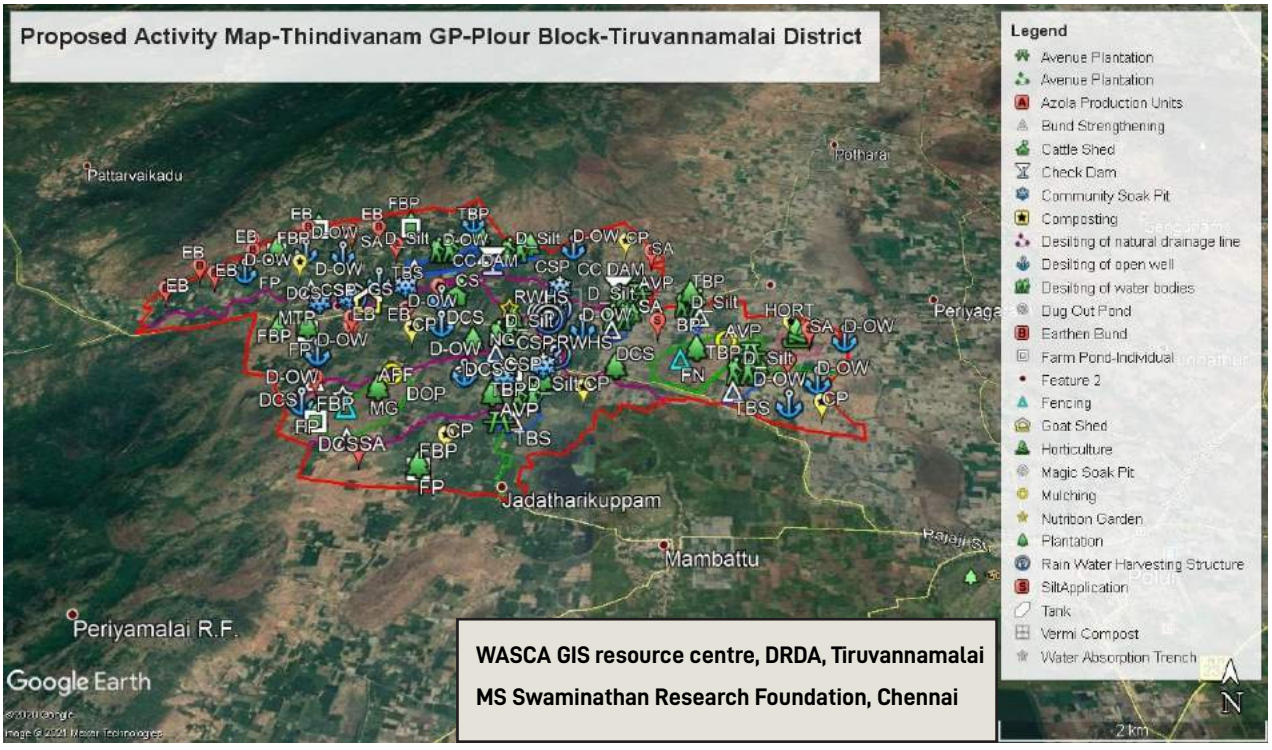
Kuruvimalai Gram Panchayat – Polur block

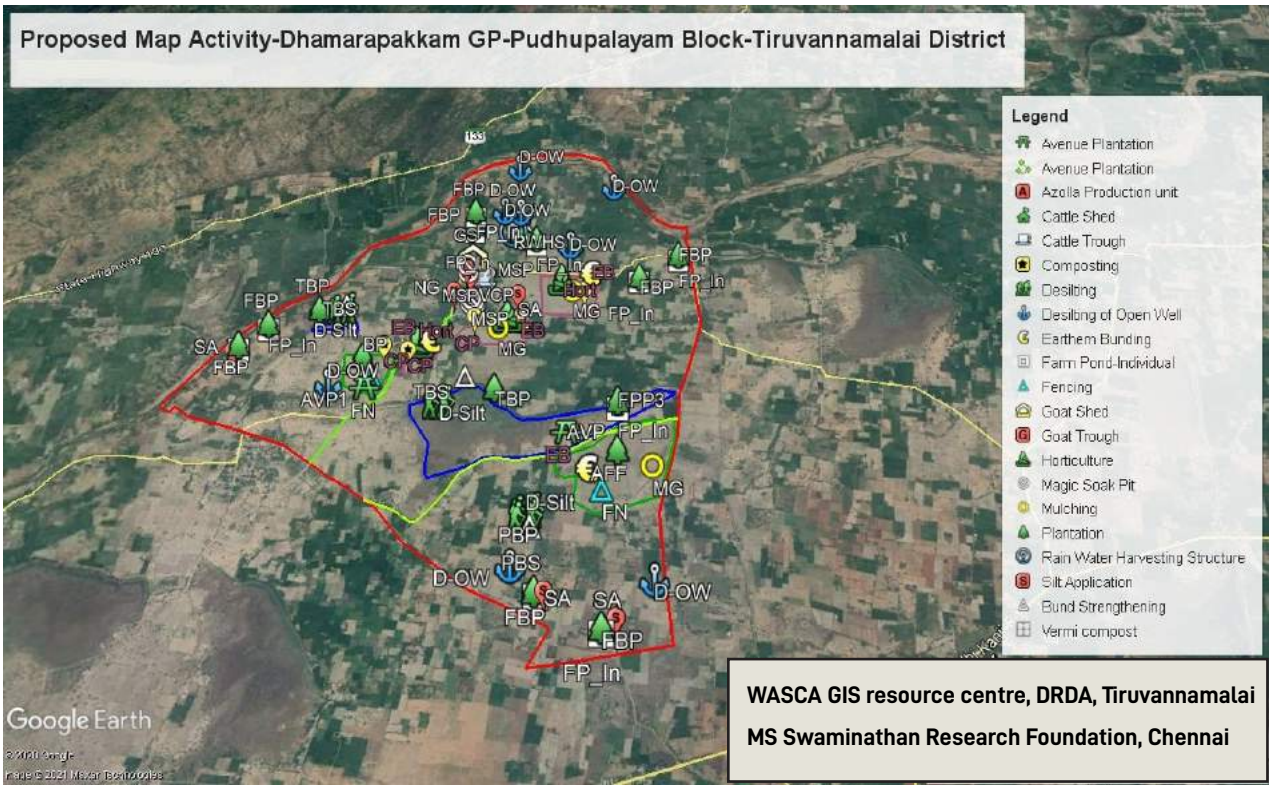




Mukkurumbai Gram Panchayat – Polur block

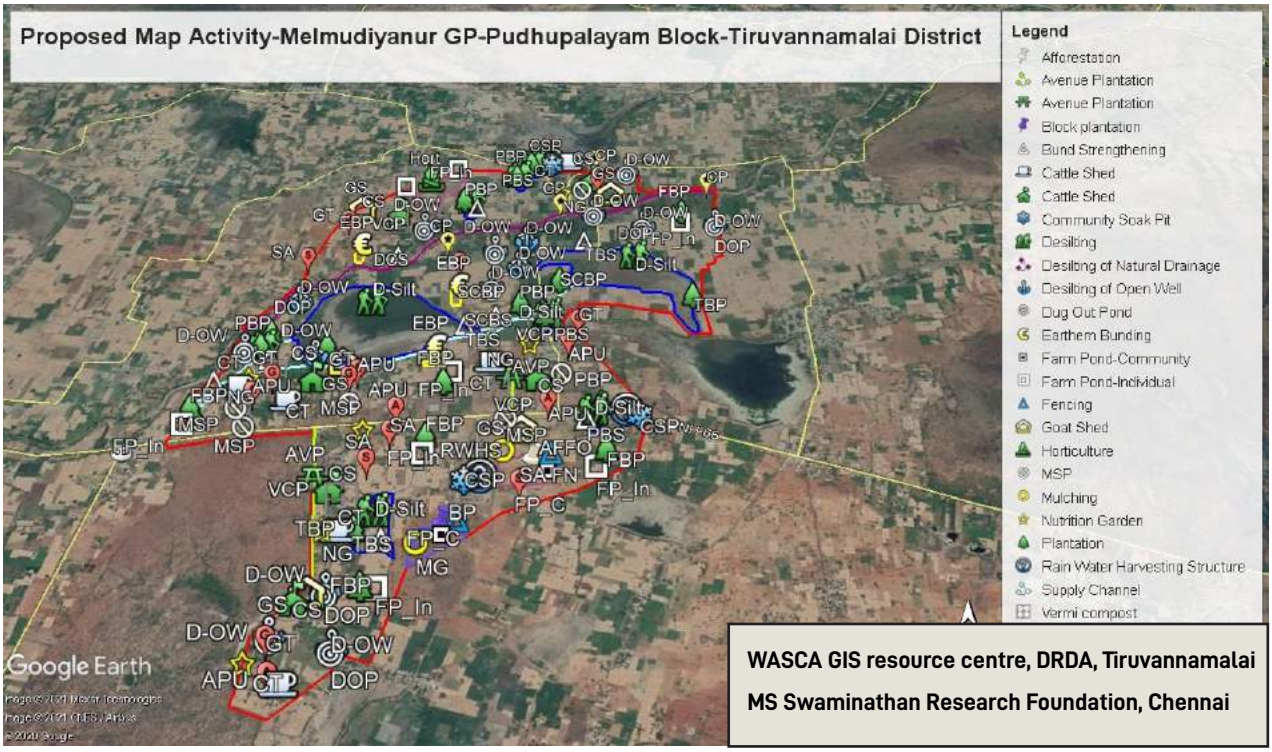
Thindivanam Gram Panchayat – Polur block

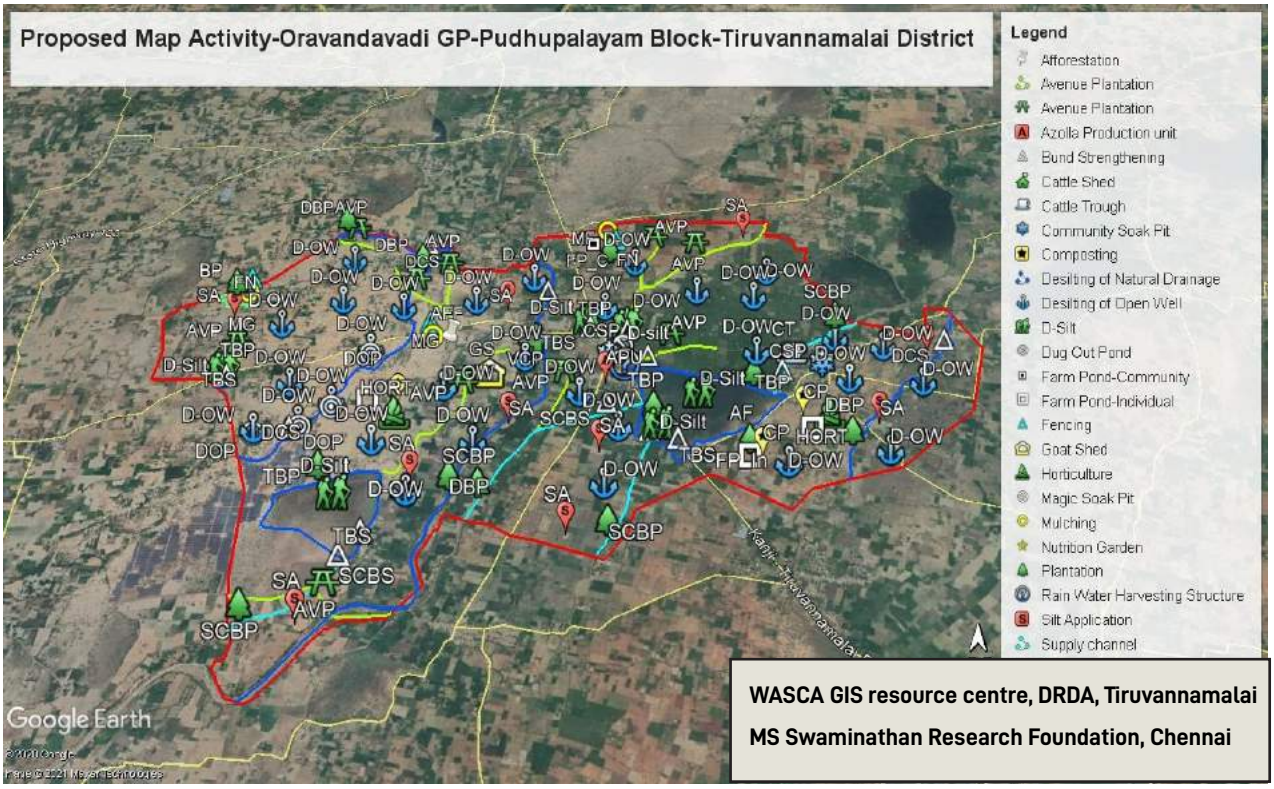




Dhamarapakkam Gram Panchayat – Pudupalayam block

Melmudiyanur Gram Panchayat – Pudupalayam block





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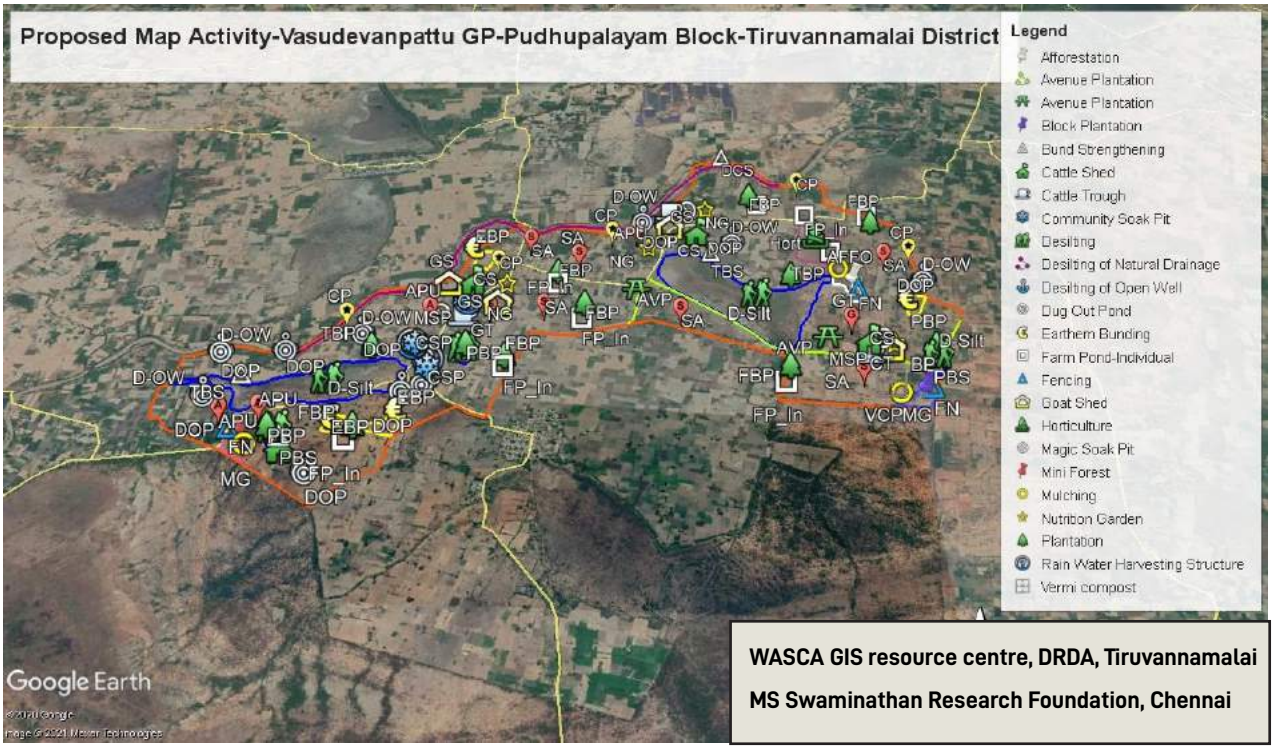
Oravandavadi Gram Panchayat – Pudupalayam block

Vasudevanpattu Gram Panchayat – Pudupalayam block



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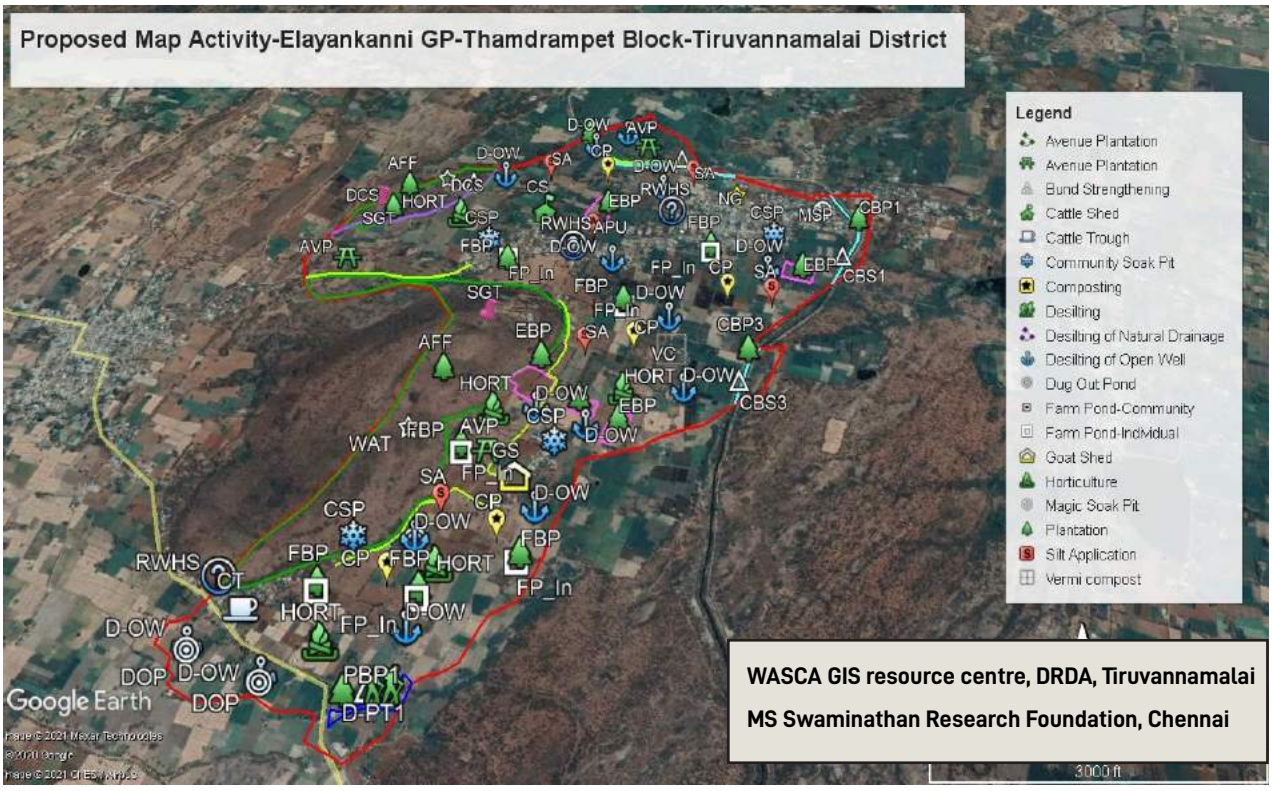
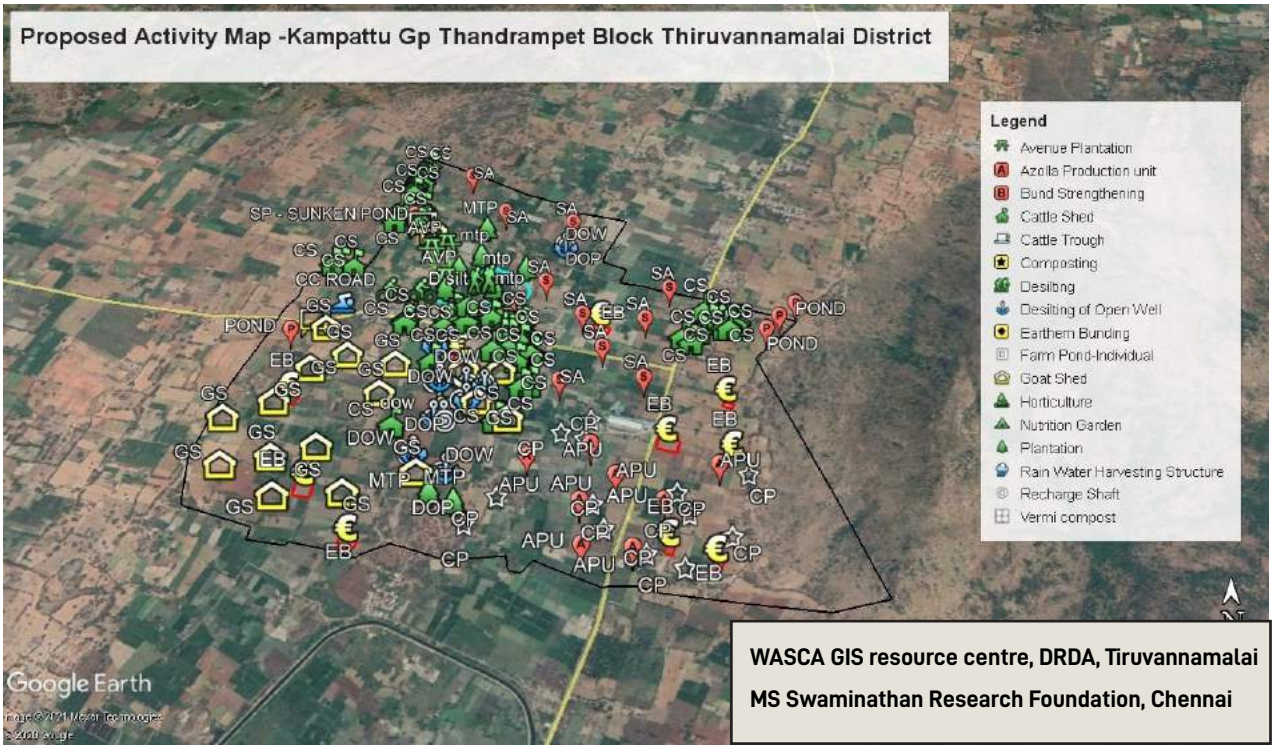
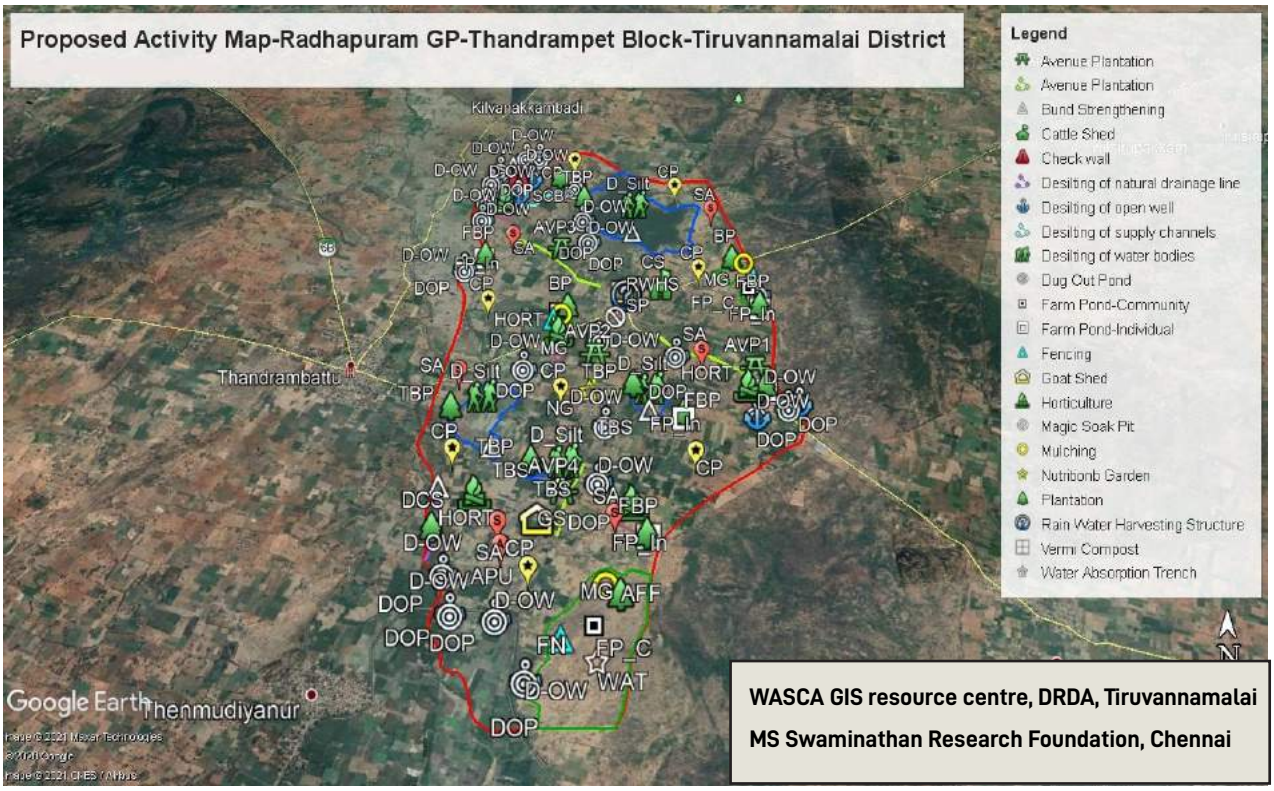


Elayankanni Gram Panchayat – Thandrampet block

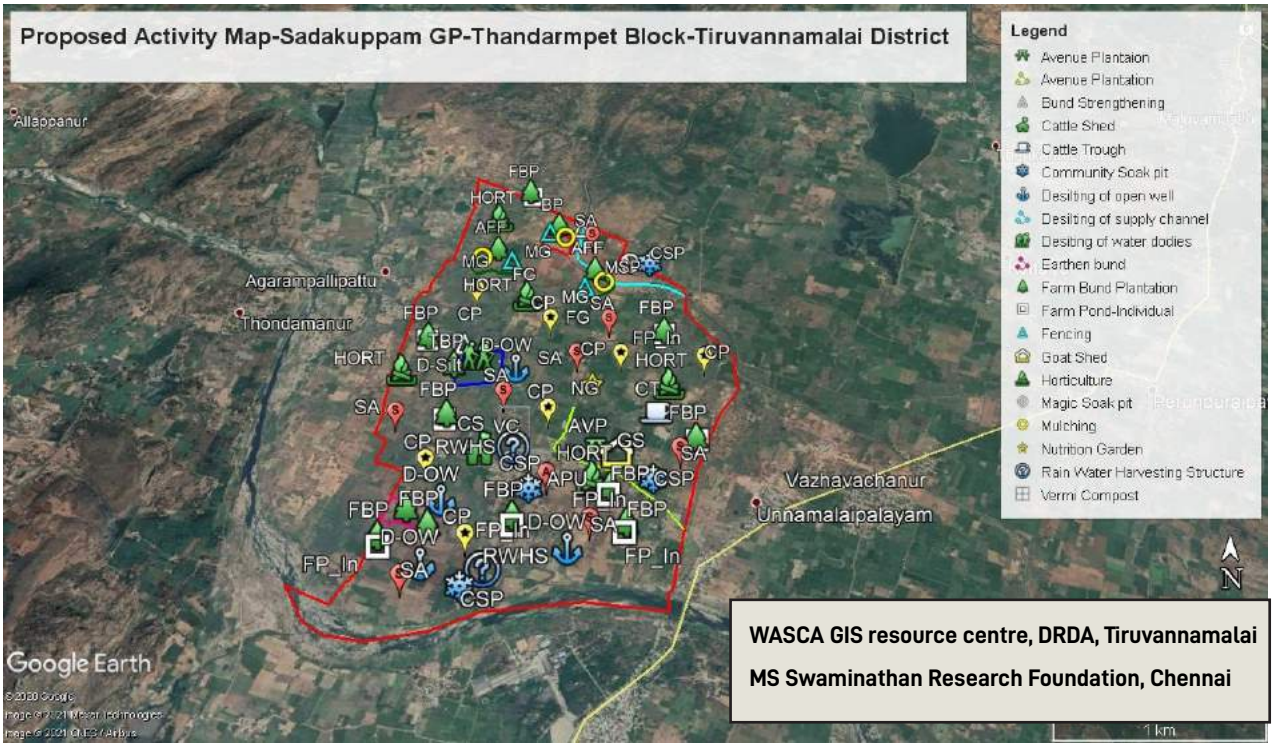
Kampattu Gram Panchayat – Thandrampet block

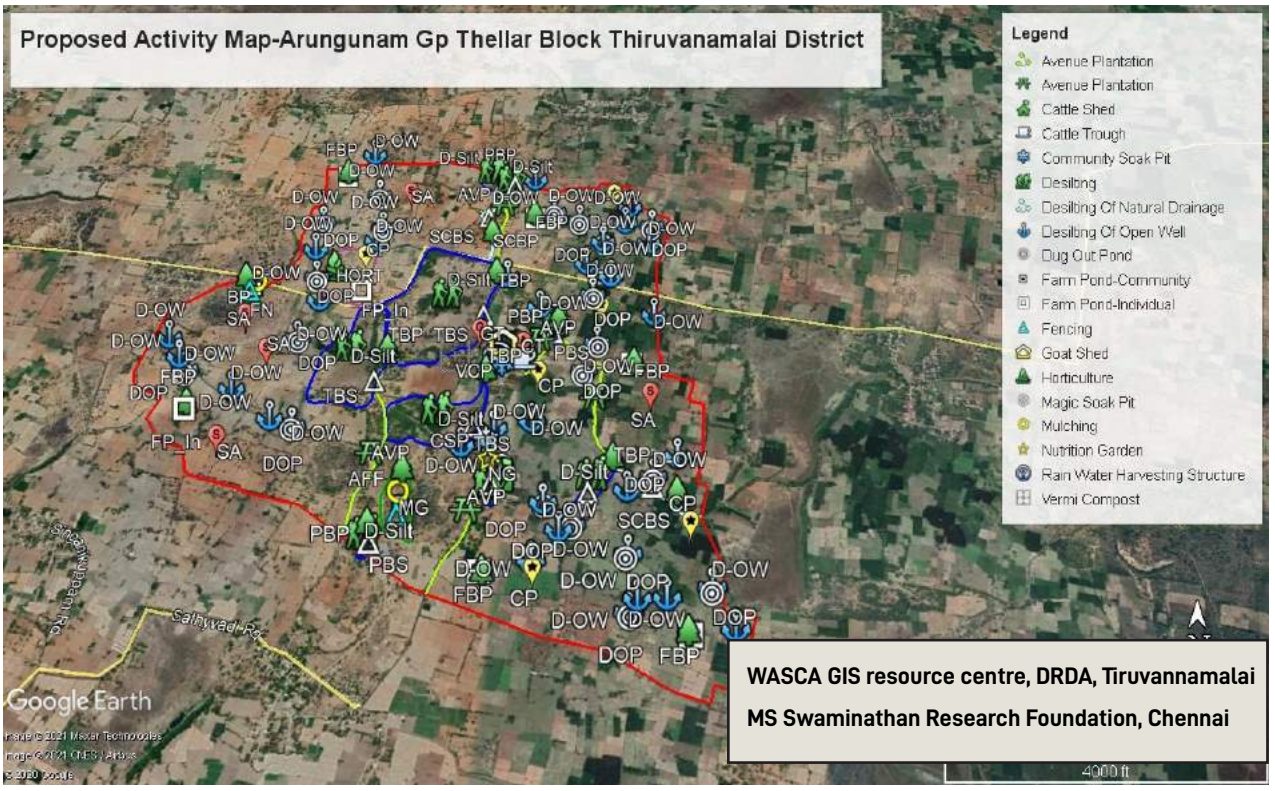




Radhapuram Gram Panchayat – Thandrampet block

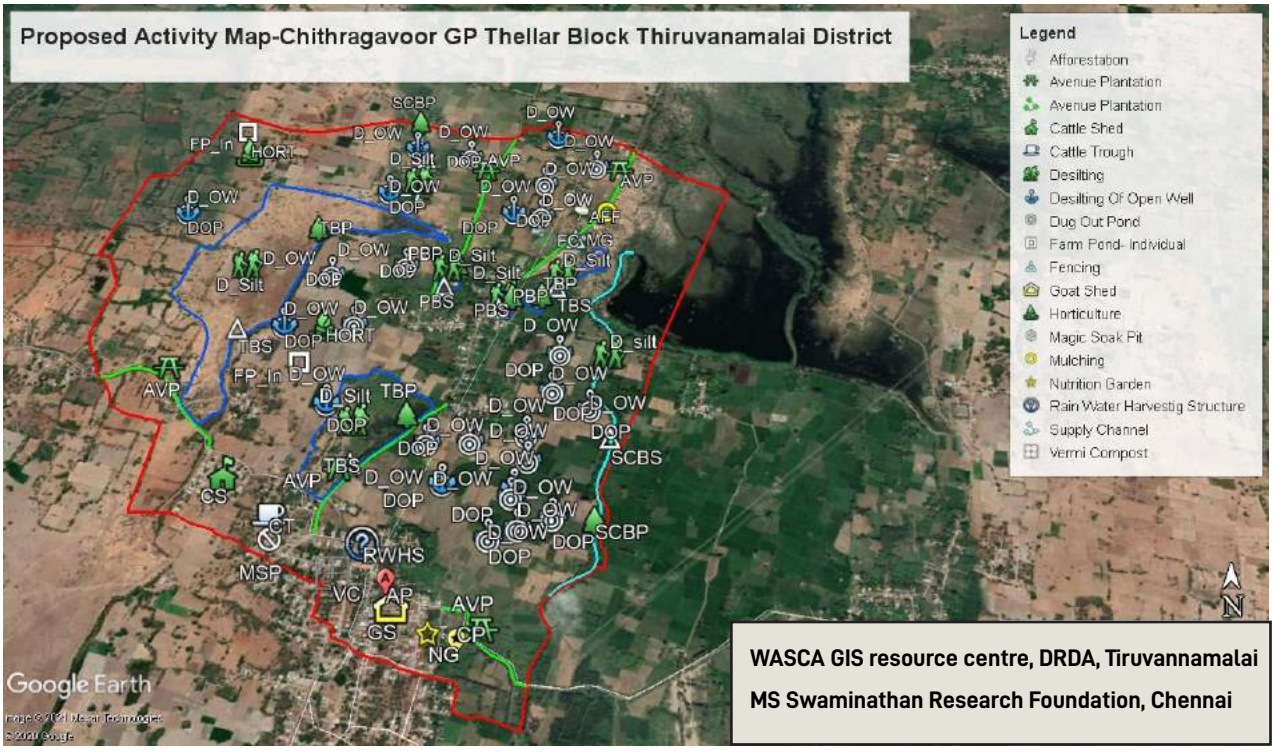
Sadakuppam Gram Panchayat – Thandrampet block

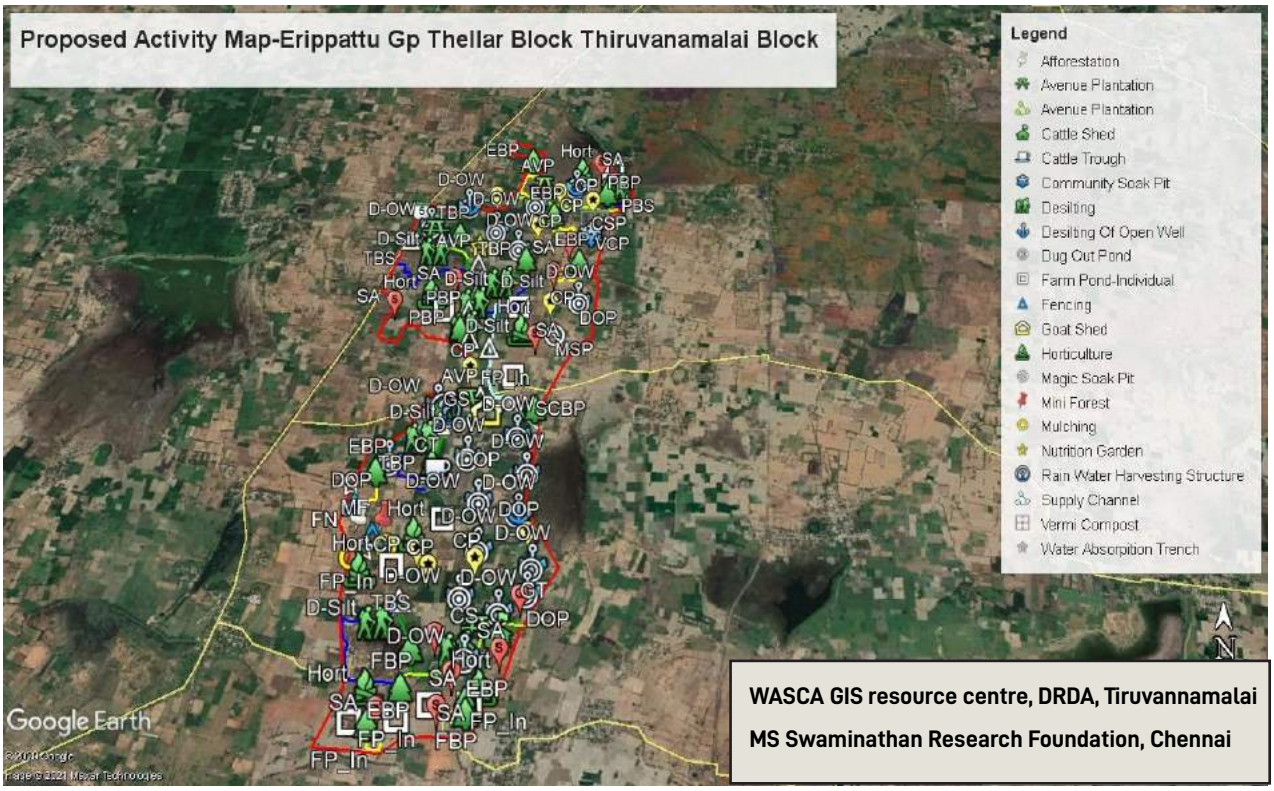




Arungunam Gram Panchayat – Thellar block

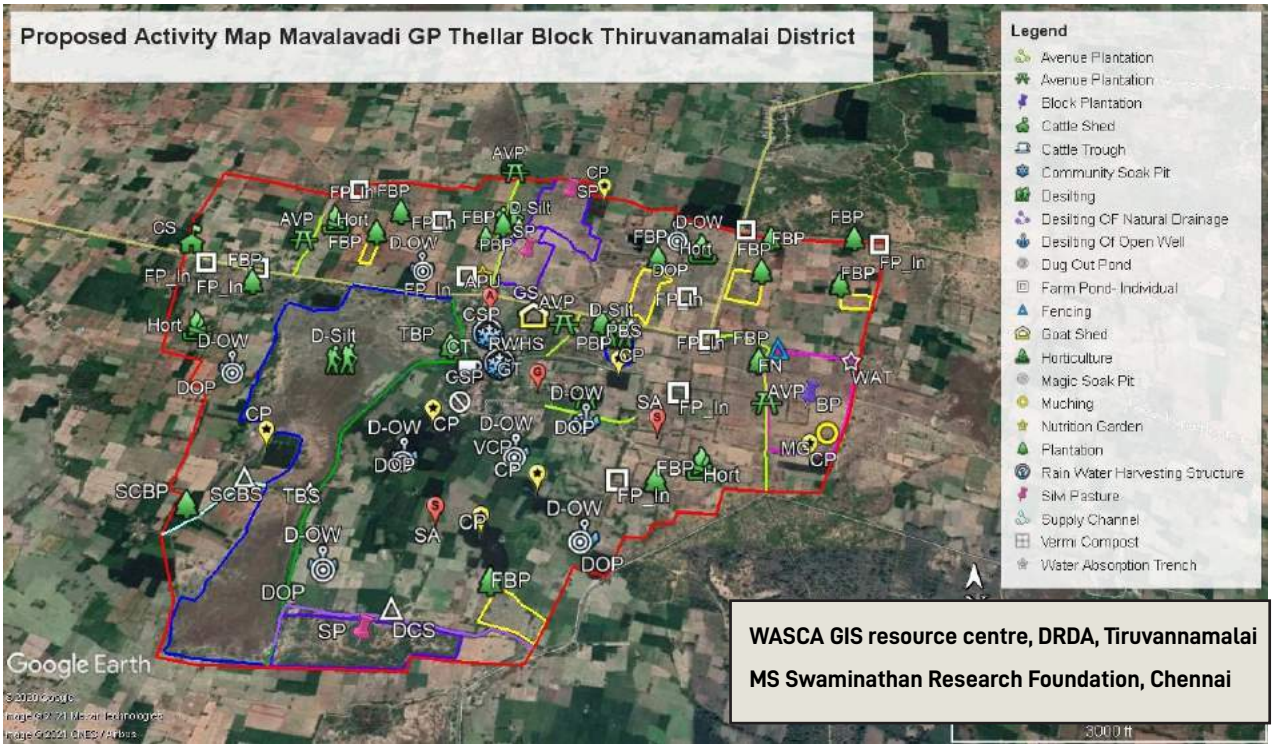
Chithragavoor Gram Panchayat – Thellar block

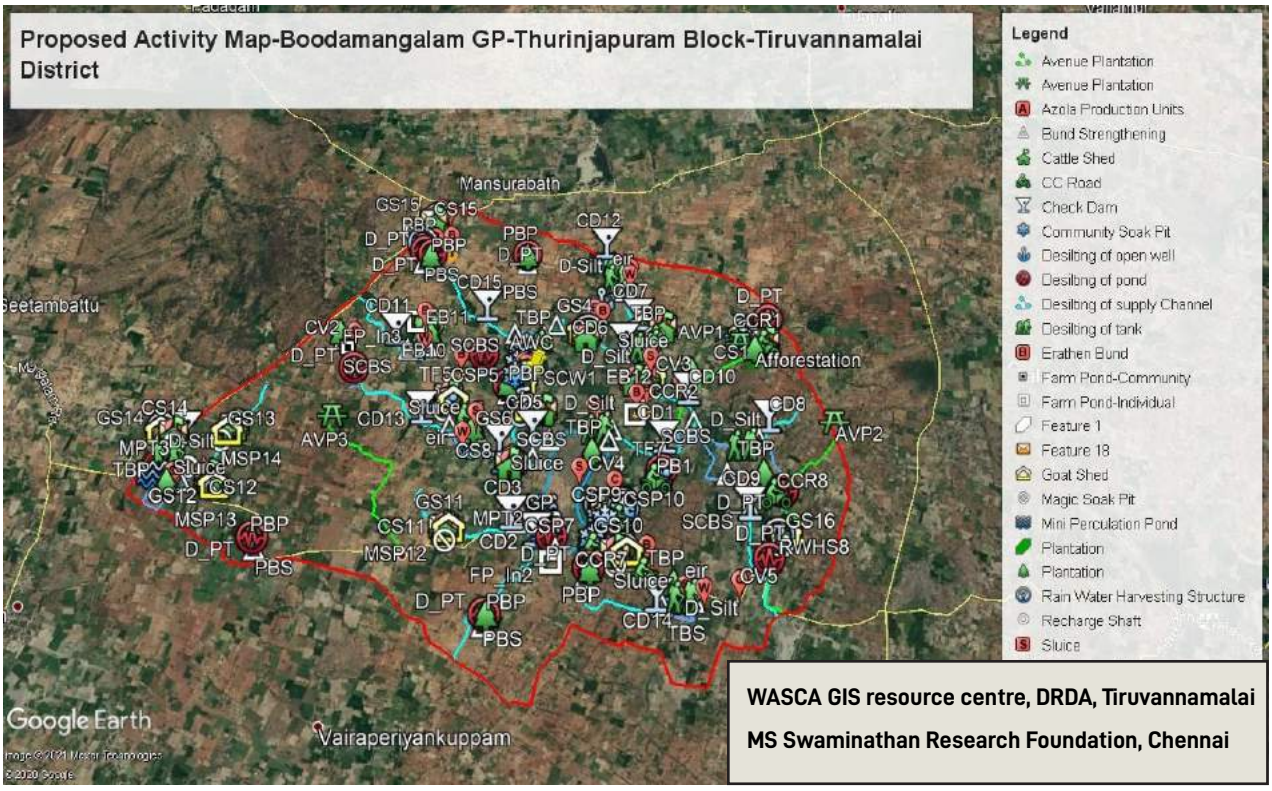




Eripattu Gram Panchayat – Thellar block

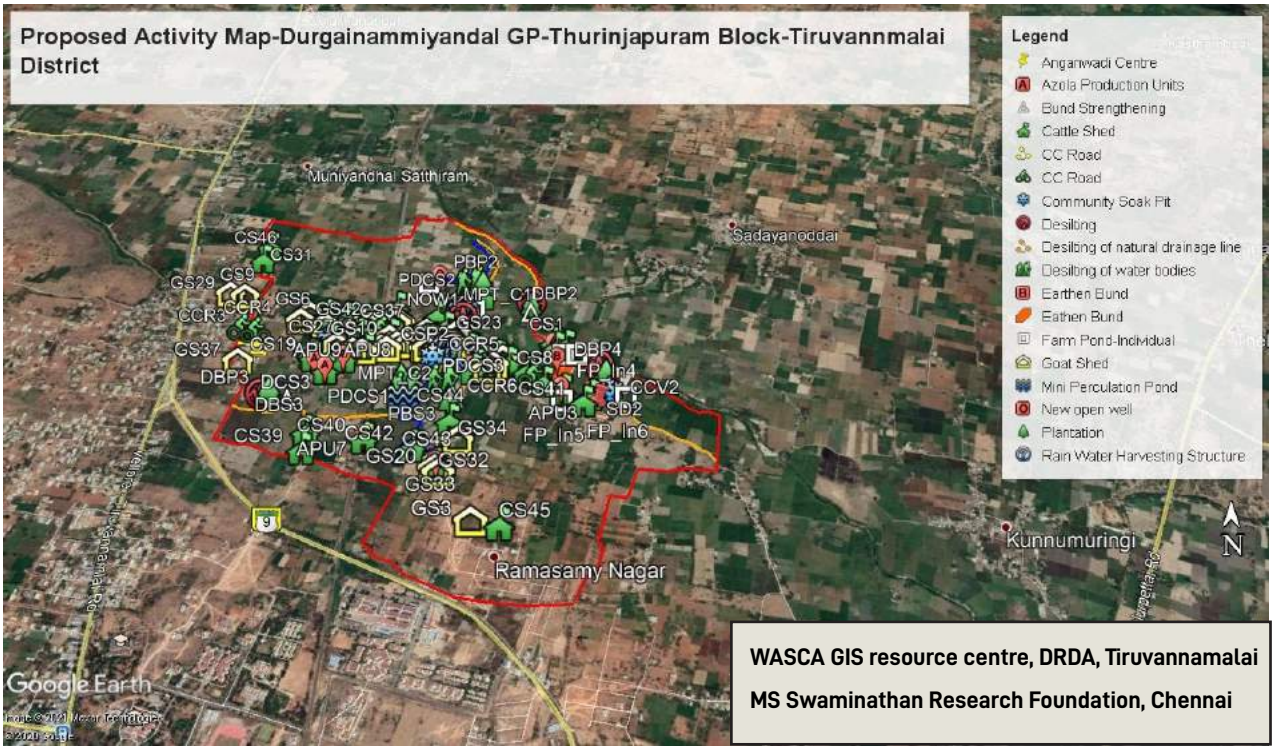
Mavalavadi Gram Panchayat – Thellar block

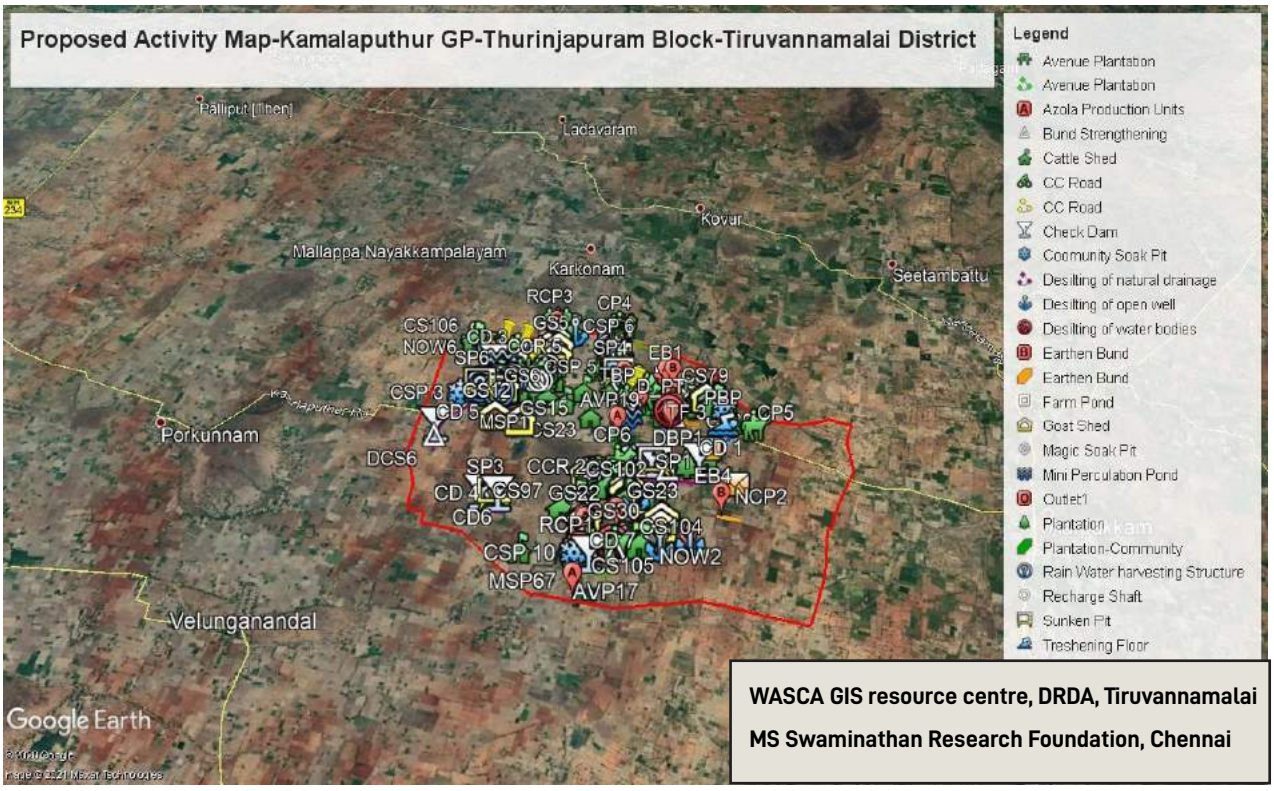




Boodamagalam Gram Panchayat – Thurinjapuram block

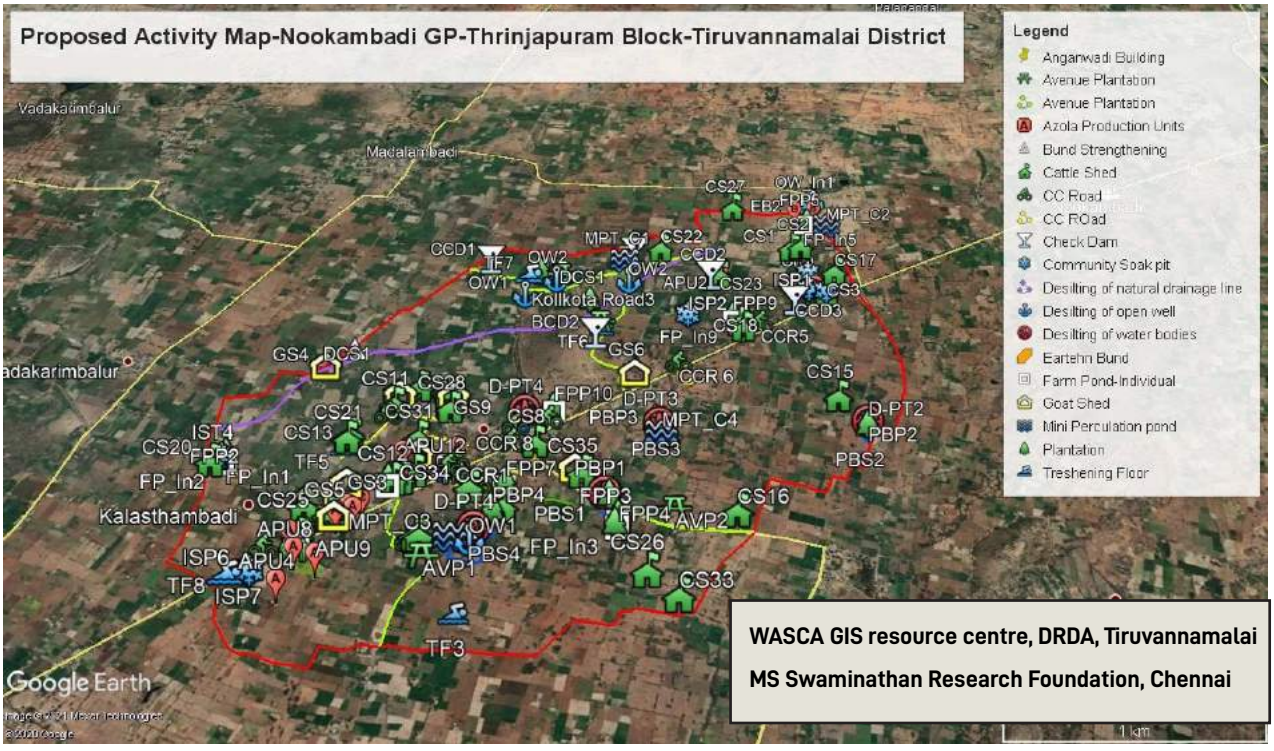
Durgainammiyandal Gram Panchayat – Thurinjapuram block

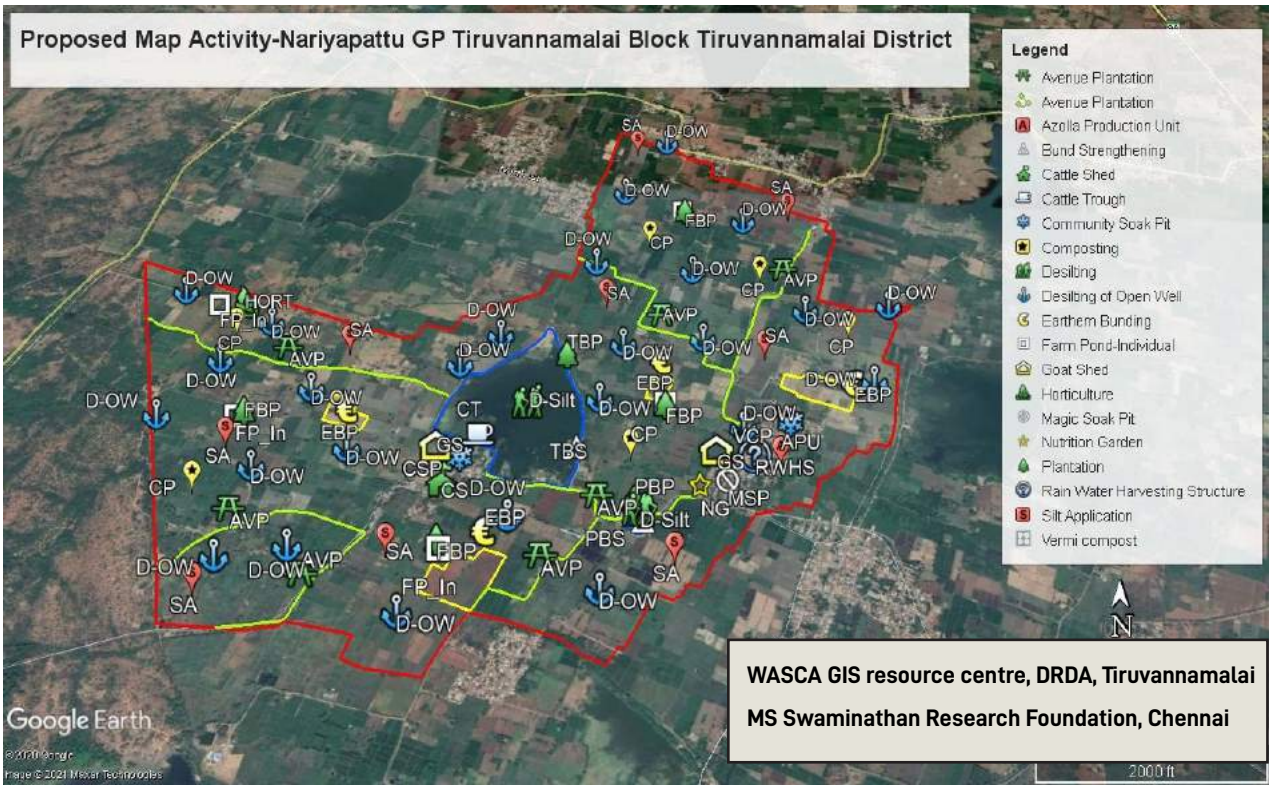




Kamalaputhur Gram Panchayat – Thurinjapuram block

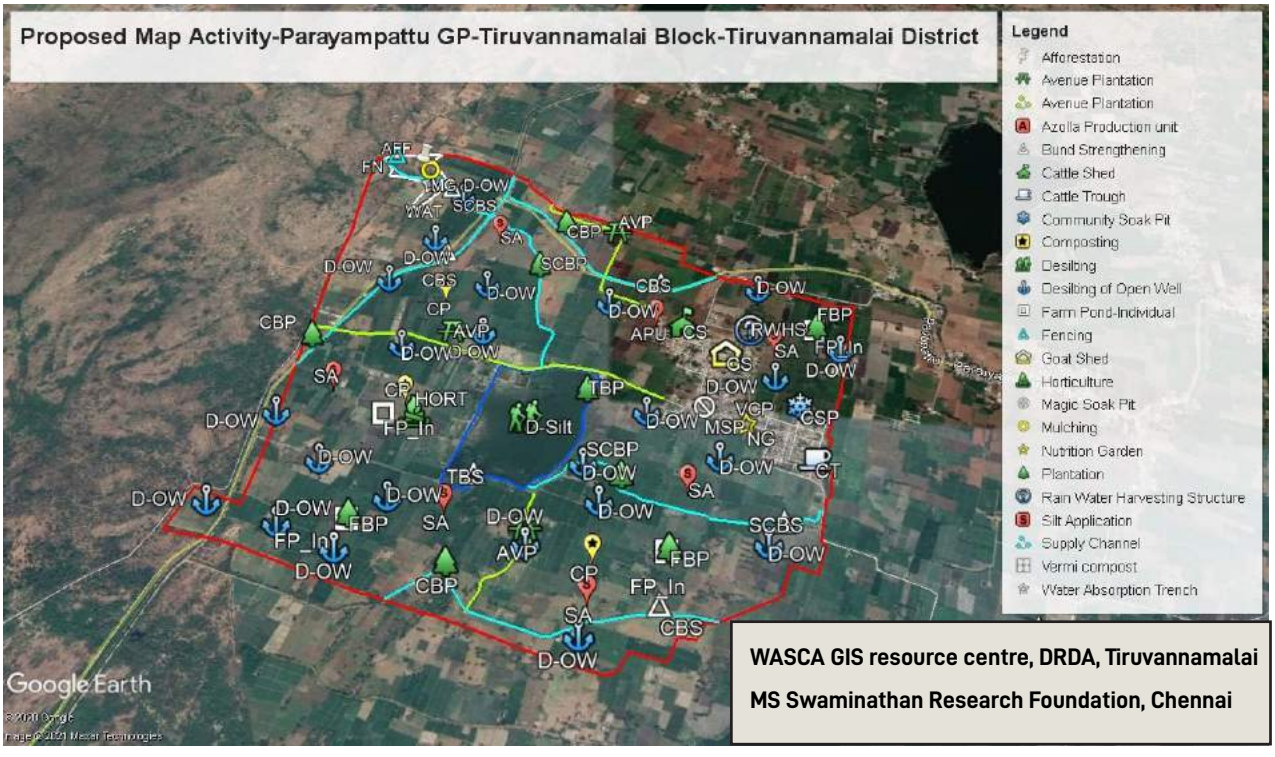
Nookambadi Gram Panchayat – Thurinjapuram block

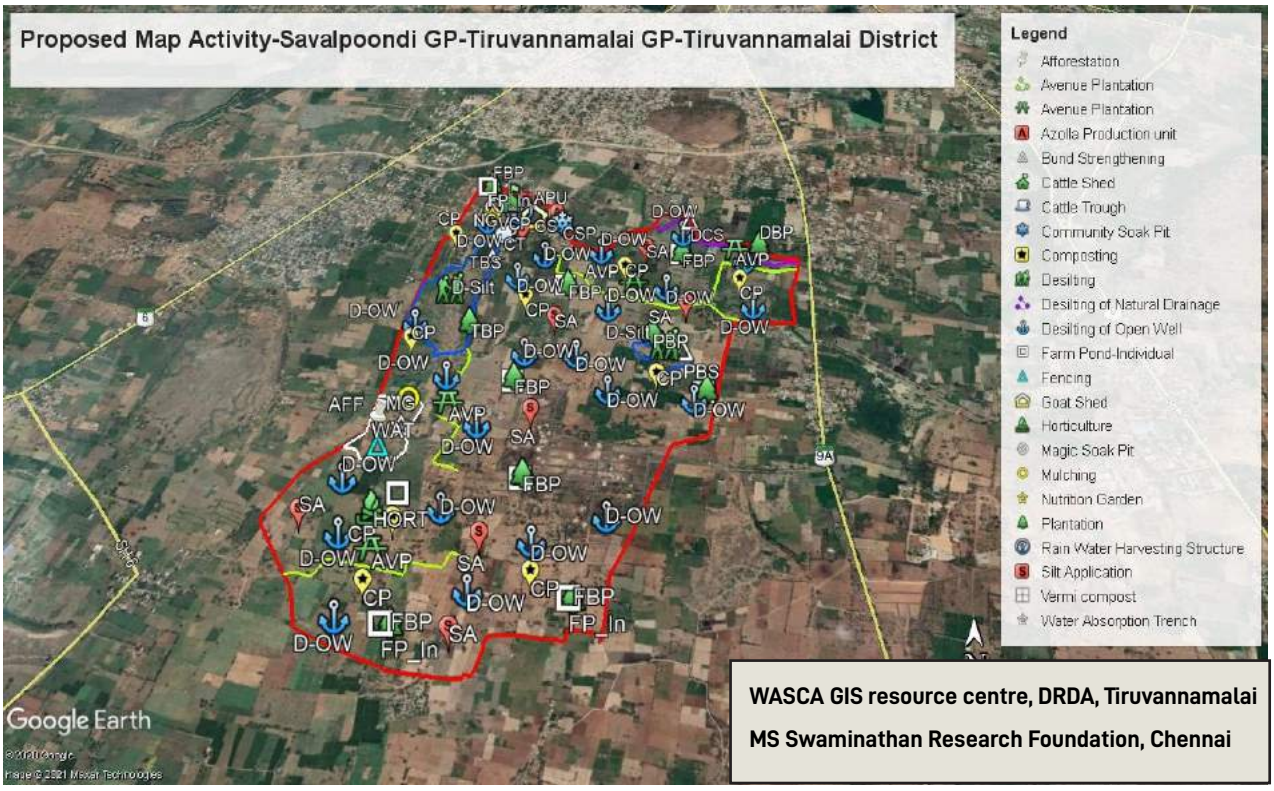




Nariyapattu Gram Panchayat – Tiruvannamalai block

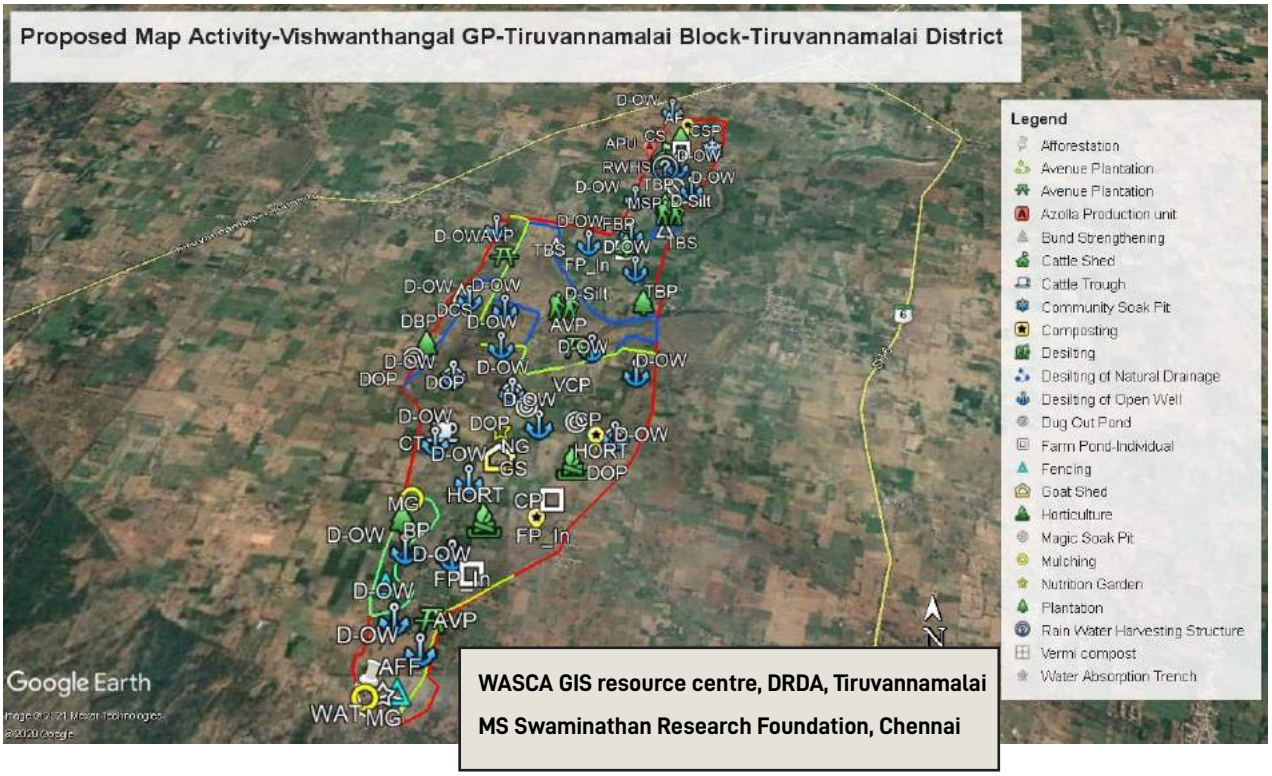
Parayampattu Gram Panchayat – Tiruvannamalai block

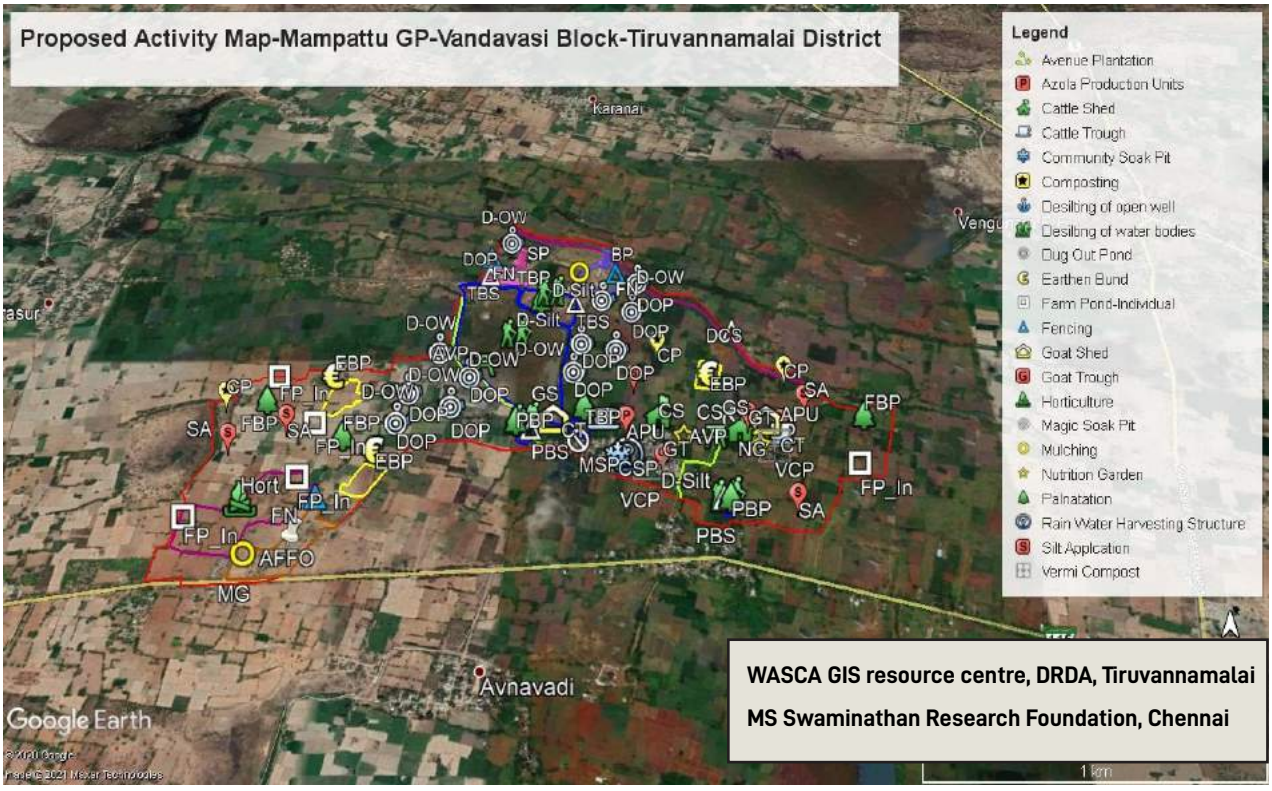




Savalpoondi Gram Panchayat – Tiruvannamalai block

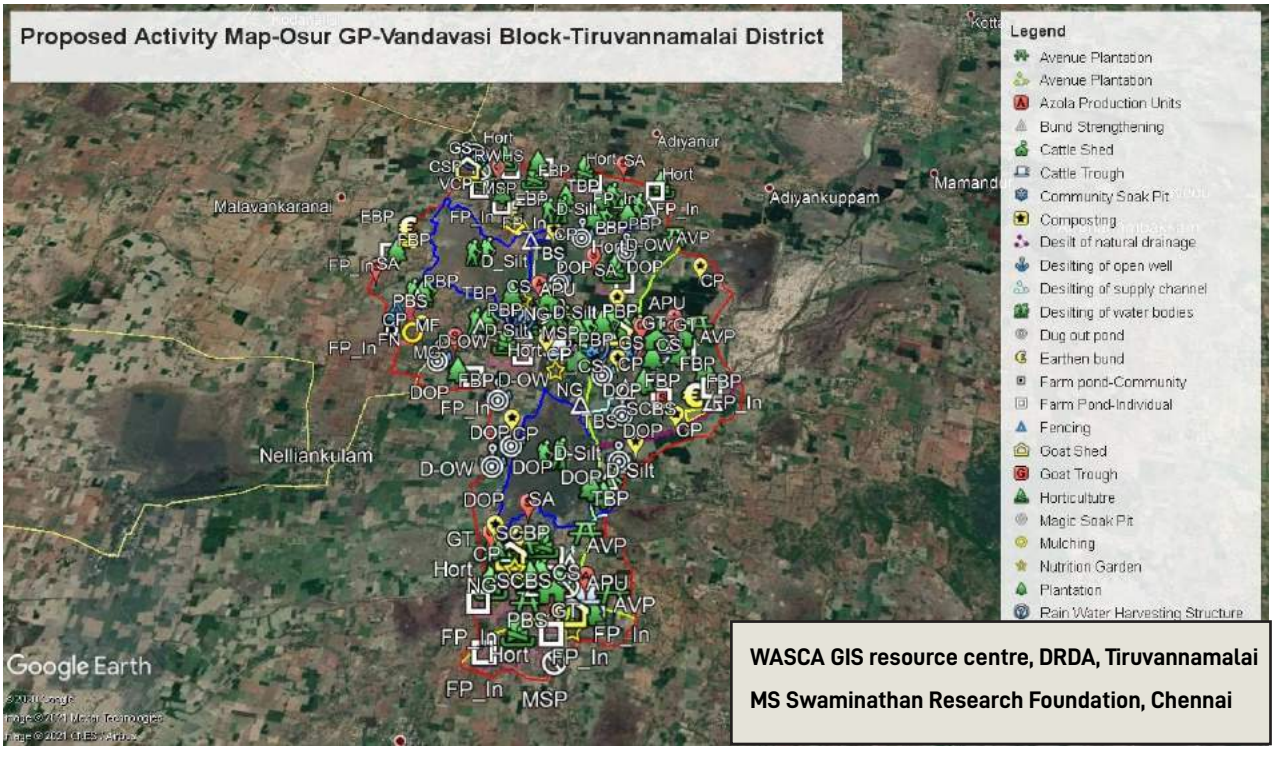
Vishwanthangal Gram Panchayat – Tiruvannamalai block

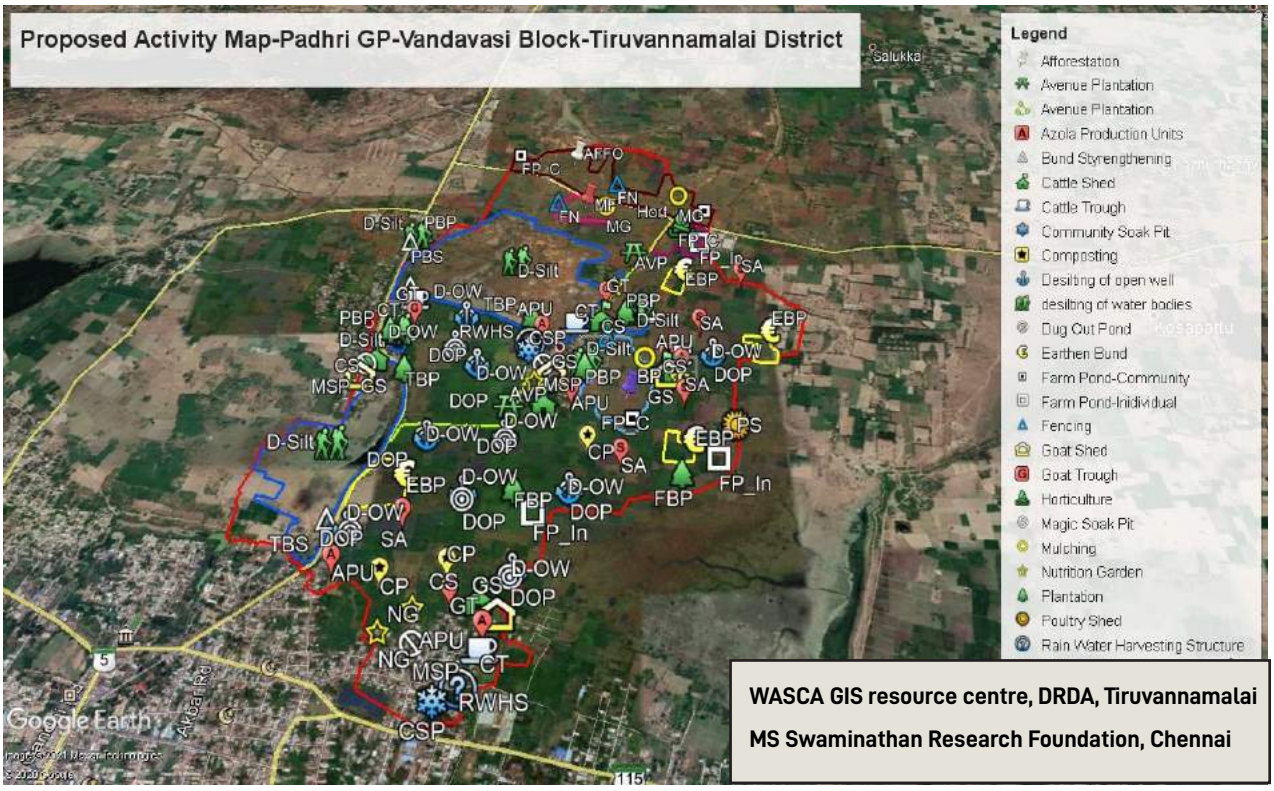




Mampattu Gram Panchayat – Vandavasi block

Osur Gram Panchayat – Vandavasi block





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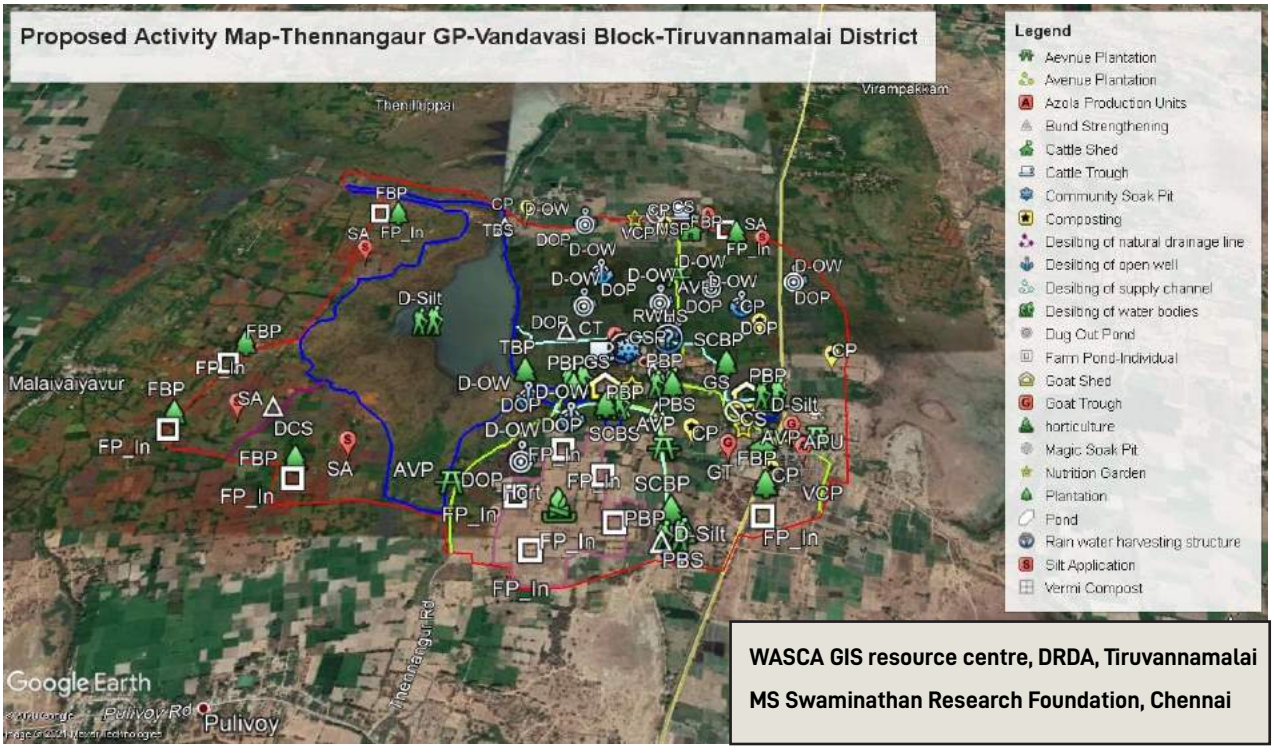
Padhri Gram Panchayat – Vandavasi block

Thennangaur Gram Panchayat – Vandavasi block



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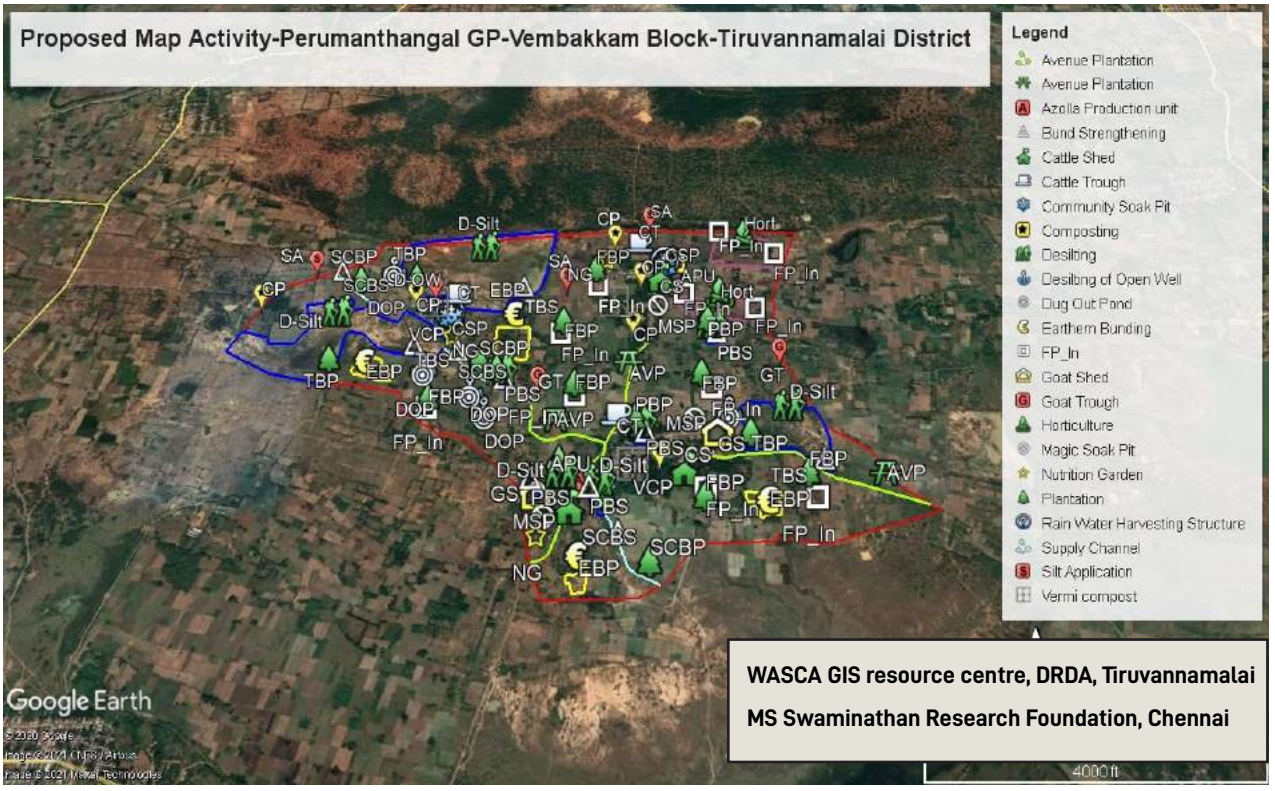
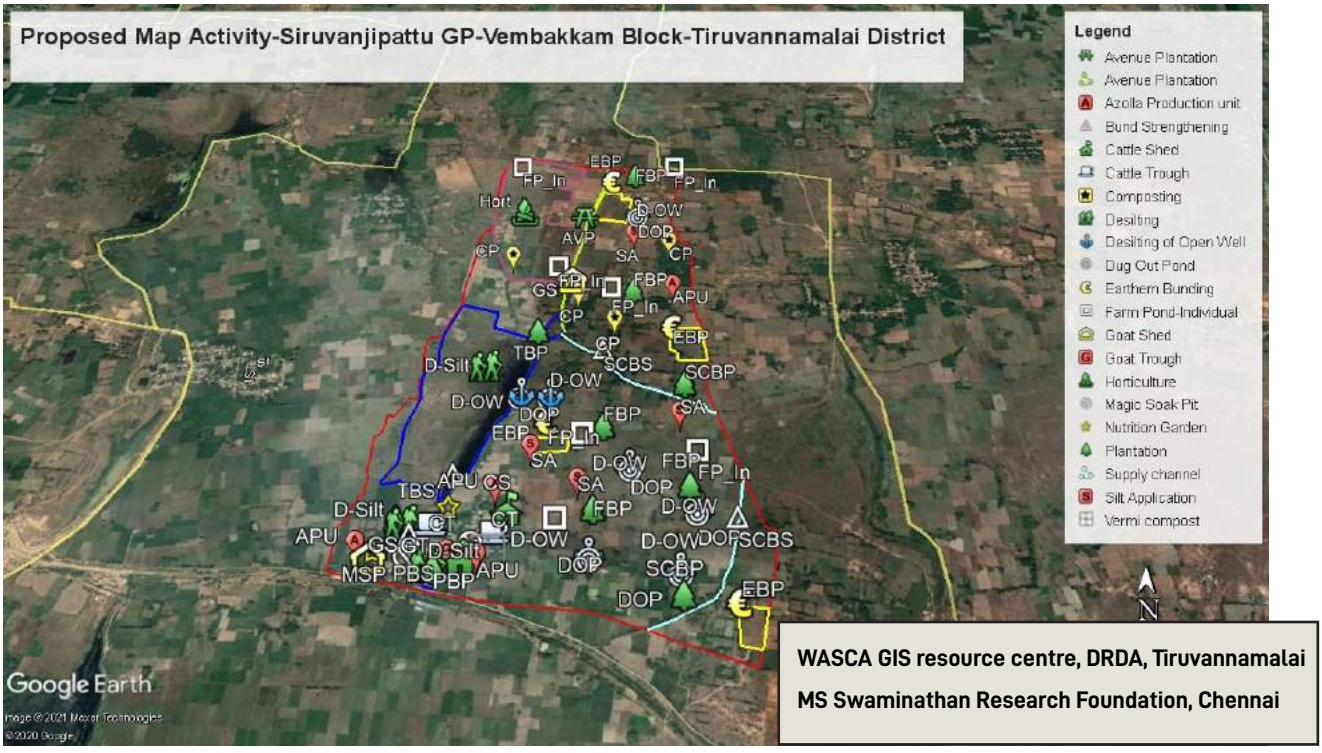
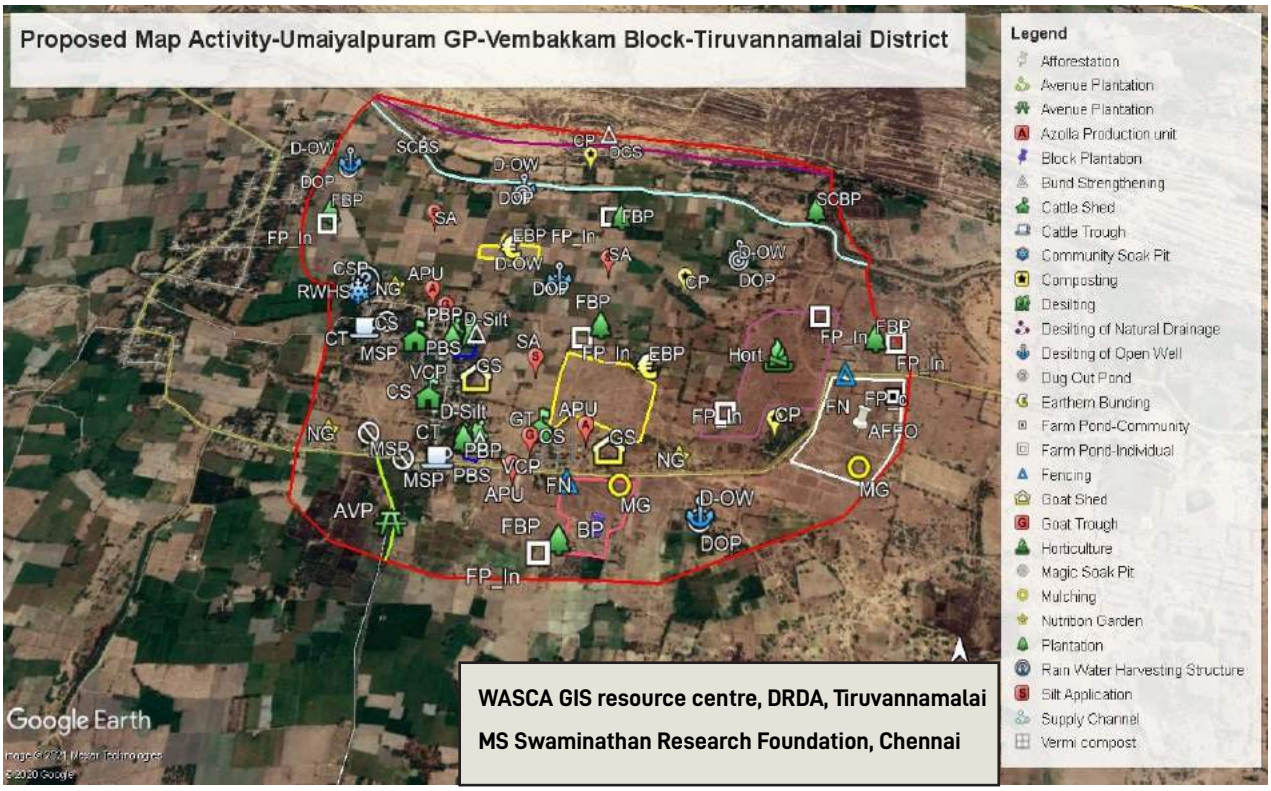


Permanthangal Gram Panchayat – Vembakkam block

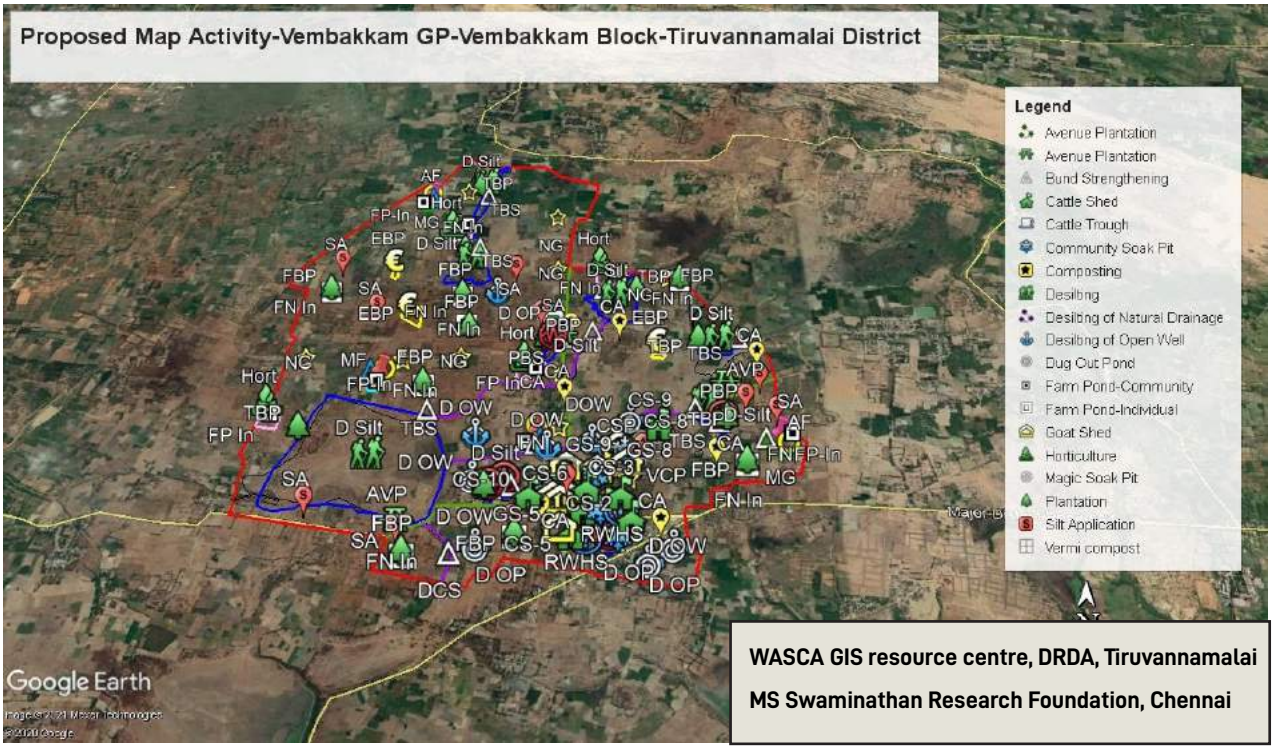
Siruvanjipattu Gram Panchayat – Vembakkam block

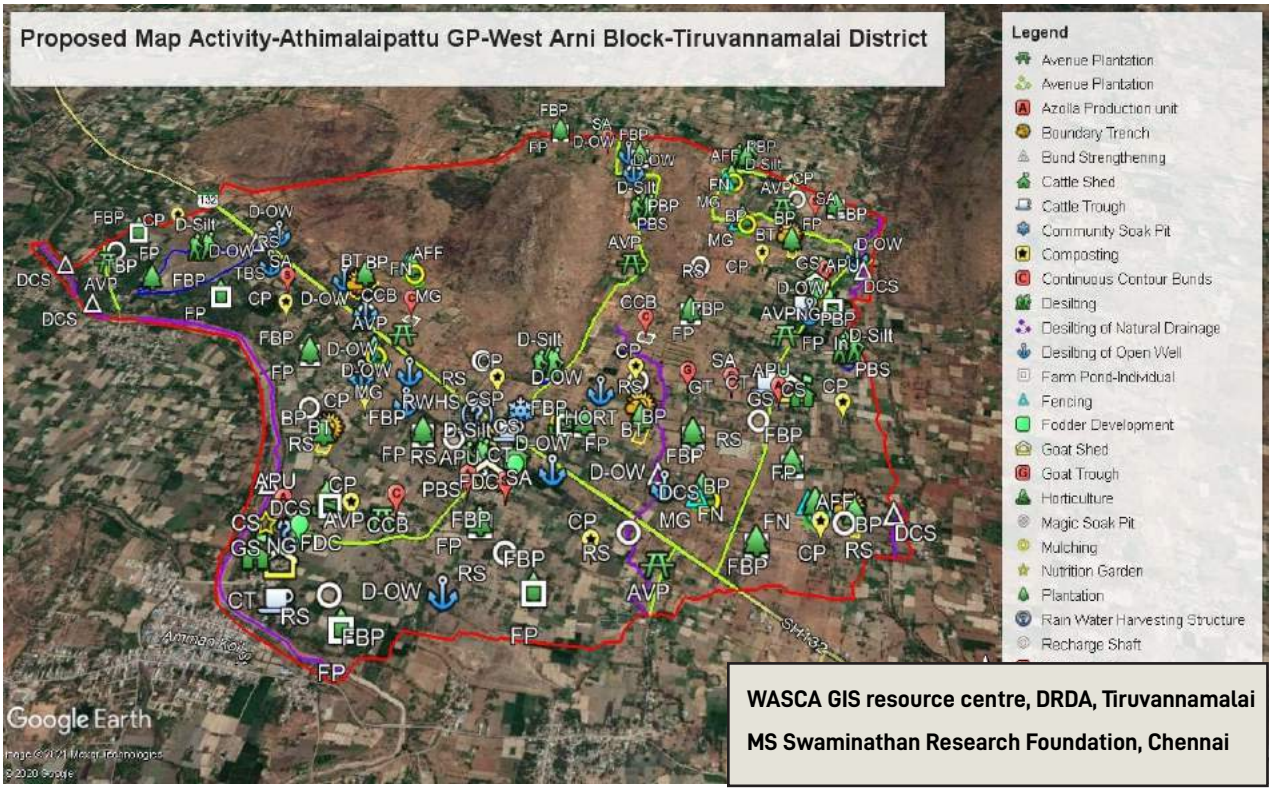




Umaiyalpuram Gram Panchayat – Vembakkam block

Vembakkam Gram Panchayat – Vembakkam block





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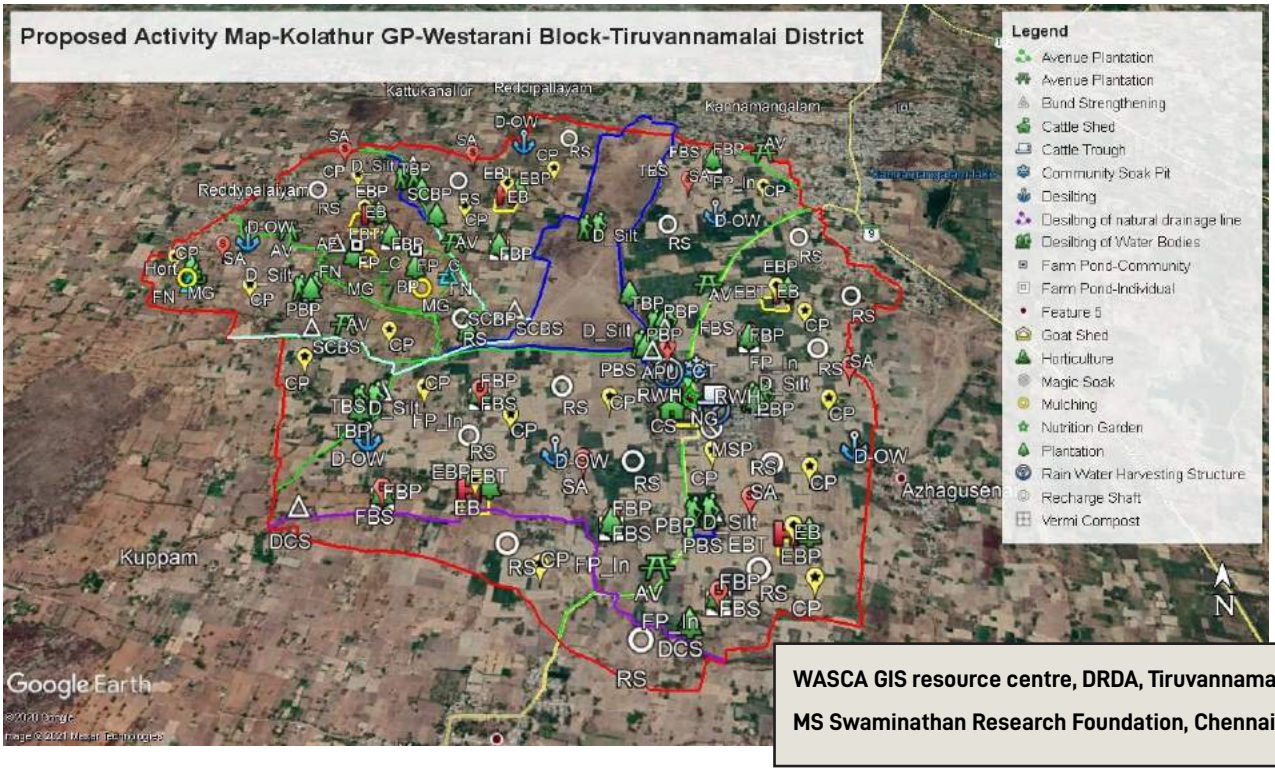
Athimalaipattu Gram Panchayat – West Arani block

Kolathur Gram Panchayat – West Arani block



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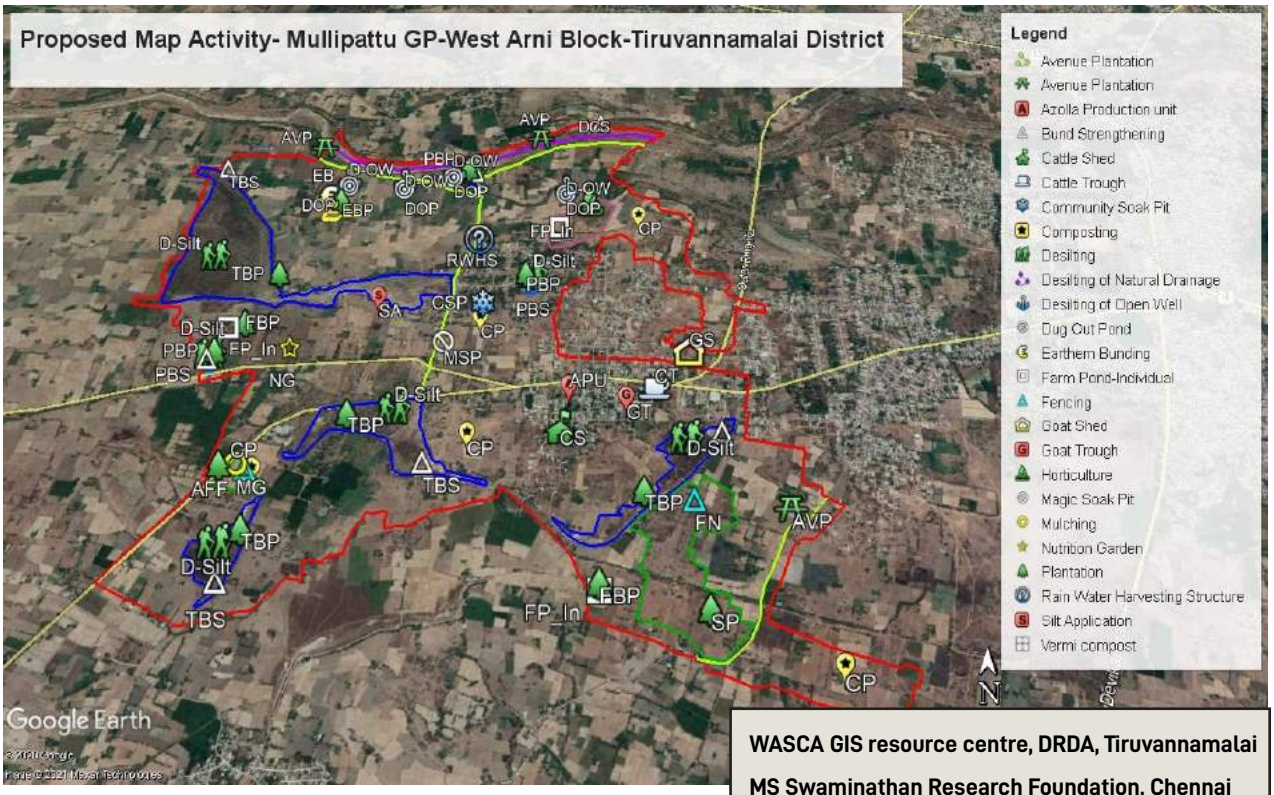

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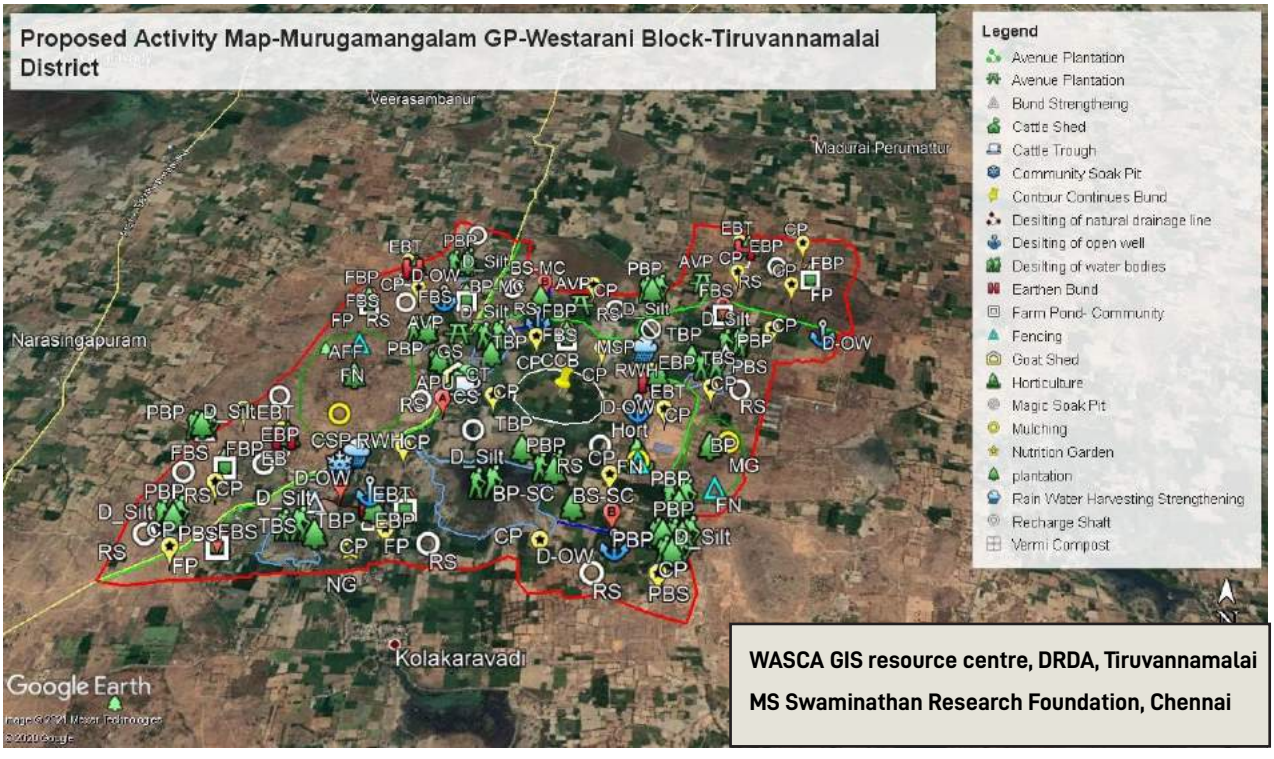
Mullipattu Gram Panchayat – West Arani block

Murugamangalam Gram Panchayat – West Arani block



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6.1) CRM Framework: Current and Future Extremities of TN

Tamil Nadu already faces several consequences of climate change causing distress to its farmers and other local communities. It is vulnerable to different types of climatic hazards such as floods, hailstorms, heat waves, drought, thunder and lightning and forest fires. Most of these hazards have direct or indirect linkages with climate change. Adverse effects these hazard ravage agricultural crops, livestock productivity, net primary productivity of forests etc.

Tamil Nadu, the trends in selected extreme event indices based on MMM projections, although due to the poor RCM performance in replicating historical extreme events caution is required when interpreting these trends. They report positive trends in certain temperature related indices, such as maximum day time temperature (TXx), maximum night time temperature (TNx) and Minimum day time temperature (TXn) and Minimum night time temperature (TNn). This indicates a warming up for both time periods and RCPs and these trends are statistically significant for limited geographical areas (districts) only. Moreover, the percentage of warm days and warm nights is projected to increase, and percentage of cool days and cool nights is projected to decrease under all scenarios and time periods. Cold spell duration indicator is projected to decrease, and warm spell duration indicator is projected to increase.

Supporting Actions for climate resilient & adaptation:

Both at the international and national targets and schemes are supporting the above actions: important ones are Tamil Nadu State Action Plan on Climate change, Nationally Determined contributions and SDGs, MGNREGA and other government schemes more relevant and contributing

1) Tamil Nadu State Action Plan on Climate Change (TNSAPCC)

2) Preparation of State Specific Action plan for Tamil Nadu (PWD)

3) Nationally Determined Contributions: Climate Change: India as per Paris Agreement and Sustainable Development Goals influencing WASCA TN (SDG 1, 6; 12, 13,14,15) related Targets

Table. 6.1 State-level targets of relevance to Agriculture and allied sectors and their linkages to national and international goals. SDG-related targets stem from the Planning, Development and Special Initiatives Department's SDG Monitoring Platform

Levels	SDG-related			NDC-related
International targets	SDG 2: End hunger, achieve food security and improved nutrition, and promote sustainable agriculture	SDG 6: Ensure availability and sustainable management of water and sanitation for all	SDG 12: Ensure sustainable consumption and production patterns	

National targets/ indicators	National-indicators have been defined in the National Indicator Framework (NIF) developed by the Ministry of Statistics and Programme Implementation, but no national-level targets other than the international Sustainable Development goals and the associated targets have been defined			For better adaptation to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, particularly agriculture
State-level targets 2030	Proportion of population (marginalized and vulnerable) with access to food grains at subsidized prices: target value to be defined	Capacity of sewage water treated (MLD): 100%		

	SDG-related	NDC-related
International targets	SDG 6: Clean Water and Sanitation: Ensure Availability and sustainable management of water and sanitation for all	
National targets/ indicators	National-indicators have been defined in the National Indicator Framework (NIF) developed by the Ministry of Statistics and Programme Implementation, but no national-level targets other than the international Sustainable Development goals and the associated targets have been defined.	To better adapt to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, particularly water resources
State-level i.e. targets 2030	100% Capacity of sewage water treated (MLD)	
Other targets and planned initiatives	• All the households rural villages are connected with water lines in Tamil Nadu.	
	• Water meters are fixed for calculating the water usage and accordingly water charges are levied	
	• Safe drinking water is provided to all the people in urban as well as in rural areas	
	• Tamil Nadu is giving utmost importance to sanitation and hygiene	
	• Under the smart city programme, for the main cities underground drainage (UGD) systems have been laid and connection have been given to all the households	

	• Regular monitoring of water quality and identification of point sources of pollution is done	
	• In the Cauvery sub-basin (Kalingarayan basin), baby canal has been constructed to separate the polluted water.	
	• Industries that are not following the pollution treatment processes are not given license for further running	
	• Selection of irrigation projects and undertaking activities for efficiency improvement –NWM	
	IAMWARM project supports drip and sprinkle irrigation which increases the water use efficiency to more than 60 percent Setting of up of basin management organizations under the auspices of DoWR and CWC	
Source: TN-SAPCC 2.0		

6.2) Climate Resilient Actions (CRA)

The following climate resilient measures are identified and activities related to horticulture for fallow land and dry land development , agro-forestry and integrated farming systems are initiated under convergence with Dept of Agriculture and Dept of Horticulture. The CRA models such as Greening of hillocks, community soak pits, nursery raising has been initiated by DRDA, Tiruvannamalai.

1) **WASCA TN – CRM 1: Greening of Hillocks**
2) **WASCA TN CRM 2: Agroforestry & Integrated farming systems**
3) **WASCA TN CRM 3: Silvi-pasture development**
4) **WASCA TN CRM 4: Horticulture for fallow land and dry lands farmers**
5) **WASCA TN CRM 5: Nursery raising**
6) **WASCA TN CRM 6: Cascade Tanks**
7) **WASCA TN CRM 7: River Rejuvenation**
8) **WASCA TN CRM 8: Artificial Recharge structures**
9) **WASCA TN CRM 9: Water Use Efficiency**
10) **WASCA TN CRM 10: Invasive species reduction**
11) **WASCA TN CRM 11: Spring sheds**
12) **WASCA TN CRM 12: Bamboo cultivation in public lands**
13) **WASCA TN CRM 13: Borewell recharge structures – Recharge Shaft**
14) **WASCA TN CRM 14: Community Soak pits**
15) **WASCA TN CRM 15: Open Wells for Irrigation**

Chapter 7. WASCA TN: CWMRP- Estimates, Tiruvannamalai

Estimates have been prepared by consolidating the key water actions in each of the CWRM themes for the number of works, person days and budget for the whole number of works identified. The following table provides the consolidated details: Of the total number of works 30.25% is for the public and common land while 56.91% for individual - Agriculture and allied sector development followed by rural infrastructure(12.84%). Similar trend has been observed in estimates. However in the case of person days, the estimated person days is lower for the public and common land development (39.62%) compared to productive land development (59.58%).

Table 7.1. Summary of the number of works, estimated budget and person days based on CWRM plans

CWRM themes	No of works	Estimate(Rs in Lakhs)	Person days	No of works	Estimate	Person days
1) Public and common land development	1,65,740	5,66,847	20,04,98,585	30.25%	39.98%	39.62%
2) Agriculture and Allied sector development	3,11,855	8,25,435	30,15,05,399	56.91%	58.21%	59.58%
3) Rural water management	70,354	25,628	40,17,604	12.84%	1.81%	0.79%
Total	**5,47,948**	**14,17,909**	**50,60,21,588**			
Source: CWRM- TN- Tiruvannamalai Plan, 2020-21						

The detailed theme wise water actions are given in the following table:

District Rural Development Agency: Tiruvannamalai
Water Security and Climate Adaptation Project
Works Estimates under Mahatma Gandhi NREGS
FY: 2021-22 to 2023-24

Water Action 1: Development of Public & Common Lands Estimated through CWRMP

S.No.	Name of the work	Number of works identified	Estimates for Three Years (2021-22 to 2023-24)	
			Estimated cost of proposed work as per RSSR-TN (INR in Lakhs)	Estimated Person Days
1	Afforestation in Public/common lands	18771	161431.89	62770726
2	Contour Continuous Bunds (CCB) for Afforestation area	46771	1169.27	467710
3	Composting	12331	2096.27	184965
4	Drainage Line Treatment (DLT)	13071	392.12	65353

5	Silvi-pasture Development	2841	48588.80	18935423
6	Linear Plantation	60	108.68	42446
7	Avenue plantation	57	102.96	40212
8	Block Plantation (Community)	8233	91388.85	35567554
9	Restoration of water bodies			
10	a.Tanks	1966	9830	1572800
11	b. Ooranis	0	0	
12	c. Ponds	3787	7574	757400
13	Artificial Recharge Structure	26113	65282.50	10210183
14	Canal Bund Plantation	23839	178792.50	69848270
15	WC - Irrigation channels - Desilting	3949	29.62	11848
16	WC- Irrigation channels - canal side plantation	3949	59.24	23696
Sub total Water action 1		**165740**	**566847**	**200498585**

CWRM Water Action 2: Agricultural and allied Sector development (Productivity Enhancement)				
S.No.	**Name of the work**	**Number of works identified**	**Estimates for Three Years (2021-22 to 2023-24)**	
			Estimated cost of proposed work as per RSSR-TN (INR in Lakhs)	**Estimated Person Days**
1	Farm Bunding	14099	21149.22	8262295
2	Micro Irrigation	1451	1451.10	0
3	Construction of farm ponds	9482	18964.00	7405442
4	Land development	22483	224826.70	87817309
5	Nursery Development	2303	34540.55	5397536
6	Cattle Shelters	36428	77227.36	12057668
7	Goat Sheep Shelters	17649	40062.55	6265289
8	Fodder development for cattle	27091	40094.68	63501304
9	Azolla units	33669	5050.35	774387
10	Cattle Trough	30453	1522.65	182718
11	Poultry shed	26006	2340.54	260060
12	Dry land Horticulture/Agro-forestry	24892	211584.81	82667428
13	Vermi compost	37889	6820.02	1023003
14	Construction of open well	27960	139800.00	25890960
Sub total - Water action 2		**311855**	**825435**	**301505399**

CWRM Water Action 3: Development of Rural Infrastructure				
S.No.	Name of the work	Number of works identified	Estimates for Three Years (2021-22 to 2023-24)	
			Estimated cost of proposed work as per RSSR-TN (INR in Lakhs)	Estimated Person Days
1	Soak pits (Community)	16547	2151.08	330936
2	Soak pits (Individual)	49167	4916.68	786669
3	Roof rain Water Harvesting	4640	18560.00	2900000
Sub total - Water action 3		**70354**	**25628**	**4017604**
Total Water actions		**547948**	**1417909**	**506021588**
Source: CWRM- TN- Tiruvannamalai Plan, 2020-21				

Chapter 8. WASCA TN: CWMRP- Climate Resilience for Future Livelihoods

Climate change, a phenomenon of international concern, poses a serious threat to human existence. As this phenomenon is constantly evolving and changing, responses to mitigation must also be dynamic, scalable and in line with new national and international threats and structures. Individual structures, such as the "Paris Agreement", have led the countries to implement their own measures to reduce emissions and take mitigation and adaptation measures reflected in the "Nationally Determined Contributions". The mitigation and adaptation measures must consider the development needs of the country and the state in order to ensure a sustainable development pathway for a country. National Action Plan on Climate Change (NAPCC) and State Action Plan on Climate Change (SAPCCs) provides guidance on long term strategy to address climate change at National and State levels respectively.

Since the adoption of NAPCC & SAPCC, important developments and changes have occurred in the broad domain of climate change. Not only have the science, knowledge and understanding of climate change evolved at the global and regional levels, so has the policy context. Notable in this context is the ratification of important development and climate goals at the International level such as the Sustainable Development Goals (SDGs) and the Paris Agreement that aims at checking the global warming (temperature. target of 1.5° C). Related Indian Government commitments, such as those recorded in the Nationally Determined Contribution and corresponding goals of individual State pose the need for an evolving, appropriate climate change action planning process.

8.1 INTENDED NATIONALLY DETERMINED CONTRIBUTION LINKAGES WASCA-TN

NDC Goals and WASCA

2015 was a historic year in which 196 Parties came together under the Paris Agreement to transform their development trajectories so that they set the world on a course towards sustainable development, aiming at limiting warming to 1.5 to 2 degrees C above pre-industrial levels. Through the Paris Agreement, Parties also agreed to a long-term goal for adaptation – to increase the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production. Additionally, they agreed to work towards making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development.

Nationally determined contributions (NDCs) are at the heart of the Paris Agreement and the achievement of these long-term goals. NDCs embody efforts by each country to reduce national emissions and adapt to the impacts of climate change. The Paris Agreement (Article 4, paragraph 2) requires each Party to prepare, communicate and maintain successive nationally determined contributions (NDCs) that it intends to achieve. Parties shall pursue domestic mitigation measures, with the aim of achieving the objectives of such contributions.

For achieving NDC's India has a definite plan of action for Mitigation and Adaption which includes 8 goals (1.Sustainable Lifestyles, 2.Cleaner Economic Development, 3.Reducing Emission intensity of Gross Domestic Product (GDP), 4.Increasing the Share of Non Fossil Fuel Based Electricity, 5. Enhancing Carbon Sink (Forests), 6. Adaptation, 7.Mobilizing Finance & Technology Transfer and 8.Capacity Building). In this 8 goals of NDCs, WASCA in Tamil Nadu State's interventions will achieve 2 major Goals (Goal5 &6) namely:

- "Enhancing Carbon Sink (Forests) - To create an additional carbon sink of 2.5 to 3 billion tonnes of CO2 equivalent through additional forest and tree cover by 2030" and
- "Adaptation - To better adapt to climate change by enhancing investments in development programmes

in sectors vulnerable to climate change, particularly agriculture, water resources, Himalayan region, coastal regions, health and disaster management"

8.2 Sustainable Development Goals – LINKAGES WASCA implementation in Tamil Nadu

WASCA – TN working on three major Actions for making "Climate Resilience for Future Livelihoods". These water actions are:

1. Developing degraded public lands and common lands
2. Developing lands under agricultural and allied activities to enhance productivity
3. Rural Water Management for reaching the domestic needs.

WASCA TN to achieve the above works closely with MGNREGA programme of Ministry of Rural Development and National Water Mission programme of Ministry of Jal Shakti are key stakeholders for WASCA. Apart from these two ministries, in addition to these two ministries, the works under WASCA TN are closely linked with Ministry of Agriculture and Ministry of Environment Forest and Climate Change (MoEFCC). Hence the commitments of the ministries on SDG goals achievements are mapped in the tables given in this section linking them with the interventions under WASCA Tamil Nadu. The intervention under WASCA TN has direct and indirect contribution to the SDGs. SDGs, its national targets set as per NITI Aayog.

SDG 1 aims to end poverty in all its forms everywhere. Ending poverty in all its forms everywhere implies focusing on complete eradication of extreme poverty as well as paying attention to other determinants that influence poverty such as social- economic, cultural, political and environmental factors. Also, Goal aims to reduce, at least by half, the proportion of men, women and children of all ages, living in poverty in all its dimensions according to national definitions. It calls for continuous monitoring including monitoring progress in social protection and inequality. Further its emphasis on creating sound policy frameworks, mobilization of resources from a variety of sources and implementing nationally appropriate social protection systems that ensure equal rights; and access to basic services and economic resources. Poverty manifests itself in diminished opportunities for livelihoods and quality education, lack of access to resources, social discrimination and exposure and vulnerability to extreme climate events.

Improved economic performance coupled with concerted interventions by the government towards poverty eradication has led to decline in poverty rates across all economic, social and religious groups at the national level and in all States.

The MGNREG Act, 2005- The MGNREGA Act, 2005 aims to provide hundred days of guaranteed wage employment in every financial to every rural household whose adult member volunteers' who demanded employment under this ACT were provided the same, in the year 2017-18. WASCA interventions will expected to lead betterment of the districts.

Table 8.1 Sustainable Development Goals (SDGs):1 Targets, WASCA Targets
India's Commitment to SDG: Nodal Ministry: MoRD
SDG 1: End Poverty in all its forms every where
1.1 By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than $1.25 a day
1.2 By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions
1.3 Implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and the vulnerable
1.4 By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance
1.5 By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters
1.a Ensure significant mobilization of resources from a variety of sources, including through enhanced development cooperation, in order to provide adequate and predictable means for developing countries, in particular least developed countries, to implement programmes and policies to end poverty in all its dimensions
1.b Create sound policy frameworks at the national, regional and international levels, based on pro-poor and gender-sensitive development strategies, to support accelerated investment in poverty eradication actions
WASCA TN interventions will be impacted all targets (1.1-1.5)

SDG 2: Eliminating hunger is fundamental to ensuring human development. Goal 2 aims to end all forms of hunger and malnutrition by 2030, making sure all people- especially children – have access to sufficient and nutritious food all year round. It seeks to end all forms of malnutrition, double agricultural productivity and ensure sustainable food production systems. Food security is influenced by a number of factors, including those that determine food availability domestic food production and the capacity to import food, as well as determinants of food access, utilization and vulnerability. Although India has surpluses of wheat and rice stocks, improving access, utilization and reducing vulnerability remain a significant challenge. Access is determined by purchasing power of households or access to government programmes. Additionally, it is also determined by inequalities such as quality of food, sanitation and quality of water. Vulnerability to shocks and disasters too influence food security.

India's Goal for 2030 is to end hunger and malnutrition by ensuring that quality food is accessible to all, to meet their nutritional needs for a healthy life. Ending hunger and malnutrition demands resilient food production systems and sustainable agricultural practices. Additionally, it requires ensuring equitable access to nutritious food by all, improving sanitation and hygiene, and reducing vulnerability to shocks and disasters.

India has targeted initiatives, both at the national as well as State level, aiming to achieve this Goal. The National Food Security Act, 2013, which mandates provision of food grains to nearly 75 percent of the population in rural areas and 50 percent of the population in urban areas at affordable prices under the targeted public distribution system.

Table 8.2 : Sustainable Development Goals (SDGs):2 Targets, WASCA
India's Commitment to SDG: Nodal Ministry: Agriculture& Farmers welfare
SDG 2: End hunger, achieve food security and improved nutrition & promote sustainable agriculture
2.1 By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round.
2.2 By 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons
2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment
2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality
2.5 By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed
2.a Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries
WASCA TN interventions will be impacted all targets (Targets 2.1-2.5)

SDG 6:. Every year millions of people, most of them children, die from diseases associated with inadequate water supply, sanitation, and hygiene. It is estimated that by 2050, more than half of the world's population will live in water stressed regions, as per researchers at MIT. More than two and a half billion people have gained access to improved drinking water sources since 1990, but 666 million people are still without. Between 1990 and 2015, the proportion of the global population using an improved drinking water source increased from 76% to 91%, however, each day, nearly 1000 children die due to preventable water and sanitation-related diarrheal diseases.

Clean water is critical to survival, and its absence can impact the health, food security, and livelihoods of families across the world. Although our planet has sufficient fresh water to achieve a regular and clean water supply for all, bad economics and poor infrastructure can skew supply unfavorably. Drought afflicts some of the world's poorest countries, worsening hunger and malnutrition. Floods and other water-related disasters account for 70% of all deaths related to natural disasters. Global goals and national priorities on reliable energy, economic growth, resilient infrastructure, sustainable industrialisation, consumption and production, and food security, are all inextricably linked to a sustainable supply of clean water. Hydropower is one of the most crucial and widely-used renewable sources of energy and as of 2011, represented 16% of total electricity production worldwide.

The SDGs have committed the international community to expand international cooperation and capacity building on water and sanitation related activities and programmes, and also to support local communities in improving water and sanitation management. Through Goal 6, the countries of the world have resolved to achieve universal access to safe drinking water and adequate sanitation and hygiene to all in the next fifteen years.

India's SDG 6: The overall proportion of Indian households with access to improved water sources increased from 68% in 1992-93 to 89.9% in 2015-16. However, in 2015-16, 63.3% of rural households and 19.7% of urban households were not using improved sanitation facilities. According to the World Bank, more than 520 million in India were defecating in the open – the highest number in the world. This figure is expected to have reduced significantly given that improving sanitation is a key priority of the government which has introduced several flagship programmes, WASCA will also help to achieve the bellow targets.

Table 8.3 : Sustainable Development Goals (SDGs):6 Targets, WASCA Targets
India's Commitment to SDG: Nodal Ministry: Ministry of Water resources, MoJS
SDG 6: Ensure availability and sustainable management of water and sanitation for all
6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all
6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations
6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally
6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity
6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate
6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes
6.a By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies
6.b Support and strengthen the participation of local communities in improving water and sanitation management
WASCA TN interventions will be impacted Targets 6.1,6.3,6.5 &6.6

SDG 13 on Climate Change aims to integrate climate change measures into national policies and strategies; and further aims to plan and promote mechanisms for raising capacity for effective climate change – related planning and management. A comprehensive strategy is required to combat the effects of climate change. Efforts at the national level for adopting green technologies', promoting use of clean and modern source of energy, advocating for behavior change for sustainable use of resources have to be complimented by international cooperation on climate change since the causes and effects of climate change transcend national boundaries.

India has great geographic diversity, and a variety of climate regimes and regional and local weather conditions, which are vulnerable to climate change. This is manifested in floods, droughts as well as the risk from tsunamis and cyclones experienced in coastal areas.

Table 8.4 SDG 13 Targets, WASCA Targets
India's Commitment to SDG: Nodal Ministry: MoEF&CC
SDG 13: Take urgent action to combat climate change and its impacts
13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries
13.2 Integrate climate change measures into national policies, strategies and planning
13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning
13.a Implement the commitment undertaken by developed- country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly $100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible
13.b Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries, and small islands developing States, including focusing on women, youth and local and marginalized communities
WASCA TN interventions will be impacted Targets 13.1 &13.2

SDG 15 aims to protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation, while also integrating ecosystems and biodiversity into national and local planning, developmental processes, poverty reduction strategies and national accounts. It also seeks to promote fair and equitable sharing of benefits arising from the utilization of genetic resources, promote appropriate access to such resources, and prevent poaching and trafficking of protected species of flora and fauna.

Land that provides habitat to more than 80 percent of all terrestrial species of animals, plants and insects, is an essential and irreplaceable resource of the world. However, unsustainable developmental activities like deforestation and desertification pose a threat to the ecosystem and affect the lives of millions of people. India's forest cover is presently 21 percent and secured territories make up almost 5 percent of the nation's aggregate land area. Millions people in India depend on land resources for their livelihood. Therefore, India aims to integrate ecosystem and biodiversity values into local planning, development processes and poverty reduction strategies.

India's progress on this Goal is important globally, since the country is home to 8 percent of the world's biodiversity, including numerous species that are unique to the country. India's global leadership on biodiversity is reflected in the pivotal role it played in facilitating the implementation of the Nagoya Protocol — one of the global Aichi Biodiversity Targets. The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of benefits.

Table 8.5. SDG 15 Targets, WASCA Targets
India's Commitment to SDG: Nodal Ministry: MoEFF&CC
SDG 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements
15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally
15.3 By 2020, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land- degradation-neutral world
15.4 By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development
15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species
15.6 Promote fair and equitable sharing of the benefits arising from the utilization of genetic resources and promote appropriate access to such resources, as internationally agreed
15.7 Take urgent action to end poaching and trafficking of protected species of flora and fauna and address both demand and supply of illegal wildlife products
15.8 By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species
15.9 By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts
WASCA TN interventions will be impacted Targets 15.1, 15.2 & 15.8

WASCA TN DRDA- Tiruvannamalai						
WASCA TN: Composite Water Resources Management Works linkage with Climate Vulnerability Area and Climate Vulnerability Indicator						
Sno	**Name of the Work**	**Climate Vulnerability Area**	**No of Works Identified CWRM**	**Climate Vulnerability Index Impacting (WASCA TN)**	**SDG Goals**	**India's NDC**
Water Action 1: Improvement of Public & Common Lands Development						
1	Afforestation	Climate, Water Resource and socio-economic	18771	C1,C2.C3. W3,	SDG 1, 2,6,13&15	1) To create an additional carbon sink of 2.5 to 3 billion tonnes of CO2 through addition al forest and tree cover by 2030
2	Contour Continuous Bunds	Water Resource	46771	W3	SDG 1,2, 6,13&15	1) To better adapt to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, particularly water resources 2) To create an additional carbon sink of 2.5 to 3 billion tonnes of CO2 through addition al forest and tree cover by 2030
3	Composting	Water Resources	12331	W1	SDG1& 6	
4	Drainage Line Treatment	Water Resource	13071	W1,W3,W4	SDG1 & 6	
5	Silvi-pasture Development	Agriculture, Climate and Socio-economic	2841	C1,C2.C3. W3,	SGG 6,12&13	
6	Linear Plantation	Climate, Water Resources and socio-Economic	60	C1,C2.C3. W3,S2	SDG 1,2,6,12&13	
7	Avenue plantation	Climate, Water Resource and socio-economic	57	C1,C2.C3. W3,S2	SDG 1, 6&13	
8	Block Plantation (Community)	Climate, Water Resource and socio-economic	8233	C1,C2.C3. W3,S2	SDG 1,6&13	
9	Restoration of water bodies	Climate, Water Resource, agriculture and Socio-economic		S2,S4	SDG 1, 2&6	

WASCA TN: CWMRP- Climate Resilience for Future Livelihoods

10	a. Tanks	Climate, Water Resource, agriculture and Socio-economic	1966	S2	SDG1,2 &6	1) To better adapt to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, particularly water resources 2) To create an additional carbon sink of 2.5 to 3 billion tonnes of CO2 through addition al forest and tree cover by 2030
11	B.Ooranis	Climate, Water Resource, agriculture and Socio-economic	0	W3	SDG 1,2& 6	
12	c. Ponds	Climate, Water Resource, agriculture and Socio-economic	3787	W4,W5,S2	SDG 1,2& 6	
13	Artificial Recharge Structure	Water Resources and Climate	26113	W5, S2,S4, C1	SDG 6	
14	Canal Bund Plantation	Climate and Water Resources	23839	W4, C1	SDG 6 &15	
15	WC - Irrigation channels - Desilting	Water Resources &Agriculture	3949	W4,W5	SDG 6& 2	
16	WC- Irrigation channels - canal side plantation	Climate and Water Resources	3949	W4, C1	SDG 6 &15	
	Total		**165740**			
Water Action 2: Agricultural and allied Sector development (Productivity Enhancement)						
1	Farm Bunding	Water Resources, Agriculture	14099	A1,A3,W1,W3	SDG 1,2&6	1) For better adaptation to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, particularly agriculture & allied activities
2	Micro Irrigation	Water Resources, Agriculture & Climate	1451	A1,A3,A5,W5	SDG 1, 2&6	
3	Construction of farm ponds	Water Resources, Agriculture & Climate	9482	A1,A3,W5,W1, W3	SDG 2& 6	
4	Land development	Agriculture and Socio Economic	22483	S2,S4,A1,A3,A4	SDG 2& 6	

5	Nursery development	Agriculture, Water Resources, Socio-Economic & Climate	2303	W1,W5,A1,A3,S2,S4	SDG 2, 6&13	
6	Cattle Shelters	Agriculture and Water Resources	36428	W1,S4	SDG 2&6	
7	Goat Sheep Shelters	Socio Economic and Climate	17649	C1,S2,S4	SDG 1,2 &6	
8	Fodder development for cattle	Socio Economic	27091	S4	SDG 1& 2	1) For better adaptation to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, particularly agriculture & allied activities
9	Azolla units	Socio Economic	33669	S4	SDG 1& 2	
10	Cattle Trough	Agriculture and Socio Economic	30453	A3, S4	SDG 1& 2	
11	Poultry shed	Agriculture and Socio Economic	26006	A3,A4,S4	SDG 1& 2	
12	Dry land Horticulture/Agro-forestry	Water Resources and Socio Economic	24892	W5,S4	SDG 1& 2	
13	Vermi compost	Socio Economic	37889	S2,S4	SDG 1& 2	
14	Construction of open wells	Water Resources and Socio Economic	27960	S3,W5,W1	SDG 1& 6	
	Total		**311855**			

Water Action 3: Rural Water Management						
1	Soak pits (Community)	Water Resources and Socio-Economic	16547	W3,S2	SDG 1& 6	1) To better adapt to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, particularly water resources
2	Soak pits (Individual)	Water and Socio-Economic	49167	W3,S2	SDG 1& 6	
3	Roof rain Water Harvesting	Water Resources	4640	W3,S1,S3	SDG 1& 6	
	Total		**70354**			
Note: SDG 1: No Poverty; SDG 2: Zero Hunger; SDG6: Clean Water and Sanitation, SDG 13: Climate Action, SDG15: Life on Land, SDG- Sustainable Development Goal						

Source: https://sdgs.un.org/goals

Water Security & Climate Adaptation: Tamil Nadu: Vulnerability Index & Key Water Action				
S NO	**Vulnerability Area**	**WASCA Vulnerability Indicators**	**Vulnerability Indicator**	**Unit for Assessment**
1	**Climate Vulnerability**	Changes in maxT	C1	Degree Celsius
2		Changes in minT	C2	Degree Celsius
3		Changes in RF	C3	%
4		Excess rainfall years	C4	No. of Years
5	**Water resource vulnerability**	Deficient rainfall years	W1	No. of Years
6		Ground water extraction	W2	%
7		Ground water Recharge	W3	in cubic meter
8		Surface water availability	W4	Mm
9		Water gap	W5	MCM
10		% of contamination	W6	%
11	**Agriculture vulnerability**	Rainfed area	A1	%
12		Cropping intensity	A2	%
13		Soil moisture	A3	kg/m2
14		Evapotranspiration	A4	kg/m2/s
15	**Socio-economic vulnerability**	Rural proportion	S1	%
16		Multidimensional poverty index	S2	Index Value
17		Source of drinking water within premises in rural	S3	%
18		marginal farmer_ landholdings	S4	%

ANNEXURES

Annexures 1 : Govt. orders of SLSC and DLSC on WASCA

ABSTRACT

Mahatma Gandhi National Rural Employment Guarantee Scheme – Implementation of Water Security and Climate Adaptation (WASCA) Project – Formation of State Level Steering Committee – Orders – Issued.

Rural Development and Panchayat Raj (CGS.1) Department

G.O.(Ms.)No.170 **Dated:25.11.2019**
விகாரி, கார்த்திகை 9
திருவள்ளுவர் ஆண்டு 2050

Read:

1. Minutes of the Meeting held under the Chairmanship of Additional Chief Secretary to Government, RD&PR Department on 20.11.2019.
2. From the Director of Rural Development and Panchayat Raj, Letter Roc.No.60138/2019/MGNREGS-I-1, dated 20.11.2019.

ORDER:

In the letter second read above, the Director of Rural Development and Panchayat Raj has stated in his proposal dated:20.11.2019 that the core objective of the Mahatma Gandhi National Rural Employment Guarantee Act is to provide 100 days of wage employment and create durable assets. In the year 2016, Mahatma Gandhi National Rural Employment Guarantee Scheme taken up national wide to address the water scarcity, implement Mission Water Conservation across the country. Mission Water Conservation is a convergence framework with scientific planning and execution of water management works with the use of latest technology. This has been mandated in consultation with an agreement of the Ministry of Water Resources (now JalShakthi) and the Ministry of Agriculture and Farmers' Welfare. Out of 260 permissible works / activities under Mahatma Gandhi National Rural Employment Guarantee Scheme, of which 181 kinds of works relate to Natural Resource Management (NRM) alone and out of the 181 NRM works, 84 are water related. 164 of the total works are related to Agriculture and Agriculture-Allied works.

Mission Water Conservation

Under Mission Water Conservation it is emphasized that the works taken up in Mahatma Gandhi National Rural Employment Guarantee Scheme should change from taking up individual, standalone works in a typical 'relief works mode' to an Integrated Natural Resource Management (INRM) perspective. Planned and systematic development of land and harnessing of rainwater following watershed principles should become the central focus of Mahatma Gandhi National Rural Employment Guarantee Scheme work across the country to sustainably enhance farm productivity and income of poor people.

Technological support shall be taken from National Remote Sensing Centre, ISRO for identification and holistic planning of permissible works to be taken up in the watersheds using Geographical Information System (GIS) Technology (BHUVAN). The GIS plans shall be comprehensive ones incorporating all eligible works under Mahatma Gandhi National Rural Employment Guarantee Scheme and the same shall be implemented in a phased manner. Pilot implementation has been started during 2019-20 with 770 Village Panchayats i.e 2 Village Panchayats per Block for all 385 Blocks.

Focus on Climate

The new master circular 2019-20 section 6.3 elaborated on need for Focus on Climate Change Infrastructure built under Mahatma Gandhi National Rural Employment Guarantee Scheme leading to increased water availability for irrigation, groundwater recharge, increased agricultural production, and carbon sequestration.

The Ministry of Environment, Forest and Climate Change recognizes Mahatma Gandhi NREGA as one of the 24 key initiatives to address the problem of climate change, while simultaneously improving the livelihoods of the poor. Mahatma Gandhi NREGA, particularly the Category A activities, which are public works relating to natural resource management. Planning and design of works under Mahatma Gandhi National Rural Employment Guarantee Scheme should take into account, impacts of climate change in order to ensure resilience of vulnerable rural communities and make the benefits sustainable in the long run. Specifically, the following things should be ensured: i) Historical and projected climate change data, especially incidence of droughts and floods, along with vulnerability assessment at the district, block or gram panchayat level should be used in the planning and design of Mahatma Gandhi NREGS works. ii) Different kinds of complementary Natural Resource Management (NRM) works such as land development with plantation on the bunds, farm ponds, and compost pits should be combined, in order to ensure durability of assets and resilience of communities that depend on such assets.

GIZ

GIZ is an international technical agency (Indo-German Corporation for Cooperation) working on issues of environment, energy in India on behalf of the German Government. GIZ is associated with MoRD through bilateral project "Environmental Benefits under Mahatma Gandhi NREGA" during 2013-19 implemented in the states of Andhra Pradesh, Chattisgrah and Rajasthan. The project for developing successful NRM and INRM models, GIS based planning and scaled up across the country.

Water Security and Climate Adaptation (WASCA)

"Water Security and Climate Adaptation" is a new MoRD GIZ bi-lateral project that will be implemented during 2019-22. The project WASCA is approved by both the governments and four pilot states are identified for the project. The states are Tamil Nadu, Rajasthan, Uttarpradesh and Madhya Pradesh. The objective of WASCA is Water resource management is enhanced through an integrated approach at national,

state and local level with regards to water security and climate adaptation in rural areas. The focus of the project is on improved planning, financing, demonstrating models in two districts per state and private sector participation.

To identify two pilot districts in the state, GIZ undertaken scientific analysis by engaging services of Centre for Climate Change and Disaster Management (CCCDM), Anna University, Chennai. CCCDM had five rounds of discussion with senior officials from RD & PR, DRD and presented their findings and recommendation to department on 20th November 2019 to Additional Chief Secretary. The 18 Indicators used by the CCCDM for the study for identification of most needy districts for WASCA are decided. They are Ramanathapuram and Tiruvanamalai districts. For implementation of WASCA, GIZ will engage technical resource agencies with various expertises in this project namely CCCDM, Anna University and MS Swaminathan Research Foundation, which has expertise in agriculture and bio-diversity.

Formation of Steering Committee

In order to oversee and smooth implementation of WASCA, it is decided to constitute a State Level Steering Committee. The Steering Committee will meet once in every Quarter and review the progress, approve action plans, provide guidance and direction on reaching the objectives set for WASCA.

Following are the members of the Steering Committee proposed:

Sl No	Designation	Role in the Committee
1.	The Additional Chief Secretary, RD & PR	Chairperson
2.	Director, RD & PR	Member Secretary / Convenor
3.	Managing Director, Tamil Nadu Water Supply and Drainage Board	Member
4.	Director, Agriculture Department.	Member
5.	Director, Horticulture Department	Member
6.	The Principal Chief Conservator of Forests	Member
7.	Director, Department of Environment	Member
8.	Director, Fisheries Department	Member
9.	Vice Chancellor, Tamil Nadu Agriculture University	Member
10.	Engineer-in-Chief, Water Resources Department(PWD)	Member
11.	Director, NRM Division, GIZ, New Delhi	Member
12.	Additional Director(MGNREGS)	Member
13.	Superintending Engineer(MGNREGS)	Member
14.	Regional Director, Central Ground Water Board	Member
15.	Regional Director, Indian Institute of Soil and Water Conservation Research Centre, Ooty (SR)	Member

18.	Director, Centre for Water Resources, Anna University	Member
19.	Director, Confederation of Indian Industry(CII)	Member
20.	Chief Engineer, Agricultural Engineering , Department of Agriculture Engineering, Nandanam	Member
21.	Prof Kavi Kumar, Madras School of Economics, Madras University	Member
22.	Director, M.S.Swaminathan Research Foundation	Member

3. The Director of Rural Development and Panchayat Raj has stated that a co-ordination meeting in this regard was conducted on 20.11.2019 under the chairmanship of Additional Chief Secretary to Government, Rural Development and Panchayat Raj Department with Anna University Officials and GIZ representatives.

4. The Director of Rural Development and Panchayat Raj has therefore requested the Government to approve the State Level Steering Committee to implement, monitor and review the Water Security and Climate Adaptation (WASCA) Project in the two districts i.e. Ramanathapuram and Tiruvannamalai.

5. The Government after careful examination, have decided to accept the proposal of the Director of Rural Development and Panchayat Raj and issue orders for the formation of the State Level Steering Committee to implement, monitor and review the Water Security and Climate Adaptation (WASCA) Project in the two districts i.e. Ramanathapuram and Tiruvannamalai, with the following Members:

1.	The Additional Chief Secretary to Government, RD & PR Department	Chairperson
2.	Director, RD & PR	Member Secretary / Convenor
3.	Managing Director, Tamil Nadu Water Supply and Drainage Board	Member
4.	Director, Agriculture Department.	Member
5.	Director, Horticulture Department	Member
6.	The Principal Chief Conservator of Forests	Member
7.	Director, Department of Environment	Member
8.	Director, Fisheries Department	Member
9.	Vice Chancellor, Tamil Nadu Agriculture University	Member
10.	Engineer-in-Chief, Water Resources Department(PWD)	Member
11.	Director, NRM Division, GIZ, New Delhi	Member
12.	Additional Director(MGNREGS)	Member
13.	Superintending Engineer(MGNREGS)	Member

14.	Regional Director, Central Ground Water Board	Member
15.	Regional Director, Indian Institute of Soil and Water Conservation Research Centre, Ooty (SR)	Member
16.	Director, Water Technology Centre, TNAU, Coimbatore	Member
17.	Director, Centre for Climate Change and Disaster Management (CCCDM), Anna University	Member
18.	Director, Centre for Water Resources, Anna University	Member
19.	Director, Confederation of Indian Industry(CII)	Member
20.	Chief Engineer, Agricultural Engineering , Department of Agriculture Engineering, Nandanam	Member
21.	Prof Kavi Kumar, Madras School of Economics, Madras University	Member
22.	Director, M.S.Swaminathan Research Foundation	Member

(BY ORDER OF THE GOVERNOR)

HANS RAJ VERMA
ADDITIONAL CHIEF SECRETARY TO GOVERNMENT

To
All Members of State Level Steering Committee of WASCA Project,
The Director of Rural Development and Panchayat Raj, Chennai-15.
All District Collectors (except Chennai District). (Through the Director of Rural Development and Panchayat Raj, Chennai-15)
All Project Directors, District Rural Development Agencies (through the Director of Rural Development and Panchayat Raj, Chennai-15).

Copy to:
The Senior Personal Assistant to Hon'ble Minister (Municipal Administration & Rural Development, Implementation of Special Programme), Chennai-9.
The Principal Private Secretary to Additional Chief Secretary to Government, Rural Development and Panchayat Raj Department, Chennai-9.
The National Informatics Centre, Secretariat, Chennai-9.
Stock file / Spare copy.

//FORWARDED BY ORDER//

25.4.2014
SECTION OFFICER

Annexure 2: Composite Water Resources Management Plan Preparation Team

District Rural Development Agency, Tiruvannamalai Team			
Sno	**Name**	**Designation**	**District / Block**
1	Ms.P. Jeya Sudha	Project Director	Tiruvannamalai
2	Mr.Sundaresan	Executive Engineer	Tiruvannamalai
3	Mr.Thanikachalam		Tiruvannamalai
4	AEEs of all the blocks		Tiruvannamalai
5	BDOs of all blocks		Tiruvannamalai
6	AEs of all blocks		Tiruvannamalai
7	Overseers of all blocks		Tiruvannamalai

M.S. Swaminathan Research Foundation Team			
S.No	**Name**	**Designation/Expertise**	**Location**
1	Dr R. Rengalakshmi	Team lead	Chennai
2	Mr.R.Nagarajan	GIS and RS coordinator	Chennai
3	Mr.P. Nandeesha	Dt. Coordinator	Tiruvannamalai
4	Mr. R.Srinivasan	Information technology	Chennai
5	Mr. Kannappan	Information technology	Chennai
6	Mr. Samu Jebaraj	GIS	Tiruvannamalai
7	Mr. Arun Siddarth	Watershed manager	Tiruvannamalai
8	Mr. Dr.R.Gopinath	Social Science	Chennai
9	Dr.S.Malarvannan	Agriculture	Chennai
10	Ms. S.Punitha	GIS	Chennai
11	Ms. B.Jayashree	Communication	Chennai
12	Mr.Rubesh	GIS	Tiruvannamalai
13	Mr.Sivakumar	GIS	Tiruvannamalai
14	Ms.R. Yogalakshmi	Water Management	Chennai
15	Ms. Madhumita	Water Management	Chennai
WASCA Resource Centre			
1	Dr.K.Palanisamy	Water Management	
2	Dr.A.Balasubramanian	Agro Forestry	
3	Mr.BallaLakshmikantham	Forestry	
4	Dr.S.Manivannan	Soil and Water Conservation	

Prime Meridian Team			
Sno	**Name**	**Designation**	**Location**
1	Mr. S.Mahalingam	Team Leader	Chennai
2	Mr. G.N.Kumaran	GIS	Chennai
3	Mr.N.Krishnan	Support staff	Chennai
4	Mr.M.Muthamilselvan	Support staff	Chennai
5	Mr.G.N.Ganesan	IT	Chennai

WASCA – NRM Division, GIZ- India Team for CWRM Planning and Support to Tamil Nadu			
Sno	**Name**	**Designation**	**Location**
1	Astrid	Technical Advisor	Germany / New Delhi
2	Dr Jagdish Purohit	Technical Advisor	New Delhi
3	Dr Jagdish Menon	Jr Technical Expert	Jaipur / Rajasthan
4	Mr. Krishan Tyagi	Technical Adviser	New Delhi
5	Dr Vaibhav Sharma	Technical Expert	New Delhi
6	Ms. Sindhu	Communication Expert	New Delhi
7	Meeka Hana Paul	Technical Expert	New Delhi
8	Dr Radhapriya	Jr Technical Expert	Chennai
9	V.R. Sowmithri	Technical Expert	Chennai
10	Dr.RajeevAhal	Team Lead	New Delhi

National Water Mission Team			
Sno	**Name**	**Designation**	**Location**
1	Mr. E. Raja	EE, State Ground and Surface water Resources Data Centre and nodal officer to NWM, MoJS	Chennai
2	PWD local staff		Tiruvannamalai

Annexure 3. CWRM plan - Tiruvannamalai - Non spatial parameters												
S No	Key CWRM Parameter	Unit	Anakavoor	Arni	Chengam	Chetpet	Cheyyar	Jawathu hills	Kalasapakkam	Keelpennathur	Pernamallur	Polur
1	2	3	4	5	6	7	8	9	10	11	12	13
1	Total Geographical Area	Ha	26090	20820	29419	23437	24081	13796	22181	24217	24420	26516
2	Total Population	Number	78799	95993	142114	94387	87347	51999	120612	104216	85475	135345
3	Total Livestock population	Number	225978	113491	201679	49640	217709	23624	131689	70078	131457	145012
4	Vulnerable population	Number	31419	23510	53272	11934	26908	48152	33011	29876	20213	27808
5	SC Population	Number	20848	23059	50814	11570	25781	1071	32571	27399	19068	27332
6	ST Population	Number	10571	451	2458	364	1127	47081	440	2477	1145	476
7	Active person Job Cards	Number	21517	30657	49520	29829	26575	17843	47370	29317	26739	39336
8	% of Clay Soil	Percentage	3.4%	0.6%	12.4%	2.7%	0.6%	0.3%	0.0%	2.2%	2.4%	0.0%
9	Good Catchment RO	MCM	6.15	34.34	17.80	3.39	2.02	6.82	3.32	9.75	13.20	20.70
10	Average Catchment RO	MCM	1.36	0.60	1.54	1.66	2.10	1.92	1.02	0.25	1.93	4.66
11	Bad Catchment RO	MCM	8.29	5.51	11.42	8.19	8.44	5.23	8.00	9.42	8.37	8.78
12	Length of Natural Drainage Lines	Km	167.7	176.9	878.6	176.6	128.2	1888.0	600.7	300.1	134.6	637.4
13	Number of Micro Watershed	Km	77	66	146	89	75	196	101	93	80	123

14	Length of Canal Network	Km	89.6	127.7	38.4	236.0	160.3	4.0	86.9	174.1	55.3	167.1
15	Number of Tanks, Ooranis	Number	420.0	235.0	335.0	294.0	338.0	15.0	277.0	404.0	423.0	180.0
16	Drinking Water Sources	Number	19909	23191	33706	23204	21278	12609	29301	24246	21112	33096
17	% GW for Drinking	Percentage	2.47%	2.35%	2.13%	1.23%	1.80%	3.22%	1.87%	2.02%	2.85%	1.34%
18	% GW for Agriculture	Percentage	91.07%	95.12%	95.12%	98.19%	94.12%	95.45%	96.28%	96.75%	93.17%	97.36%
19	% GW for Livestock	Percentage	6.45%	2.53%	2.75%	0.59%	4.08%	1.33%	1.86%	1.23%	3.98%	1.30%
20	Area Under Forest	Ha	497.72	0	0	2.35	0	331.66	0	0	0	44.33
21	Area under Non-Agricultural Uses	Ha	7953.59	3587.53	3565.75	5409.72	5705.38	811.95	4690.5	3939.29	6076.04	5262
22	Barren & Un-cultivable Land Area	Ha	81.54	5712.25	1825.98	544.04	178.44	1096.01	678.46	913.65	361.16	1155.17
23	Permanent Pastures and Other Grazing Land Area	Ha	305.76	36.42	2.64	479.5	251.62	15.12	83.18	2.92	292.11	77.15
24	Land Under Miscellaneous Tree Crops etc. Area	Ha	224.5	2.81	2.77	73.08	409.81	0.35	167.15	46.13	185.94	43.88

25	Culturable Waste Land Area	Ha	83.41	230.51	691.75	199.47	288.5	856.05	211.66	65.27	396.84	1989.09
26	Fallows Land other than Current Fallows Area	Ha	1165.39	752.75	1833.05	993.31	1833.59	1604.03	962.18	19.45	889.12	714.74
27	Current Fallows Area	Ha	7653.83	4477.36	9879.15	4975.08	7498.86	2157.63	3928.2	7289.13	5498.2	4229.4
28	Total Unirrigated Land Area	Ha	2709.95	1695.82	1697.23	2844.93	3348.73	6094.12	1528.26	4473.25	4116.02	2231.61
29	Area Irrigated by Source	Ha	5414.61	4325.28	9921.09	7915.52	4566.09	829.12	9932.03	7468.71	6604.56	10768.51
30	Grewater Generation	MCM	0.000144	0.000175	0.000259	0.000172	0.000159	0.000095	0.000220	0.000190	0.000156	0.000247
31	% of Area Under Paddy	Percentage	68	44	34	52	44	15	56	12	41	57
33	Water Demand For Humans	MCM	215.7	262.8	389.0	258.4	239.1	142.3	330.2	285.3	234.0	370.5
34	Water Demand For Agriculture	MCM	7584	10145	16577	19778	11952	4035	16249	13065	7318	25750
35	Water Demand for Livestock	MCM	824.8	414.2	736.1	181.2	794.6	86.2	480.7	255.8	479.8	529.3
36	Run Off Conserved	MCM	6541	5667	6581	5573	5699	3083	5200	5452	5858	6372
37	Ground Water Availability	MCM	6149.3	4433	6731.73	6284.77	5445.47	6669.12	4068.73	6245.39	4998.94	7395.04

38	Ground Water Recharge	MCM	6832.56	4925.56	7479.7	6983.08	6050.52	7410.14	4520.81	6939.32	5554.38	8216.72
39	Soil Moisture content	TMC	4.17	3.96	5.95	4.15	4.23	2.99	4.02	4.66	4.22	4.89
40	ET Losses	MCM	73.7	48.8	93.6	91.1	69.0	58.5	94.3	96.5	90.2	106.0
41	Ground Water Status	OE/C/SC/ SF/S	SC	SC	OE	SC	SC	C	OE	OE	OE	OE

S No	Key CWRM Parameter	Unit	Pudupalayam	Thandarampet	Thellar	Thiruvannamalai	Thurinjapuram	Vandavasi	Vembakkam	West Arni
1	2	3	14	15	16	17	18	19	20	21
1	Total Geographical Area	Ha	19726	39313	29063	28453	29759	28890	31777	17586
2	Total Population	Number	89491	178648	97938	161661	123213	110990	122175	89409
3	Total Livestock population	Number	83508	71648	92105	99027	49678	129510	235789	105752
4	Vulnerable population	Number	29424	58843	32140	46952	29693	36443	33900	16411
5	SC Population	Number	28306	41825	29911	43372	28031	34271	32600	16082
6	ST Population	Number	1118	17018	2229	3580	1662	2172	1300	329
7	Active person Job Cards	Number	32879	52916	31807	44776	44173	30956	36214	26443
8	% of Clay Soil	Percentage	9.2%	10.0%	2.2%	3.6%	6.7%	2.4%	6.4%	0.0%
9	Good Catchment RO	MCM	0.64	33.30	19.52	18.65	16.02	3.68	3.55	1.29
10	Average Catchment RO	MCM	0.65	2.00	1.77	1.30	0.78	2.54	2.28	0.61
11	Bad Catchment RO	MCM	7.42	14.14	10.74	11.47	11.16	9.88	11.07	6.54
12	Length of Natural Drainage Lines	Km	431.3	1350.3	271.5	304.2	439.9	235.6	214.0	152.8
13	Number of Micro Watershed	Km	87	168	86	83	112	84	93	90
14	Length of Canal Network	Km	7.0	192.1	163.7	110.1	39.2	102.6	192.1	57.0
15	Number of Tanks, Ooranis	Number	248.0	237.0	443.0	349.0	381.0	397.0	482.0	295.0
16	Drinking Water Sources	Number	20960	41656	24422	35762	29832	27201	29637	21738

ANNEXURES

17	% GW for Drinking	Percentage	1.19%	2.26%	3.00%	2.29%	2.07%	2.46%	2.68%	2.36%
18	% GW for Agriculture	Percentage	97.80%	96.91%	94.43%	96.44%	97.17%	94.94%	92.62%	95.09%
19	% GW for Livestock	Percentage	1.01%	0.83%	2.57%	1.27%	0.76%	2.61%	4.70%	2.54%
20	Area Under Forest	Ha	0	97.17	24.96	0	11.93	0	0	0
21	Area under Non-Agricultural Uses	Ha	4213	5789	5661	4554	5014	7139	7793	3698
22	Barren & Un-cultivable Land Area	Ha	67.93	3628.85	633.87	1187.17	277.53	384.66	334.68	242.06
23	Permanent Pastures and Other Grazing Land Area	Ha	0	11.05	310.9	142.94	69.58	412.65	335.77	78.45
24	Land Under Miscellaneous Tree Crops etc. Area	Ha	32.27	16.41	95.54	54.7	17.15	188.52	203.2	33.29
25	Culturable Waste Land Area	Ha	264.01	876.49	397.89	392.77	265.43	571.63	496.02	165.45
26	Fallows Land other than Current Fallows Area	Ha	1177.13	6861.37	1416.82	596.24	797.9	1095.97	2686.97	598.91
27	Current Fallows Area	Ha	5794.16	2957.47	7934.56	9279.03	6164.6	7025.82	12475.73	6153.74
28	Total Unirrigated Land Area	Ha	337.01	1831.4	4970.93	2676.73	6255.74	4637.23	2024.46	2497.32
29	Area Irrigated by Source	Ha	7840.97	17244.02	7616.92	10875.56	9579.62	7434.7	5427.03	4119.09
30	Grewater Generation	MCM	0.000163	0.000326	0.000179	0.000295	0.000225	0.000203	0.000223	0.000163
31	% of Area Under Paddy	Percentage	50	27	44	18	22	39	73	48
33	Water Demand For Humans	MCM	245.0	489.0	268.1	442.5	337.3	303.8	334.5	244.8
34	Water Demand For Agriculture	MCM	19195	19999	8049	17823	15125	11217	11047	9399
35	Water Demand for Livestock	MCM	304.8	261.5	336.2	361.4	181.3	472.7	860.6	386.0
36	Run Off Conserved	MCM	4521	9225	6699	6700	6351	6921	7568	4055

37	Ground Water Availability	MCM	3089.99	8392.05	7178.04	7265.25	7521.38	7767.91	7573.11	4478.25
38	Ground Water Recharge	MCM	3433.32	9324.5	7975.6	8072.49	8357.09	8631.01	8414.56	4975.83
39	Soil Moisture content	TMC	3.57	7.71	5.38	5.8	5.39	5.14	5.52	3.19
40	ET Losses	MCM	66.1	154.6	104.8	110.7	128.3	102.0	64.3	54.2
41	Ground Water Status	OE/C/SC/ SF/S	OE	OE	OE	OE	OE	OE	SC	C

B. Consolidated Spatial parameters

District Rural Development Agency: Tiruvannamalai Water Security and Climate Adaptaiont Project Composite Water Resources Management Plan (Spatial Data) Key Parameters									
		Description		Name of the Block					
S No	Key CWRM Parameter	Unit	Legend	Anakavoor	Arni	Chengam	Chetpet	Cheyyar	Jawathu hills
1	2	3		4	5	6	7	8	9
1	Area under erosion	Ha	Sheet Erosion	1622.95	1977.11	19439.79	4710.86	540.1	12946.25
2	Waste Lands	Ha	Degraded Forest and Scrub Land	455.37	55.49	513.28	1633.94	279.06	333.49
3	Salt Affected Area	Ha	Sodic - Slight	0.00	670.86	1984.20	80.67	56.94	0.00
4	Slope Categorey	NA		Very Flat	Very Flat	Very Flat & Gently Sloping	Very Flat	Very Flat	Steep
5	Drinage Density Categorey	NA		0.0064	0.0085	0.0299	0.0075	0.0053	0.1369

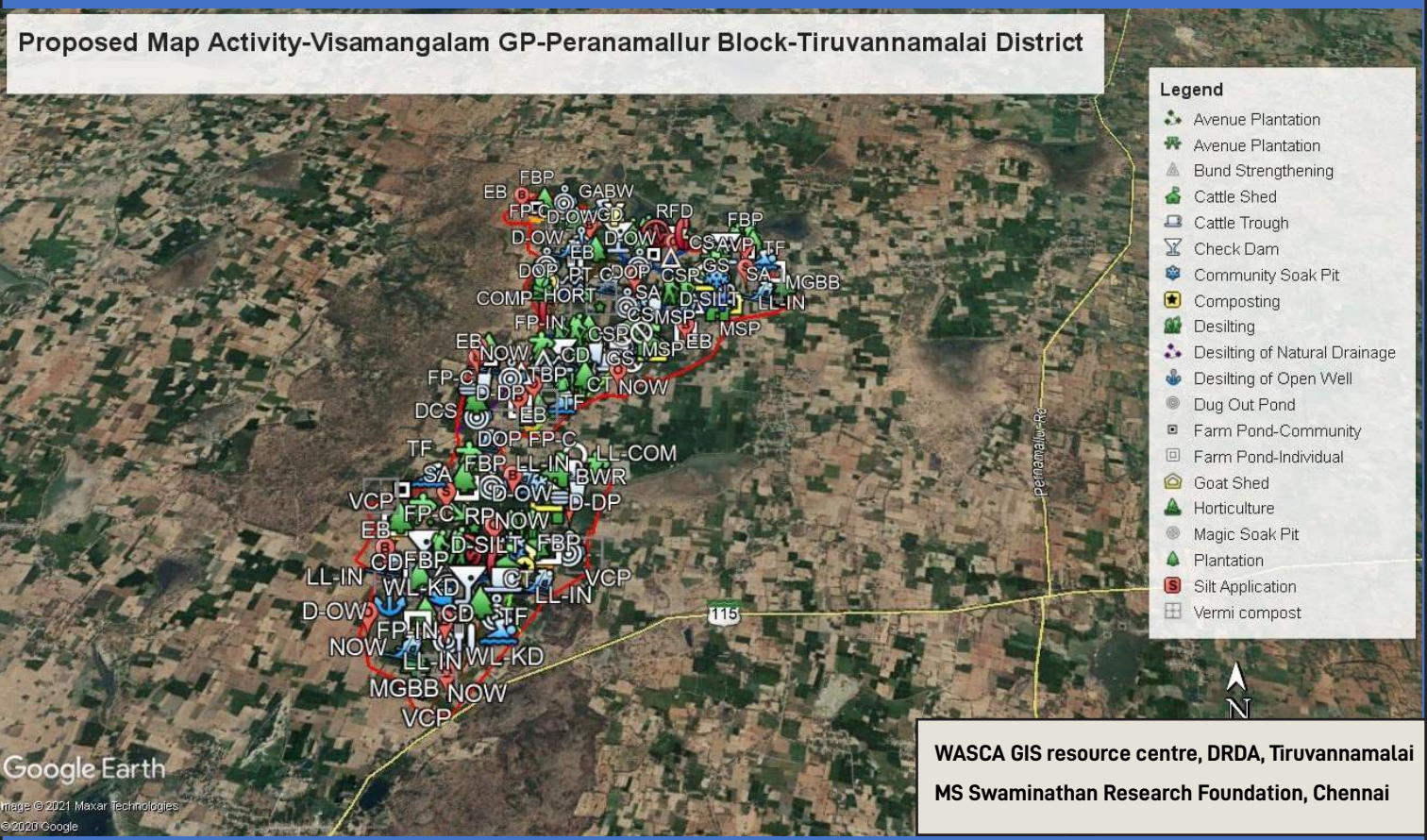
5	Micro Watersheds	Number		77	66	146	89	75	196
7	Geomorphology Type (Major)	NA		Denudational Origin-Pediment-Pediplain Complete	Denudational Origin-Pediment-Pediplain Complete	Denudational Origin-Pediment-Pediplain Complete	Denudational Origin-Pediment-Pediplain Complete	Denudational Origin-Pediment-Pediplain Complete	Structural Origin-Moderately Dissected Hill and valleys
8	Ground Water Prospectus	NA		> 80 m Deep Well	> 80 m Deep Well	> 80 m Deep Well	> 80 m Deep Well	> 80 m Deep Well	>80 m Deepwell

		Description		Name of the Block					
S No	**Key CWRM Parameter**	**Unit**	**Legend**	**Kalasapakkam**	**Keelpennathur**	**Pernamallur**	**Polur**	**Pudupalayam**	**Thandarampet**
1	**2**	**3**		**10**	**11**	**12**	**13**	**14**	**15**
1	Area under erosion	Ha	Sheet Erosion	4105.15	4872.63	3916.14	5127.61	8926.57	15663.7
2	Waste Lands	Ha	Degraded Forest and Scrub Land	595.32	908.35	246.56	2328.85	332.47	1690.21
3	Salt Affected Area	Ha	Sodic - Slight	26.51	12.80	42.15	6.00	1711.59	75.78
4	Slope Categorey	NA		Very Flat	Flat to very Flat	Very Flat	Very Flat	Very Flat	Flat
5	Drinage Density Categorey	NA		0.0271	0.0124	0.0055	0.0240	0.0219	0.0343
5	Micro Watersheds	Number		101	93	80	123	87	168
7	Geomorphology Type (Major)	NA		Denudational origin Pediment Pediplain Complex	Denudational origin Pediment Pediplain Complex	Denudational origin Pediment Pediplain Complex	Denudational origin Pediment Pediplain Complex	Denudational origin Pediment Pediplain Complex	Denudational origin Pediment Pediplain Complex

8	Ground Water Prospectus	NA		>80m Deepwell	>80m Deepwell	>80m Deepwell	>80m Deepwell	>80m Deepwell	> 80 m Deep Well

		Description		Name of the Block					
S No	**Key CWRM Parameter**	**Unit**	**Legend**	**Thellar**	**Thiruvannamalai**	**Thurinjapuram**	**Vandavasi**	**Vembakkam**	**West Arni**
1	**2**	**3**		**16**	**17**	**18**	**19**	**20**	**21**
1	Area under erosion	Ha	Sheet Erosion	3171.08	7493.55	3387.11	2597.79	1432.31	2413.08
2	Waste Lands	Ha	Degraded Forest and Scrub Land	459.21	1802.27	1295.11	286.72	340.07	373.93
3	Salt Affected Area	Ha	Sodic - Slight	98.48	191.9	22	192.87	0	105.19
4	Slope Categorey	NA		Very Flat	Very Flat	Very Flat	Very Flat	Very Flat	Flat
5	Drinage Density Categorey	NA		0.0093	0.0107	0.0148	0.0082	0.0067	0.0087
5	Micro Watersheds	Number		86	83	112	84	93	90
7	Geomorphology Type (Major)	NA		Denudational Origin-Pediment-Pediplain Complete	Denudational Origin-Pediment-Pediplain Complete	Denudational Origin-Pediment-Pediplain Complete	Denudational Origin-Pediment-Pediplain Complete	Denudational Origin-Pediment-Pediplain Complete	Denudational Origin-Pediment-Pediplain Complete
8	Ground Water Prospectus	NA		30 to 80 m Deep Well	> 80 m Deep Well	30 to 80 m Deep Well	> 80 m Deep Well	> 80 m Deep Well	> 80 m Deep Well

Proposed Map Activity-Visamangalam GP-Peranamallur Block-Tiruvannamalai District



WASCA GIS resource centre, DRDA, Tiruvannamalai

MS Swaminathan Research Foundation, Chennai